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PROCEEDINGS

SOUTHERN WEED SCIENCE SOCIETY

THE CHANGING WORLD OF WEED SCIENCE

57th Annual Meeting

Servicing Agriculture In:

ALABAMA
ARKANSAS
FLORIDA
GEORGIA
KENTUCKY
LOUISIANA
MISSISSIPPI
PUERTO RICO
MISSOURI
NORTH CAROLINA
OKLAHOMA
SOUTH CAROLINA
TENNESSEE
TEXAS
VIRGINIA

January 26, 27, and 28, 2004
The Peabody Hotel
Memphis, TN

ISSN:0362-4463

PREFACE

These PROCEEDINGS of the 57th Annual Meeting of the Southern Weed Science Society contain papers and abstract of presentations made at the annual meeting. These papers and abstracts are indexed according to subject matter and authors. A list is also included giving the common and trade or code names, chemical names and manufacturers of all herbicides mentioned in the publication. Other information in these PROCEEDINGS includes: biographical data of recipients of the SWSS Distinguished Service, Outstanding Educator, Outstanding Young Weed Scientist, and Outstanding Graduate Students awards; the RESEARCH REPORT; lists of officers and committee members; minutes of all business meetings; and lists of registrants attending the annual meeting, sustaining members, charter members, and contributors to the SWSS Endowment Foundation.

Only papers presented at the meeting and submitted to the Editor in the prescribed format for printing are included in the PROCEEDINGS. Papers may be up to five pages in length and abstracts are limited to one page.

Authors are required to submit an original abstract according to the instructions available in the "Call for Papers" and on the SWSS web site (www.swss.ws). Templates are available in Word and WordPerfect to help ensure an acceptable format was followed.

The use of commercial names in the PROCEEDINGS does not constitute an endorsement, nor does the non-use of similar products constitute a criticism, by the Southern Weed Science Society.

Additional copies of the 2004 PROCEEDINGS and of some prior year editions of the PROCEEDINGS AND RESEARCH REPORTS are available. Also, copies of the SWSS RESEARCH METHODS IN WEED SCIENCE (3rd edition, 1986), and the SWSS WEED IDENTIFICATION GUIDES are available. This document is also available in PDF format at the SWSS web site (www.swss.ws). For information concerning the availability and cost of these publications, contact Mr. R. A. Schmidt, Business Manager, Southern Weed Science Society, 1508 West University Avenue, Champaign, IL 61821-3133.

Peter A. Dotray, Editor
Southern Weed Science Society
www.swss.ws

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THESE PROCEEDINGS ARE DEDICATED TO CHESTER G. McWHORTER AND CHARLES E. MOORE

Chester G. McWhorter

We are saddened to report that Dr. Chester McWhorter, distinguished USDA-ARS research scientist, passed away June 17, 2003 following a stroke. Dr. McWhorter will be remembered as a leader in weed science research and a great mentor and example to scientists throughout the world. He is also known as the man who has successfully spanned the gap between basic and applied research in this area. The improved weed control technology that he generated is now used on millions of acres of agronomic crops annually in the United States and internationally.

His pioneering research led to the discovery that surfactants and other adjuvants increase herbicide activity and improve selectivity and safety. He discovered that a group of herbicides known as dinitroanilines selectively control the weed johnsongrass from both rhizomes and seed in soybeans when used in a specific regimen. He also discovered that the postemergence activity of another widely used class of herbicides, the s-triazines, was greatly increased when applied in emulsions of paraffinic oil in water. This practice, which reduces herbicide use rates, is widely used on million of acres annually.

He invented several innovative herbicide application devices and techniques, including the recirculating sprayer, application of herbicides in foam and wax bars, subsurface application of herbicides in soil with a subsurface blade, and soil injection of herbicides.

Dr. McWhorter is recognized internationally as the foremost authority on johnson grass biology, ecology, taxonomy, physiology, and control. The technology issuing from his research is widely used as a model by extension agents, industry, other scientists, and producers to reduce losses caused by weeds, to control costs of weed control, and to aid in conducting national market surveys. He has shared his research results through more than 200 publications.

During his career, Dr. McWhorter served on the board of directors of the Weed Science Society of America (WSSA) and Council for Agricultural Science and Technology. He was president of both WSSA and the Southern Weed Science Society. A lengthy list of awards is capped by Dr. McWhorter's inclusion in the USDA-ARS Hall of Fame in 1994, USDA's Distinguished Research Scientist of the Year in 1989, a 1990 Research Award from the Southern Weed Science Society, and Research Scientist of the Year 1991 for Outstanding Contributions to Delta Agriculture, by the Delta Council.

A native of Decatur, MS, Dr. McWhorter was born May 3, 1927. After serving in the U.S. Navy from 1945 to 1946, he earned his B.S. (1951) and M.S. (1952) degrees in Agronomy at Mississippi

State University. He began his career in weed science research at the Delta Branch Experiment Station, Stoneville, MS in1952, but left in 1956 to obtain his Ph.D. in plant physiology from Louisiana State University, Baton Rouge. Dr. McWhorter returned to Stoneville to work with ARS in 1958. He directed the Southern Weed Science Laboratory from 1975 to 1987 when he requested that he be allowed to return to full-time bench research. In 1990, Dr. McWhorter was asked to lead the newly formed Application Technology Research Unit at Stoneville, and he remained in that leadership position until his retirement in 1992.

Survivors include his wife, Ann; two sons, Patrick and Walter; granddaughter Anna, and brother John.

Charles E. Moore

Charles E. Moore, better known as "Charley", was a native of Nettleton, Mississippi where he grew up on a general crop and livestock farm in Itawamba County. He received his B.S. degree from Mississippi State University in Agronomy-Soils. After serving two years in the army, he returned to Mississippi State and completed a Master of Science degree in Agronomy-Crops.

Mr. Moore's first career assignment was a plant breeder and general agronomist for a large seed-producing and processing organization in the San Juaquin Valley in California. While there, he developed the first two commercial varieties of alfalfa to be bred and certified by a private company. Following his experience in California, he served three years as the extension cotton specialist for the Mississippi Cooperative Extension Service.

Charles joined Elanco Products Company in 1965 and served as the Plant Science Representative for the Midsouth for one year. He was named Regional Coordinator/Regional Research Manager for Lilly Research Laboratories for the Midsouth Region in 1966 and served in that capacity until his retirement in 1987. Charley was instrumental in the development and success of several herbicides including Treflan, Balan, Sonalan, Graslan and Sonar. He was a mentor to several Lilly Research Laboratories Scientists.

Mr. Moore was a very active member and provided leadership in the Southern Weed Science Society for over 25 years. He held the office of Vice President, President Elect and President in addition to serving on several committees, such as Finance, Research, Program, Awards, Nominating, Site Selection and Site Policy.

He was active in the Weed Science Society of America and served on various committees including Site Selection Committee and was the recording secretary for the WSSA Regional Weed Science Society Committee. Mr. Moore was an active member of the Tennessee Agricultural Chemicals Association, Mississippi Weed Science Society, involved with the Southern Soybean Disease Workers organization and a member of CAST.

REGULATIONS AND INSTRUCTIONS FOR PAPERS AND ABSTRACTS TO BE PUBLISHED IN THE PROCEEDINGS OF THE SOUTHERN WEED SCIENCE SOCIETY

Regulations

1. Persons wishing to present a paper(s) at the conference must first electronically submit a title to the SWSS web site (http://www.swss.ws/) by the deadline announced in the "Call for Papers".

2. Only papers presented at the annual conference will be published in the Proceedings. An abstract or paper must be submitted electronically to the SWSS web site by the deadline announced at the time of title submissions.

3. Facilities at the conference will be provided for LCD-based presentations only!

4. Terminology in presentations and publications shall generally comply with standards accepted by the Weed Science Society of America. English or metric units of measurement may be used. The approved common names of herbicides as per the latest issue of Weed Science or trade names may be used. Chemical names will no longer be printed in the annual program. If no common name has been assigned, the code name or trade name may be used and the chemical name should be shown in parenthesis if available. Common names of weeds and crops as approved by the Weed Science Society of America should be used.

5. Where visual ratings of crop injury or weed control efficacy are reported, it is suggested that they be reported as a percentage of the untreated check where 0 equals no weed control or crop injury and 100 equals complete weed control or complete crop kill.

6. A person may not serve as senior author for more than two articles in a given year.

7. Papers and abstracts must be prepared in accordance with the instructions and form provided in the "Call for Papers" and on the SWSS web site. Papers not prepared in accordance with these instructions will not be included in the Proceedings.

Instructions to Authors

Instructions for title submissions, and instructions for abstracts and papers will be available in the "Call for Papers" and on the SWSS web site (http://www.swss.ws/) at the time of title or abstract/paper submission. Word and WordPerfect templates will be available on the web to help ensure the proper format is followed. Because a CD ROM containing all electronically submitted abstracts and papers will be the only form of publication available in the Abstract Collections room, it is important that submission deadlines are carefully followed.

Typing Instructions-Format

1. Margins, spacing, etc.: Use 8-1/2 x 11" paper. **Leave 1" margins on all sides.** Use 12 point type with a ragged right margin, **do not justify and do not use hard carriage returns** in the body of the text. Single space with double space between paragraphs and major divisions.
   Do not indent paragraphs.

2. Content:

   Abstracts - Title, Author(s), Organization(s) Location, the heading ABSTRACT, text of the Abstract, and Acknowledgments. Use double spacing before and after the heading, ABSTRACT.

   Papers - Title, Author(s), Organization(s), Location, Abstract, Introduction, Methods and Materials (Procedures), Results and Discussion, Literature Citations, Tables and/or Figures, Acknowledgments.

Each section of an abstract or paper should be clearly defined. The heading of each section should be typed in the center of the page in capital letters with double spacing before and after.

Pertinent comments regarding some of these sections are listed below:

Title - All in capital letters and bold. Start at the upper left hand corner leaving a one-inch margin from the top and all sides.

Author(s), Organizations(s), Location: - Start immediately after title. Use lower case except for initials, first letters of words, etc. Do not include titles, positions, etc. of authors.

Example: **WEED CONTROL SYSTEMS IN SPRINKLER-IRRIGATED RICE.** K.H. Akkari, R.F. Talbot, J.A. Ferguson and J.T. Gilmour; Department of Agronomy, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

First line of abstract begins at left margin. **Do not indent paragraphs.**

Acknowledgments - Show as a footnote at the end of the abstract (not end of the page) or the bottom of the first page of papers.

Literature Citations - Number citations and list separately at the end of the text.

Table and Figures - Place these after literature citations. Single space all tables. Tables should be positioned vertically on the page. Charts and figures must be in black and white.

2004 Distinguished Service Award-Academia

Don S. Murray

Don S. Murray is a Regents Professor in the Department of Plant and Soil Sciences at Oklahoma State University where he has been involved in research and teaching since 1978. His research focuses on the biology and ecology of weeds, weed-crop interference, and weed control systems with agronomic row crops. He teaches an undergraduate/ graduate level Advanced Weed Sciences course. In 1991 he was selected to hold the P.E. Harrill Distinguished Professorship in Crop Science, and was appointed to Regents Professor in 1998.

Don received his B.S. degree in 1966 in Agronomy and his M.S. degree in 1968 in Agronomy (Soil Microbiology) from Oklahoma State University. After completion of his M.S. degree he served as an enlisted serviceman for 3 years with the U.S. Army in Europe. He returned to OSU in 1971 and received his Ph.D. degree in Crop Science (Weed Science) in 1974.

Following graduation Don joined CIBA-GEIGY Corporation as a Field Research Representative covering the Dakotas and Montana. The next year, Don joined the faculty of Auburn University in the Department of Agronomy and Soils, where he conducted weed science research with soybeans, and developed and taught an Advanced Weed Science course.

Don's research assignments and collaboration with co-workers and graduate students have resulted in authorship or co-authorship of 3 book chapters, over 50 journal publications, and over 140 abstracts. He has been a major advisor to 29 M.S. and 16 Ph.D. graduate students and has served on the committees of 31 others.

Don has held offices or served on committees in four weed science societies – Alabama Weed Science Society, WSSA, SWSS, and NCWSS. Don has participated in SWSS since 1972, was elected as Member-at-Large (Academia), Secretary-Treasurer, SWSS Representative to WSSA, and is now a Past President. He has chaired several committees, served on numerous other committees, and is a Charter Club Member of the SWSS Endowment Foundation. In addition to his SWSS activities he is a former Board Member of WSSA and NCWSS, and is a past Editor of the WSSA Abstracts. Don has been Secretary and Chairman of two Southern Regional Research Projects, and is the past Chairman of a Southern Association of Agricultural Experiment Station Directors Task Force. He was the fifth recipient of the SWSS Outstanding Young Weed Scientist Award, and in 1999 was awarded WSSA Fellow.

2004 Distinguished Service Award-Industry

Michael S. DeFelice

Mike DeFelice is Senior Marketing Manager for Pioneer Hi-Bred International in Johnston, IA. He has been with Pioneer since 1995 and has global responsibility for marketing of insecticide seed treatments, and long-term valuation and positioning for agronomic traits and transgenic herbicide resistance traits in Pioneer crops. Mike earned his B.S. in Plant Protection in 1977 and his M.S. in Agronomy – Weed Science in 1980 at the University of Arkansas. He was a Field Research and Development representative for Rohm and Haas Co. covering Alabama, Florida, and Georgia from 1980 to 1982. He then earned a Ph.D. in Agronomy – Weed Science in 1985 at the University of Kentucky. From 1985 to 1991 Mike was an Assistant Professor in the Agronomy Department at the University of Missouri with an 80% Extension and 20% research appointment in Weed Science. From 1991 to 1995 he was Associate Professor at the University of Missouri with a 50% Research, 30% Teaching, and 20% Extension appointment. While at the University of Missouri Mike was major professor for 15 M.S. students and published 17 refereed journal articles. He wrote and updated the annual Missouri weed control and herbicide extension guides from 1985 to 1994. He was also voted "Outstanding undergraduate teacher" by the students in the Univ. of Missouri Plant Sciences Unit in 1992, 1993, and 1994. Mike is the producer, programmer, and co-writer of the Southern Weed Science Society CD-ROM "Weeds of the United States and Canada", Versions 1 and 2, and is currently working on Version 3. Mike has more recently been an active contributor to the "Intriguing World of Weeds" series for Weed Technology, and has written eight articles in the last three years. He has been a member of the SWSS since 1979, a member of the SWSS Weed ID committee since 1985, the chair of the SWSS Sales Coordination Committee from 1999 to 2002, and has presented numerous papers at the SWSS, WSSA, and NCWSS since 1979.

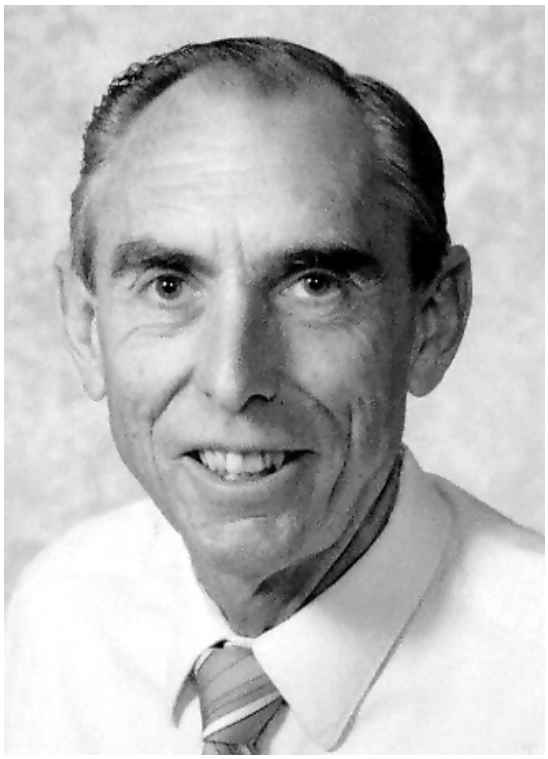
2004 Outstanding Educator Award

William Vencill

William Vencill has been at the University of Georgia in the Crop and Soil Sciences Department as a weed scientist (50% research; 50% teaching) since 1989. His duties include research in the areas of herbicide physiology; herbicide persistence in soil and water; and weed management in cotton, corn and soybean. Dr. Vencill has authored or co-authored 38 refereed journal articles, 110 conference papers or abstracts, and 25 technical research reports and related publications. His teaching responsibilities include undergraduate coordinator of the Crop and Soil Sciences Department, teaching an introductory Weed Science course, a graduate course in Herbicide Physiology, and team teaching courses in Pesticide Management, Integrated Pest Management, and Toxicology of Agricultural and Industrial Chemicals. Dr. Vencill has been the major advisor for 16 graduate students (3 Ph.D., 8 M.S., and 5 non-thesis students). Dr. Vencill has been active in both the SWSS and WSSA. He was the editor of the eighth edition of the *Herbicide Handbook* published in 2002. He has been an associate editor of *Weed Science* since 1998; and has been chair of the Graduate Contest Committee (1993), Herbicide Resistance Committee (1998), Outstanding Educator Award sub-committee (1998), and has served most recently on the Weed Identification Committee, Computer Applications Committee, Newsletter Committee, and Graduate Weed Contest Committee.

2004 Weed Scientist of the Year

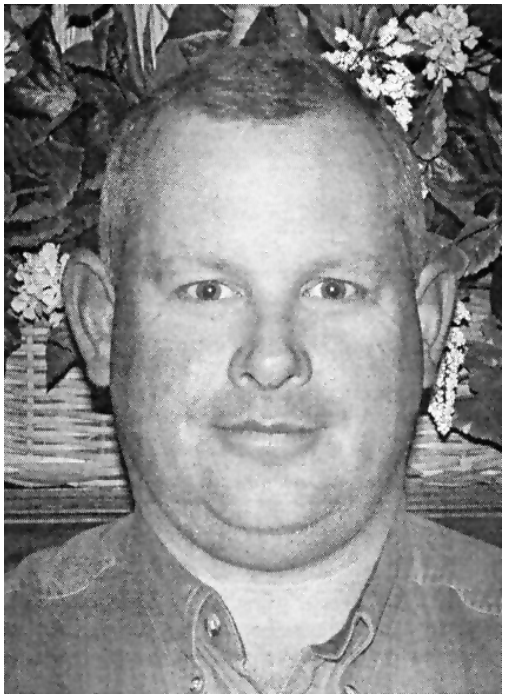
Gene D. Wills



Dr. Gene D. Wills is a Weed Scientist at the Delta Branch Experiment Station, Stoneville, Mississippi, where he has conducted research and advised graduate students in weed science since 1996. He has been involved in studies on herbicide absorption and translocation including the effects of environment, adjuvants and inorganic salts on herbicide activity. He is conducting research to reduce drift of ground and aerial applied herbicides and is involved in a team approach to use satellite imagery for conducting precision crop management. Dr. Wills is a world authority on purple nutsedge *(Cyperus rotundus)* with published information on the anatomy, morphology and on different biotypes from around the world. He has authored and coauthored numerous papers on various aspects of weed science including a chapter in the WSSA monograph - Adjuvants for Herbicides and in the second and third International Symposium on Adjuvants for Agrichemicals. Dr. Wills has delivered over thirty invitational papers with more than ten outside the United States, has served on the organizing committees of the Fifth International Congress on Pesticide Chemistry in Kyoto, Japan and the First International Weed Control Congress in Melboure, Australia. More recently, he has served on an advisory panel to the United Nations' Joint FAO/IAEA Division of Nuclear Techniques in food and Agriculture in Vienna, Austria. He has served on ten committees of the Weed Science Society of America, four years as a reviewer and three years as associate editor of Weed Science. He has served on the Executive Board and seven committees, and received the Distinguished Service Award of the Southern Weed Science Society. Also, he has served on the Executive Board, and served as a committee chair, received both the Outstanding Research Award and the Distinguished Service Award of the Mississippi Weed Science Society. He has received the Award of Excellence for Research from the Mississippi Agricultural and Forestry Experiment Station and is a Fellow in the Weed Science Society of America.

2004 Outstanding Young Weed Scientist Award-Industry

James C. Holloway



James C. Holloway Jr. was born December 11, 1964 in Greenville, MS. James' agricultural interest began at an early age. He was raised around agriculture and spent many days in cotton fields and cotton gins that his father serviced during ginning season. In high school, James worked during the fall on farms helping harvest and preparing land for the following growing season. In 1983, James entered Mississippi Delta Junior College and obtained a 2-year degree in Agriculture. In 1984, James secured a summer job with American Hoechst in Leland, MS where he became interested in Weed Science. In 1986, James married Dee Dee Swafford and continued his education at Mississippi State University where he received his B.S. in Weed Science (1989) and M.S. with a minor in Agronomy (1992) and Ph.D. (1995).

His M.S. graduate research focused on the Effects of soil type and pH on forage re-crop intervals following metsulfuron methyl under the direction of Dr. Wayne Cole. His Ph.D. graduate research investigated ivyleaf morningglory interference in soybean following treatment with soil-applied herbicides under the direction Dr. David R. Shaw. James graduated in 1995 with his Ph.D. in Weed Science with minors in Entomology, Plant Pathology, and Statistics.

Before graduation in May 1995 from Mississippi State University, he accepted a Research Scientist I position with Ciba Geigy in Greenville, MS. James worked on the Ciba Geigy Research Station located in Winterville, MS. His responsibilities included Weed Scientist on the station as well as the R&D Field Representative for weed control in Mississippi and Louisiana.

In 1998, following the merger of Ciba Geigy and Sandoz, James became the interim manager of the Winterville Research Station for Novartis Crop Protection while maintaining his previous positions of Weed Scientist on the station as well as the R&D Field Representative for weed control in Mississippi and Louisiana.

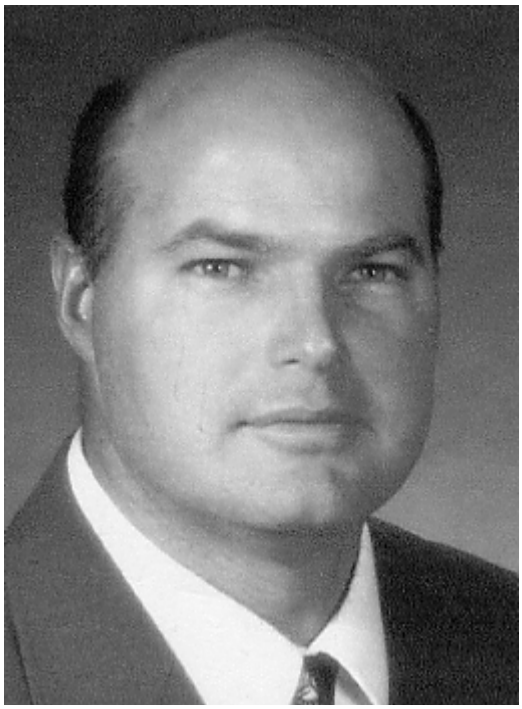
In late 2000, following the merger between Novartis and Zeneca, James accepted the position of Field R&D representative for Mississippi responsible for weed science, entomology, and plant pathology field studies. By the time this merger was complete, James had reached R&D Scientist III status in the company.

James was named an adjunct weed science Professor at Mississippi State university where he was a committee member for two M.S. students under the direction of Dr. David Shaw. Both students worked for James at the Winterville Research Farm during the summers where they conducted their research as well as working on Syngenta field trials.

James has authored or co-authored 7 peer-reviewed journal articles, 39 abstracts for poster and oral presentations, and 8 experiment station bulletins and research reports. James is very active in the local MWSS as well as the SWSS. He has always been a big supporter of the SWSS weed contest and sets on several committees within the MWSS and the SWSS.

2004 Outstanding Young Weed Scientist Award-Academia

David L. Jordan



David L. Jordan was born on May 25, 1963 and grew up on a row crop and livestock farm in northeast North Carolina. He received his B.S. degree in Agronomy (1985) and his M.S. degree (1988) in Crop Science (Weed Science) under the direction of Alan York from North Carolina State University. He worked under the direction of Robert Frans at the University of Arkansas as a Research Associate from 1988 through 1992. He was employed by the Louisiana State University Agricultural Center's Northeast Research Station from 1992 through 1996 where he conducted applied weed management research in rice, soybean, milo, and small grains. In his current position as peanut extension specialist at North Carolina State University, David directs statewide educational programs for weed management and agronomic production in peanut. He also conducts applied research in areas of weed management, pesticide interactions, tillage and cropping systems, fertilization, plant growth regulation, integrated pest management, and irrigation systems.

David has been an active member of the Southern Weed Science Society since 1988. He has served on the SWSS Board of Directors and on numerous committees within the SWSS, WSSA, and other professional societies. He also has served as an associate editor for *Agronomy Journal, Journal of Production Agriculture, Peanut Science, and Weed Technology*.

David's research has included development of weed management programs for rice, soybean, cotton, and peanut. Specific areas of research have focused on pesticide interactions, the influence of adjuvants on herbicide efficacy and compatibility, efficacy of reduced rates of herbicides in rice, and weed management in reduced tillage systems. Results from this research, combined with the many contributions of colleagues, fellow and current graduate students, technical staffs, and industry and farm cooperators have led to 79 papers in *Weed Science, Weed Technology, Agronomy Journal, Peanut Science,* and the *Journal of Cotton Science* and 192 published abstracts. He also has written numerous experiment station and extension bulletins and popular press articles. He teaches two courses in the Agricultural Institute program at North Carolina State University and co-instructs a graduate level course on cotton, peanut, and tobacco production. He is involved in the Certified Crop Advisor program and maintains a highly visible and effective extension program. He is currently involved as a weed scientist/agronomist in a USAID Peanut CRSP project in West Africa evaluating integrated pest management strategies for peanut.

2004 Outstanding Graduate Student Award (Ph.D.)

Eric Scherder

Eric Scherder was born and raised on a farm near Bowling Green, Missouri. He was very active in FFA and was an Ambassador in a Russian Youth Leadership Program that helped establish an organization in Russia similar to FFA. He obtained his B.S. degree in Agriculture-Plant Science Emphasis from the University of Missouri. He worked for the Entomology Department at MU and as an intern with American Cyanamid for three summers. He completed his M.S. and Ph.D. degrees under Dr. Ron Talbert at the University of Arkansas. His M.S. research was on the development of Command for herbicide-resistant barnyardgrass control in rice. The research also involved rice cultivar tolerance to Command. His Ph.D. research involved defining the minimal water needs for highly productive rice on the silt loam soils of the Grand Prairie. His research indicated that weed control in rice could be maintained with modern herbicide technologies and that significant reductions in water use, up to 50%, could be accomplished while still maintaining high yields using the practice of "intermittent flooding". In cooperative studies with Dr. Joe Massey, this water management system was also found to dramatically reduce methane, a greenhouse gas. He also studied environmental factors affecting the activity of the selective rice herbicide, Clincher, which have benefited producers in using this new technology.

His service to the SWSS Graduate Student Organization as President and Vice-President and as Student Representative to the SWSS Executive Board was notable. He was recognized with numerous awards during his graduate studies: Outstanding M.S. Student in 2000 and Outstanding Ph.D. Student in 2003 in the Department of Crop, Soil, and Environmental Sciences; SWSS first place poster in 1999, SWSS first place Oral Presentation in 2003; member of the University of Arkansas Weed Team that placed first in 2000 and 2002 and second in 2001 at the Southern Weed Contest (he placed sixth, tenth, and third as an individual); three Second Place and one First Place Award for Oral Presentations at the Arkansas Crop Protection Association Research Conferences; and Second Place Award at the Gamma Sigma Delta Oral Presentation Contest. He has taught numerous college lectures and laboratories in a variety of classes and was a leader in the Department Graduate Student Association. He has one paper published in Weed Technology and numerous papers published in B. R. Wells Rice Research Experiment Station Series, as well as numerous other short articles and abstracts of presentations made at scientific meetings. Dr. Scherder is presently employed with AgriGold Seed Company, Princeton, IN.

2004 Outstanding Graduate Student Award (MS)

Walter E. Thomas

Walter Thomas was raised in Lillington, NC. He obtained a B.S. degree in Agronomy with a turfgrass management concentration from North Carolina State University. During his undergraduate career he was awarded undergraduate research grants to study germination requirements of an emerging troublesome weed, slender amaranth. These works led him to begin a M.S. degree program under the direction of Dr. John Wilcut. He has presented 3 poster and 11 oral presentations at various research conferences. He was awarded second place for his oral presentation at the Beltwide Cotton Conference (2003) and first place for his poster presentation by the Southern Weed Science Society (2002) and the North Carolina Weed Science Society. Walter plans to graduate in December 2003.

SOUTHERN WEED SCIENCE SOCIETY 2004-2005 OFFICERS AND EXECUTIVE BOARD

100. SOUTHERN WEED SCIENCE SOCIETY OFFICERS AND EXECUTIVE BOARD

100a. OFFICERS

President – W. W. Witt - 2004
President Elect – J. S. Harden - 2004
Vice President – D. Shaw - 2004
Secretary-Treasurer - T. C. Mueller - 2005
Editor - P. A. Dotray - 2005
Immediate Past President – J. W. Wells - 2004

100b. ADDITIONAL EXECUTIVE BOARD MEMBERS

Member-at-Large – S. A. Senseman - 2006
Member-at-Large – W. F. Strachan - 2006
Member-at-Large – E. P. Webster - 2004
Member-at-Large – Dunk Porterfield - 2004
Representative to WSSA – T. R. Murphy - 2005
Representative to CAST – J. W. Barrentine - 2005

100c. EX-OFFICIO BOARD MEMBERS

Constitution and Operating Proc. – G.D. Wills - 2006
Business Manager – R. A. Schmidt
Forestry Representative – L. Nelson - 2007
Student Representative – G. Steele - 2004
Web Site – D.B. Reynolds

101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

J. C. Banks - President - 2005
R. M. Hayes – Vice President - 2006
E. P. Prostko – Secretary 2007
R. L. Ratliff- 2008
T. J. Monaco– Past President – 2004

101b. BOARD OF TRUSTEES – EX-OFFICO

T. C. Mueller (SWSS Secretary-Treasurer)
J. S. Harden (SWSS Finance Committee Chair)
R. A. Schmidt (SWSS Business Manager)
G. D. Wills (SWSS Constitution & Operating Proc. Committee Chair)
Audie Sciumbato (Student Representative)

102. AWARDS COMMITTEE PARENT (STANDING) – *The Parent Awards Committee shall consist of the immediate Past President as Chairperson and each Subchairperson of the Award Subcommittees.*

J. L. Wells*	2004	A. R. Rhodes	2004
K. L. Smith	2004	C. Pearson	2004
A. Wiese	2004	A. C. York	2004

*Chair

The Awards Subcommittes shall consist of six members including the subchair, serving staggered three year terms with two rotating off each year.

102a. Distinguished Service Award Subcommittee

D. M. Simpson	2004	D. L. Jordan	2005	J. L. Yeiser	2006
T. L. Smith	2004	K. L. Smith*	2005	W. K. Vencill	2006

102b. Outstanding Young Weed Scientist Award Subcommittee

D. Sanders	2004	T. R. Murphy	2005	S. W. Murdock	2006
A. R. Rhodes*	2004	H. S. McLean	2005	L. Cargill	2006

102c. Weed Scientist of the Year Award Subcommittee

D. R. Shaw	2004	E. Palmer	2005	J. Breen	2006
J. D. Green	2004	A. C. York*	2005	L. Nelson	2006

102d. Outstanding Educator Award Subcommittee

A. Wiese*	2004	Megh Singh	2005	J. Doran	2006
T. Crumby	2004	L. L. Whatley	2005	T. F. Peeper	2006

102e. Outstanding Graduate Student Award Subcommittee

W. Wells	2004	C. Pearson*	2005	W. K Vencill	2006
S. Garris	2004	S. Senseman	2005	A. W. Ezell	2006

103. COMPUTER APPLICATION COMMITTEE (STANDING)

A. C. Bennett*	2006	S. Senseman	2005	C. Medlin	2004
W. K. Vencill	2006	A. Bailey	2005	J. Ferrell	2004
D. B. Reynolds (Ex-officio)					

104. CONSTITUTION AND OPERATING PROCEDURES COMMITTEE (STANDING)

G. D. Wills*	2006	J. A. Dusky	2006	R. M. Hayes	2006

106. FINANCE COMMITTEE (STANDING) – *Shall consist of the Vice President as Chairperson and President-Elect, Secretary-Treasurer, Chairperson of the Sustaining Membership Committee, and others if the President so chooses, with the Editor serving as ex-officio member.*

D. Shaw *	2004	J. S. Harden*	2004	J. C. Holloway	2004
T. C. Mueller	2005	K. L. Smith	2004	D. Poston	2004
P. Dotray (Ex-Off) 2005					

107. HISTORICAL COMMITTEE (STANDING)

C. D. Elmore*	2004	N. Buehring	2006
G. D. Wills	2004	J. Griffin	2006

108. LEGISLATIVE AND REGULATORY COMMITTEE (STANDING)

D. Shilling*	2006	J. W. Everest	2004	J. Wilcutt	2005
G. MacDonald	2006	M. Locke	2004	M. M. Kenty	2004
J. L. Ralston	2006				

109. LOCAL ARRANGEMENTS COMMITTEE – 2004 (STANDING)

Chairperson – Dan Poston
Audio Visual – Trey Koger
Registration – Laura Clark
Meal Functions – Mark Kurtz
Room Setup – James Holloway
Spouses Program – Steve Nichols
Signs and Exhibits – Al Rankins
Graduate Student & Room Reservations – Frank Carey
Public Relations Liaison – Anthony Mills
Placement Liaison – Walt Bachman
Information Booth & Message Coordinator – Rhonda Watson
Equipment Storage & Security – Charles Bryson

110. LONG RANGE PLANNING COMMITTEE (STANDING) - *Shall consist of the previous five presidents with the Chair appointed to a three year term.*

R. L. Ratliff	2004	D. S. Murray	2005*	L. L. Whatley	2005
J. E. Street	2006	J. L. Wells	2007	W. W. Witt	2008

111. MEETING SIDE SELECTION COMMITTEE (STANDING) - *Shall consist of six members and the business manager. The members will be appointed by the President on a rotating basis of one each year and shall serve six-year terms. The Chairperson will rotate to the senior member within the geographical area for the meeting being considered.*

H. R. Smith	2004	J. D. Byrd, Jr.	2005	T. Grey	2008
R. L. Ratliff*	2006	A. Klosterboer	2007	M. E. Kurtz	2005
R. A. Schmidt (Ex-Off)					

112. NOMINATING COMMITTEE (STANDING) – *Be composed of the Past President as Chairperson in addition to nine individuals each chosen to represent one of the three different geographic areas and different disciplines of the Society. The members will serve staggered 3-year terms with 3 new members going on each year.*

J. L. Wells*	2004	S. K. Rick	2005	G. Schwarlose	2006
B. Watkins	2004	J. A. Kendig	2005	M. A. Thompson	2006
S. Hagood	2004	J. L. Yeiser	2005	G. MacDonald	2006
L. L. Whatley	2004				

113. PLACEMENT COMMITTEE (STANDING)

C. D. Youmans*	2004	W. S. Garbett	2005	C. Brommer	2007
J. A. Kendig	2004	R. Jain	2005	D. Dodds	2007
Nathan Buerhing (Student Representative)					

114. PROGRAM COMMITTEE – 2004 (STANDING) - *Shall consist of the President-Elect as Chairperson and the Program Selection Chairpersons as the remaining members.*

Chairperson J. S. Harden
1. Agronomic Crops . . . . . E. P. Protsko
2. Turf, Pastures & Rangeland . . . . . S. Askew
3. Horticultural Crops . . . . . D. K. Robinson
4. Forest Vegetation Management . . . . . H. Quicke
5. Utility, Railroad & Highway Rights-of-Way, Industrial Sites . . . . . J. D. Byrd
6. Ecological, Physiological & Biological Aspects . . . . . C. Tingle
7.Educational & Regulatory . . . . . J. Ducar
8. Development from Industry . . . . . G. Stapleton

9. Application of Herbicides . . . . . T. Adcock
10. Soil & Environmental Aspects . . . . . J. P. Massey
11. Research Posters . . . . . J. Mitchell

115. PROGRAM COMMITTEE—2005 (STANDING)

Chairperson . . . . . D. Shaw
1. Agronomic Crops . . . . . D. Jordan
2. Turf . . . . . C. Waltz
3. Horticultural Crops . . . . . A. Bennett
4. Forest Vegetation Management . . . . . D. Stevens
5. Rights-of-Way and Industrial Sites . . . . . G. MacDonald
6. Physiology, Biology, and Ecology . . . . . T. Baughman
7. Invasive Species . . . . . J. Byrd
8. Developing Technologies . . . . . C. Koger
9. Education and Extension . . . . . D. Lanclos
10. Soil and Environmental Aspects . . . . . C. Smith
11. Posters . . . . . R. Scott
12. Pasture and Rangeland . . . . . C. Medlin
13. Regulatory . . . . . J. Holloway

116. PUBLIC RELATIONS COMMITTEE (STANDING)

T. Koger*	2006	R. C. Scott	2004	G. L. Cloud	2005
L. Nelson	2006	D. Poston	2004	B. W. Bean	2005

117. RESEARCH COMMITTEE (STANDING) - *Shall consist of the Vice President as Chairperson and the remaining members as Section Chairpersons for the following sections: (1) Chemical and Physical Properties of New Herbicides, (2) Extension Publications (3) Economic Losses Due to Weeds, and (4) Weed Survey - Southern States. Section Chairpersons shall be appointed by the Chairperson for a period of 3 years.*

D. Shaw*		2004
E. P. Webster	Economic Losses Due to Weeds	2004
J. D. Byrd	State Extension Weed Control Publications	2004
T. M. Webster	Weed Survey - Southern State	2004
V. L. Ford	Chemical & Physical Properties of New Herbicides	2004

118. RESOLUTIONS AND NECROLOGY COMMITTEE (STANDING)

M. E. Kurtz	2004	S. Askew	2005	T. Willian	2006
G. L. Schwarzlose*	2004	J. C. Holloway	2005	C. Main	2006

119. SALES COORDINATION COMMITTEE (STANDING)

D. L. Jordan	2004	D. R. Reynolds	2005	M. DeFelice*	2006
B. Kline	2004	T. Barber	2005	J. Driver	2006

120. SOUTHERN WEED CONTEST COMMITTEE (STANDING)

C. T. Bryson	R. M. Hayes	T. C. Mueller	J. F. Stritzke
C. B. Corkern	J. A. Kendig	L. R. Oliver	J A. Tredaway
P. A. Dotray	M. L. Ketchersid	M. G. Patterson	W. K. Vencill
J. A. Dusky	R. T. Kincade	D. B. Reynolds	E.P. Webster*
J. W. Everest	W. B. Langston	S. Senseman	T. Whitwell
J. L. Griffin	W. Mitchem	D. R. Shaw	W. W. Witt
E. S. Hagood	D. W. Monks	D. G. Shilling	T. Koger
H. Cummings (student rep)			

121. STUDENT PROGRAM COMMITTEE (STANDING)

T. Baughman*	2004	R. Etheridge	2005	S. Murdock	2006
T. Heap	2004	J. P. Massey	2005	T. Peeper	2006
S. M. Schraer	2004	R. B. Batts	2005	T. Grey	2006
T. McKemie	2004	K. M. Jennings	2005	D. Gealy	2006

C. Jones (Student Representative)

122. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

K. L. Smith*	2004	T. Holt	2005	M. Nespeca	2006
B. Minton	2004	D. L. Jordan	2005	J. Ralston	2006

123. TERMINOLOGY COMMITTEE (STANDING)

Deleted

124. WEED IDENTIFICATION COMMITTEE (STANDING)

C. T. Bryson*	2005	M. L. Ketchersid	2006	J. D. Green	2004
M. DeFelice	2004	T. M. Webster	2004	T. Koger	2005

125. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

D. E. Dippel	R. Rivera*	S. Snodgrass	A. C. York

126. MEMBERSHIP COMMUTTEE (SPECIAL)

J. D. Byrd	W. N. Kline	T. R. Murphy	G. Stapleton
R. B. Cooper	M. Locke*	T. F. Peeper	S. O. Duke
J. H. Miller	D. B. Sims	J. W. Wilcut	

127. HERBICIDE RESISTANT WEEEDS COMMITTEE (STANDING)

R. L. Nichols *	A. Bailey	N. Burgos	F. Carey
J. M. Chandler	J. Collins	L. Glasgow	J. D. Green
J. L. Griffin	J. B. Guice	R. M. Hayes,	I. Heap
D. C. Heering	J. A. Kendig	V. B. Langston	G. E. MacDonald
C. R. Medlin	E. C. Murdock	D. B. Reynolds	D. Sanders
R. E. Talbert	W. Vencill	G. Wehtje	J. W. Wells
J. W. Wilcut	H. P. Wilson	W. W. Witt	A. C. York

Minutes of Summer SWSS Board Meeting
Peabody Hotel,
June 19-20, 2003

Meeting called to order at 1:00 PM by President Bill Witt.

Those in attendance :Scott Senseman (Board Member Academia), Peter Dotray (Proceedings Editor), Tim Murphy (WSSA Rep), David Shaw (Vice President), Bob Schmidt (Business Manager), Jim Barrentine (CAST rep), John Harden (President Elect; Program Chair), Fred Strachan (Board Member Industry), Dan Reynolds (Web Master), Bill Witt (President), Gene Wills (MOP rep), Larry Nelson (Forestry Representative), Greg Steele (Grad Student Rep), Dunk Porterfield (Board Member Industry), Eric Webster (Board Member Academia), Trey Koger (Local Arrangements), Dan Poston (Local Arrangements Chairman)

Minutes from the January 2003 board meeting were reviewed. Harden asked to clarify new sections for the 2004 program, including deletion of "developments from industry "and adding "invasive species ". Also, clarify Web submissions of abstracts. Senseman moved and Webster seconded to accept minutes as revised. Motion passed.

Mueller and Shaw reminded Witt that copies of committee reports are late and need to be completed on time. This is affecting the activities of several other officers.

Bob Schmidt presented financial report for treasurer Mueller. Sales of Weed ID Guide sets greatly diminished in the last three years. CD sales fairly constant. Attendance at 2003 meeting revised to 417. SWSS in solid financial standing.

Grad student Rep report (Greg Steele). Raffle status discussed, discussed details about prizes. Proposed to have ticket sales by individuals via each university. Details of ticket sales, timelines, and accountability discussed. Witt suggested having raffle drawing at the SWSS banquet. Steele presented idea for a lapel pan with SWSS logo, which was conceived by Hennen Cummings (NCSU), board discussed idea. Barrentine moved, Murphy seconded to purchase 200 lapel pins at a cost of up to $500. Motion passed. No graduate student luncheon planned for 2004.

Gene Wills presented a constitutional amendment to add Web Master as ex officio member of the board. Wills will add to paper ballot of normal officer elections (already scheduled for fall 2003). Some discussion occurred about electronic voting for officer elections; essentially all members have e-mail, so this would not be a large limitation. However, some computer network fire-walls deny access to some members. Consensus was for no change at this time.

Sales coordination committee report (Witt presented written report by Mike Defelice). Shaw reminded board about W.S.S.A. XID project. Witt led a lengthy discussion on sales of the weed ID guides. Shaw suggested “renaming” weed ID CD. Schmidt suggested considering producing a product to place weed ID information on a Palm or handheld computer. Discussion then centered on producing a version able to be sold on Palm/Windows CE product. There may be technical difficulties due to file architecture.

The next major topic was printed version of Weed ID Guide sales. Previous board action was to print only those needed to sell existing inventory. Discussion occurred about reducing the price on the printed weed ID guides. Murphy moved, Senseman seconded to lower the price of sets 1 through 7 including binder and shipping to $29.95. Shaw moved to amend, Strachan seconded to change price to $39.95. Amendment carried. Motion, as amended, passed.

Shaw moved, Senseman seconded to change price from $20 to $10 for individual Weed ID Guide sets including shipping. Motion passed.

Newsletter Editor directed to advertise in August newsletter new prices. Newsletter Editor directed to inform listserver of new prices.

Shaw asked for clarification on weed ID set number 8. Process has apparently already begun, with an unknown cost to SWSS already incurred. Previous board action directed set number 8 to print 1500 copies of set #8. NOTE: later clarification by the SWSS board resulted in a decision to "not expend any further time or effort on development of Weed ID guide set #8, with the expectation that we could incorporate these weeds in the next CD, and in the book if we develop it.". This action (not proceeding with set #8) was carefully examined in a conference call by a subgroup of the SWSS board (Witt, Harden, Shaw, Mueller), and a later email vote by the full board. The board vote on not proceeding with set # 8 was strongly in favor of this move, largely for financial reasons.

Board discussed potential for reformatting weed ID guide to book format. Witt will call Bryson and update situation and discuss the possibility of producing a book (perhaps paperback). This may be a good opportunity to help spread costs to allow society to recoup costs while utilizing a better way to disseminate this information. Defelice/Bryson need to be asked about proper method to proceed on re-formatting the images to allow for process to move forward. This could be a major under-taking converting from current formats to new (potential books). Any actions would need to be discussed and approved by Arlyn Evans.

Harden mentioned (again) the XID project (WSSA Web based weed ID project) and that WSSA desired a review by SWSS. Witt will ask Bryson to review this project.

CD ROM discussion. Webster encouraged lower prices for greater distribution. Senseman moved, Barrentine seconded to change price to $69.95 per weed ID CD including shipping, and the price to upgrade to $49.95. Motion passed. Shaw moved, Murphy seconded to provide 40 percent discount only to resellers. Motion passed. Discussion occurred to remove other volume discounts. Schmidt said these were seldom used.

Site Selection Report (Ray Smith)
for 2006 meeting, to be held in western section of SWSS (TX, AR, OK, LA) Smith discussed the search process used by the committee (himself and Arlen Klosterboer), and they proposed 3 locations: North Dallas, Houston (same location as 2003 meeting), and San Antonio (west side, Omni hotel, not on Riverwalk). Discussion occurred relative to the various locations. The ranking of the search committee was that San Antonio was #1, then Houston, and then Dallas. Witt informed board that he desired to wait on official vote until members could think about it.

Poston requested clarification of status of GLP training at SWSS meeting, and Smith volunteered to provide leadership to GLP program.

Forestry book discussion. Nelson proposed repricing Forest Plants of the Southeast United States book. Shaw moved, Barrentine seconded to increase price of Forest Plants of the Southeast United States to $55 and offer to distribute via Amazon.com and other resellers and normal discount. Motion passed.

Shaw moved, Porterfield seconded to hold price at $50 with CD-ROM of Forest Plants of Southeast United States and allow resellers to distribute CD-ROM at normal discount. Motion passed.

Meeting adjourned 5: 30 Central standard Time. Board members ate dinner as a group. Meal was sponsored by Southern weed science society.

Meeting resumed at 7:30 AM Continental breakfast was served during a meeting.

Finance report-Shaw Registration fees were raised substantially for the 2003 meeting. SWSS realized substantial net income from meeting. Poston informed board that costs for 2004 meeting would be much higher (banquets, other meal functions, breaks, student room charges). Shaw recommended no increase in registration. Shaw encouraged advertising to local areas to increase attendance, and board encouraged public relations committee to be active. Specific actions would be to contact potential local attendees, and strongly encourage them to attend. Discussion about having a symposium on adjuvants may increase attendance. The charge for this local outreach function was directed to the public relations committee. Poston asked for list to distribute to local contacts. Board consensus was to have same registration fees for 2004 as in previous year.

Program committee 2004 (Harden).
Title yet to be determined, but will focus on changes in the weed science discipline. Harden asked for comments on the title and other ideas. Poston asked for press release, including theme. Harden discussed program contents:

GLP training planned (over the weekend)

Rice weed control symposium, half day symposium, $75 registration fee for one day (Bob Scott leader)

Weed control in organic farming symposium (David Jordan leader)

Harden considering symposium on adjuvants

graduate student symposium (Harden leader)

Submission of PowerPoint presentations to meeting (Reynolds)
-- Mississippi State University will allow space for Web site use at no charge
-- Reynolds encouraged all talks/posters to be designated a number for ease of organization
-- Reynolds proposed to receive PowerPoint files on Monday the week before the meeting, but allow for CD submission (still one week before the meeting).
-- requested two computers in abstract area, to allow authors to preview slides

Discussion centered on advantages and disadvantages of early file submission. Extended discussion on the logistics. Original idea was to submit all PowerPoint files to central web site, then send to Andy Bennett (chair computer applications committee), and then send to Trey Koger (local arrangements audiovisual chair) for final loading on the computers for use at the meeting. After extended discussion, Senseman suggested that it would be better to simply load all presentations at the meeting. Board consensus was to load presentations on site at the annual meeting. PowerPoint 2000 will be the version to use. This decision rests with the program chair (Harden).

Reynolds led a discussion on changes to allow purchase of SWSS products and services using a credit card at a web site. Reynolds reported that Mississippi State University would allow for online functions using a pointer web site to a secure site for money transfers, i.e. Pay Pal. Reynolds and Shaw discuss details concerning Pay Pal. Reynolds suggested opening separate checking account for use in online transactions. Shaw supported move to use Pay Pal. Mueller moved, Shaw seconded to use electronic form of payment (such as Pay Pal) for purchases of SWSS items, including annual meeting registrations. Motion passed. Shaw moved, Mueller seconded to establish separate account for use electronic transactions. Motion passed.

Score sheet changes for students paper and poster contests at annual meeting. Witt led discussion on proposed changes to judges score sheets (submitted by Todd Baughman). Discussion occurred with respect to appropriateness of current score sheet. Board consensus was to make following changes:
No. 1 -- delete hypothesis line, and add the word "hypothesis" immediately in front of objectives.
No. 2 -- eliminate the individual allocation of points for each line, but at the number of points to each section.
No. 3 -- reformat score sheet to allow space on score sheet for judges comments.

No. 4 -- add " ____ of _____ " at top of score sheet to indicate the judges that ranking will be is to determine winners.
The board also directed the graduate student contest (paper/poster) committee to consider moving No. 2 section into other sections, and to consider revamping and renewing the score sheet with fewer categories, while still providing some guidance to judges.

Newsletter editor report (Mueller). Shaw encouraged Mueller to include information on Washington liaison reports in SWSS newsletter. Witt instructed Mueller to place full address and phone number for the newsletter editor in every single issue of the newsletter. Mueller presented idea to mail only first, or cover, page of newsletter to all members. This would include the most important points of each newsletter, and the back page would be ordering information for items for sale. The full version of the newsletter would be available on web site. This would greatly simplify formatting for the newsletter, reduce costs, while still providing a tangible contact to each member. Mueller proposed to make this change next year. No changes proposed until further board action.

Proceedings report (Dotray). Proceedings complete, distribution ready; should be distributed in late June. Approval process for minutes discussed, and Shaw suggested rapid electronic dissemination and approval by board e-mail vote. Barrentine suggested formatting minutes to use "bold" text for most important items in agenda. Dotray reported cost savings of $6000 on proceedings (previous cost for hardcopy proceedings equal $13,000, compared to cost for CDs and shipping equal $7000). Barrentine moved and Shaw seconded to dedicate 2004 proceedings to Charles E. Moore and Chester G. McWhorter. Motion passed.

Site selection voting. Mueller moved, Senseman seconded to select San Antonio-Omni hotel for 2006 meeting (Jan. 23 -- 26) motion passed. Note: this hotel is not on the Riverwalk.

WSSA report. (Murphy) distributed written report. Murphy discussed concerns about Western Weed Science Society audit. Mueller requested Murphy to express concern to the WSSA board about difficulty and cumbersome nature of online submission of manuscripts.

CAST report (Barrentine). Distributed written report, primary focus and number one issue of CAST is membership and money crisis. Decreased company funding has resulted in $100,000 deficit. CAST is taking steps to reduce expenses. Barrentine mentioned CAST leadership conference on Nov. 15th -- 18th, 2003 in Harpers Ferry VA. Barrentine moved, Webster seconded to send three board members to CAST leadership conference. SWSS will pay registration costs of $800 per person. Motioned passed. Selected representatives were Shaw, Mueller, and Senseman. Witt will contact CAST and submit proposal for our attendance.

Journey to understanding Weeds funding. Mueller read from previous minutes that board had directed funding to Intermountain agriculture foundation. Board said for Schmidt to send a check for $500 (previous board action to be implemented).

Old business.

New Award Discussion. Webster discussed with the Board a previous idea to have an award to honor those members in the society from industry. Webster moved, Senseman seconded to establish an Outstanding Young Weed Scientist Award-Industry to be effective for the upcoming 2004 meeting. After discussion, motioned passed. Board consensus was the same requirements as the Outstanding Young Weed Scientist Award for Academia, and to rename that award to Outstanding Young Weed Scientist Award -- Academia. The Outstanding Young Weed

Scientist Award committee will administer and select both awards. Witt will contact awards Committee Chairman (Wells) concerning language for the new award.

Meeting adjourned 11:14 AM

Respectfully submitted,

Thomas C. Mueller, Secretary

Minutes of SWSS Board Meeting
Peabody Hotel, Memphis, TN
January 25, 2004

Meeting called to order at 1:00 PM by President Bill Witt.

Those in attendance: Scott Senseman (Board Member Academia), Peter Dotray (Proceedings Editor), Tim Murphy (WSSA Representative), David Shaw (Vice President), Bob Schmidt (Business Manager), Jim Barrentine (CAST representative), John Harden (President Elect; Program Chair), Fred Strachan (Board Member Industry), Dan Reynolds (Web Master), Bill Witt (President), Gene Wills (MOP representative), Larry Nelson (Forestry Representative), Greg Steele (Grad Student Rep), Dunk Porterfield (Board Member Industry), Eric Webster (Board Member Academia), Jackie Driver (incoming vice president for 2004), John Byrd (incoming Board member for academia), and Rob Hedberg (Washington liaison with WSSA).

Secretary Report. Witt asked that minutes be amended to read "list of committees were late". Mueller moved, Harden seconded, minutes approved as amended.

Newsletter Report. Mueller reported that 3 issues were produced in 2003, and asked Board to consider publishing only via the web to allow for greater flexibility in content and to reduce costs. Mueller moved, Wells seconded to have email notice of publication on the SWSS website of each issue of the newsletter, with change being effective for the December 2004 issue. Motion passed. Previous issues (those prior to December 2004) will have notices advising members of upcoming changes. Reynolds informed Board that new procedures will allow efficient loading of the newsletter on website.

Business Manager Report. Membership still declining, with decrease in 2003 down to 452. Weed ID guide sales increased to $14,700 during second half of 2003. SWSS in secure financial condition.

Program Committee Report. Harden provided overview of upcoming meeting, and commended Reynolds for his good work concerning online submission of paper titles and abstracts. Schmidt commented that program growth (# of papers/posters) is causing the printed program to get too big, thus increasing printing costs. Schmidt suggested not having titles in all capital letters (referred to program chair, webmaster).

Editors Report. Dotray informed Board that proceedings were distributed in early July, 2003, with only CD versions produced. 2003 Proceedings grew to 573 pages (increase from 408 pages in 2002), largely due to beginning each abstract on a separate page and an increase in font size from 10 to 12 point. Dotray informed Board that there is adequate additional storage space on a CD to allow for several more years of future proceedings. Dotray commended and thanked Reynolds for excellent assistance.

Awards Committee Report. Wells suggested that non-winning nomination packets be forwarded to business manager for consideration the following year. Harden asked for clarification of funding for Outstanding Young Weed Scientist Award-Industry. Mueller moved, Shaw seconded for SWSS to fund OYWSA-Industry award at $1000 each year. Motion passed. Senseman asked for clarification concerning Outstanding Graduate Student Award criteria and qualifications. Item tabled pending subsequent report from Wells**.**

Nomination Committee Report. Wells reported on slate of officer nominations, including Mike DeFelice, Jackie Driver* for Vice President; Shawn Askew, John Byrd* for Board Member-Academia; Susan Rick*, Gary Schwarzlose, Board Member-Industry; Henry McLean, William Vencill* for Editor; and Mike Chandler*, Alan York for Endowment Foundation Board member (those elected by member ballots indicated by *).

Long Range Planning Committee Report. Don Murray reported that the new committee structure (several past presidents, etc) is working well. Murray reported on several items, including: A. SWSS consider having an attorney on retainer for prompt advice on legal matters, B. Consider adding an Endowment Fund Member to the SWSS Board (some subsequent discussion concerning adding as exofficio member), and C. Suggest SWSS actively embrace those individuals involved in the management of invasive plant species, even possibly a change in the makeup of the SWSS Board, and other substantial changes.

Shaw reported on Shared Leadership Conference (participation funded by SWSS). Attendees included Shaw, Mueller, Senseman. Training was sponsored by Kellogg Foundation and hosted by ICL (Institute for Conservation Leadership) and CAST, and was entitled "Changing Leadership for Changing Agriculture". Shaw provided an overview of the experience, including participating groups, and various aspects of the process of change in non-profit organizations associated with agriculture. The three attendees also presented some potential ideas for the SWSS Board to consider relative to areas of changes within the SWSS, including those related to increasing SWSS membership by reaching out to under-represented groups (View supported by Hedberg), changes to the meeting structure (ie program), and an assessment of business activities (ie mass marketing of SWSS products, sales via internet, etc).

Shaw proposed that board members conduct an assessment of the SWSS prior to the 2004 summer Board meeting, and to conduct a strategic planning session in concurrence with the summer Board meeting. Board consensus was to proceed with this plan.

CAST Report. Barrentine reported on CAST changes, focusing on budget deficit of that organization, which are resulting in personnel changes due to revenue loss (due to industry consolidations and some member organizations not renewing). CAST considering changing board member terms from 3 to 5 years to increase continuity on Board.

Forest Plants of SE Reprint Pre-Proposal. Jim Miller presented proposal for reprinting Forest Plants of the Southeast and Their Wildlife Uses, including the following ideas:

1. Propose that the 1999 version be reprinted after minor corrections and sold through retail outlets, book websites, and forestry-wildlife catalogs. Two incorrect images need to be replaced with typo's and mistakes corrected.
2. Propose that a lower weight paper be used to reduce the total book weight and costs of reprinting (recognizing that paper quality and weight is a major cost of printing).
3. Propose the use of a "lay-flat" cover stock or a semi-hard binding.
4. Propose that the CD version be placed in a pocket on the inside of the back cover to increase the value to the user with low production costs.
5. Propose the sale price be as low as possible to be competitive with comparable books and to foster use as a text as well as to gain wider sales. (Comparable books range from 14 to 18 dollars on Amazon.com)

Witt asked Miller for time frame for revision vs. reprinting, Miller said extensive revision not probable at this time. Mueller asked Schmidt about cost to reprint using previous printer (Craftmaster, Auburn, AL), and Schmidt estimated cost to be $40,000 for 4,000 copies (this was only an estimate). Miller suggested reprinting 10,000 copies (had no cost estimates). Witt informed Board he would take a copy of the book to University Press of Kentucky and determine their level of interest in publishing it for SWSS.

Barrentine moved and Murphy seconded to have Schmidt get a cost estimate from previous publisher (Craftmaster) for publishing 5,000 or 10,000 copies prior to summer Board meeting. Hedberg suggested contacting Joe Neal (involved with similar book of Weeds of NE), and Tom Whitson (Weeds of the West).

Local Arrangements Committee Report. Dan Poston provided corrections to the printed program to Board. Informed Board that process flowing smoothly and orderly.

Weed ID DVD, Book Report. Bryson reported on progress on Reformatting Weed ID guides into a book format. Board discussion focused on timetables, and need for this book. Mueller moved, Dotray seconded to spend $500 to convert current slides (those from Arlyn Evans) into a CD-compatible format. Motion passed. DeFelice requested "firm commitment" from SWSS Board prior to beginning the large endeavor of producing the book, with proposed title of "Encyclopedia of North American Weeds". Facets of proposal included: Use Greenleaf as publisher, SWSS has strong technical position (excellent image quality, various growth stages) for two books (southern and national). Senseman moved, Shaw seconded the following: SWSS commissions the Weed ID committee (lead by DeFelice and Bryson) to develop the materials necessary to create the "Encyclopedia of North American Weeds", and to then explore avenues of marketing this book through the major book resellers. The SWSS Board commits to publication of this book if it is accepted for publication into the mainstream publishing system through Ingram Book Distributors". Motion passed.

Barrentine asked for market research to determine need for the book, and Wells asked how binding this agreement would be.

Bryson made a written report that requested funding to pay for production of DVD of weed ID material (insufficient storage capacity in current CD format). Shaw moved, Wells seconded to allocate $4500 to "burn" DVD, place into a case, encase in shrink wrap, include a post card for registration, make 1500 copies, contents of DVD to be updated version of the Weed ID CDROM, and to rename the DVD as "Interactive Encyclopedia of North American Weeds." Motion passed.

Sales Coordination Committee Report. DeFelice expressed appreciation for lower prices of SWSS products. He discussed various aspects of the publication process. DeFelice commented on the book monopoly held by Ingram, (where they obtain a large percent of revenues), and that the only way to get into the mainstream publishing process is through a registered book publisher. He reminded board members that Amazon required 55% cost share to enter into their system (including Amazon Select), and that there is often hidden costs to publishing, such as shipping costs, returned books, etc. DeFelice encouraged SWSS to vigorously promote books, CD, DVDs, etc. Shaw suggested that the Sales Coordination Committee be asked to aggressively market SWSS publications, and for that committee to provide specific recommendations on strategic marketing of all SWSS products by the summer Board meeting.

WSSA Report. Murphy provided report. Future meetings are planned for Kansas City (2004), Honolulu, HI (2005), New York City (2006), and a southern or south central location (2007). Other aspects of WSSA presented and briefly discussed.

Adjourned 5:20 PM

Minutes of SWSS Board Meeting
Peabody Hotel, Memphis, TN
Monday, January 26, 2004

Monday, January 26, 2004

Meeting called to order at 10:00 AM by President Bill Witt.

Those in attendance: BillWitt, Dan Reynolds, David Shaw, Fred Strachan, Gene Wills, Jim Barrentine, John Harden, Peter Dotray, Scott Senseman, Tim Murphy, Tom Mueller, Jackie Driver, John Byrd, Sue Rick, Cody Gray.

Endowment Foundation Report. Randy Ratliff reported net worth = $282,143 (an increase of approximately $17,000 for the year). Ratliff expressed several concerns: GLP training had insufficient attendance to warrant conducting it (the GLP training is usually a good source of revenues to the Endowment Foundation), Certificates of Deposit are rolling over and the new interest rate is very low (a net result of this is decreased funds available for programs), and there were few individual contributions to SWSS Endowment Fund. Ratliff encouraged Board to consider alternate mechanisms for funding student activities. He presented and discussed several ideas for fund-raisers, including "series of prints" for auction and series of email reminders to encourage direct contribution by members. He also strongly supported the Long Range Planning Committee recommendation to have a liaison from Endowment Board on SWSS Board, and he submitted the name of Eric Prostko for consideration by the Board.

Director of Science Policy Report. Rob Hedberg presented information on several projects, including recent meeting dealing with invasive weeds in Florida meeting, APHIS project on glyphosate-tolerant bentgrass, National Weed Awareness Week, and others. He discussed his current financial funding, and he indicated that he is an employee of WSSA. He shared with the Board his desire to increase the visibility and focus on Weed Science.

Computer Applications Committee (CAC) Report. Andy Bennett proposed revised guidelines for video presentations, and volunteered more activity from this committee to assist local arrangements committee in this matter. Specific technical recommendations included saving presentations as Powerpoint 2000, to discourage use of portable memory "sticks" (can be erased, want CD to be reloaded if needed), to have SWSS provide internet access for attendees to check email, and encouraged standardization with hardware (mouse, having long enough cables to allow computer to be on podium). Witt asked Bennett for written report from CAC prior to summer Board meeting. Harden moved, Barrentine seconded to have CAC work in conjunction with local arrangements committee to provide technical support (instructional information prior to meeting and assistance at meeting), but section chairs are still responsible for their sections. Motion failed. Wells moved, Strachan seconded for CAC to provide section chairs with loaded presentations onto CD. Motion passed. Shaw requested CAC to provide written report prior to summer Board meeting.

Student Contest Report. Todd Baughmann informed Board there were 26 papers (3 sections), 18 posters (2 sections). He would provide detailed recommendations for Board action at Thursday Board meeting.

Finance Committee . Shaw expressed wish to plan for large future expense to print publications (maintain liquidity). He asked for clarification about status of reprinting Forest ID book (to consider at summer Board meeting). He suggested finding a different chair to Sales coordination committee, to allow DeFelice to focus on producing future SWSS products (Shaw will send recommendation to Harden). Shaw commented on shipping and handling fees for various products. Shaw moved, Mueller seconded to keep all prices at current rates, but add shipping and handling charges (standardized for each product at the discretion of the business manager). Motion passed.

Shaw asked for clarification on funds available for Weeds Contest, and the liability of the society for future Weeds Contest Expenses. Report from Mueller that Weeds Contest funds are held separately from SWSS funds, and adequate reserves are maintained to eliminate SWSS liability.

Research Report. Shaw moved, Webster seconded to drop section on Economic Losses Due to Weeds. Motion passed. Shaw noted that Chemical and Physical Properties of Herbicides information is lacking in the SWSS Proceedings.

Weeds Contest. Webster reported on 2003 contest. 24 students, 4 teams, one individual. He is having difficulty obtaining a host for 2004 contest, but believes company support for contest is still strong.

Graduate Student Organization (GSO) Report. Greg Steele discussed funding options to support the Endowment Foundation, graduate student luncheon, and the graduate student symposium (well received last year). He asked for more clear communication between SWSS Board, Endowment Board, and GSO. Wells commented that SWSS Board desired GSO to have autonomy, yet some interaction. Witt commended Steele for good service to SWSS. Cody Gray will be new GSO representative to the Board.

Placement Committee Report. Cletus Youmans requested MOP revision (for example, no need for type writers and carbon paper, etc). He suggested only having a table for the placement service.

Old Business. Wells moved, Wills seconded to clarify Graduate Student Award eligibility as follows: Student must be enrolled as a graduate student in the degree program (MS or PhD) for which she/he is nominated within the calendar year in which the nomination is made. Motion passed.

Senseman asked if students received comments from judges concerning paper/poster contests. Mueller said that students should receive score sheets from student program chair after meeting.

Barrentine reminded Board about annual evaluation of business manager. Several comments were brought forward by Board members to be considered by Witt and Harden (those designated to review Schmidt on Thursday AM).

New business: Board Consensus was to add an Endowment Board member to SWSS Board as exofficio member. Shaw suggested examining entire Board structure, including non voting members and adding an Endowment to Board. Harden suggested to appoint AD-HOC committee.

Meeting adjourned 12:52 PM January 26, 2004

Respectfully submitted,

Tom Mueller
SWSS Secretary/Treasurer

BUSINESS MANAGER'S REPORT - Bob Schmidt January 22, 2004

Southern Weed Science Society

Business Manager's Report

Membership as of December 31

	2003	2002	2001	2000	1999	1998	1997
Members and Sustaining Members	452	500	510	527	559	662	661
Students	111	118	126	131	136	136	120
Totals	563	618	636	658	695	798	781

Research Methods to date

Expense $38,003 Income $41,146

Weed Identification Guide to date

Expense $480,234 Income $780,404
$14,728 of sales at $39.95

Weeds of the United States and Canada CD-ROM vs 1,2,2.1
Expenses $29,038 Income $141,912

Forest Plants of the Southeast and Their Wildlife Uses

Expenses $109,656 Income $183,810

Preregistration

	2004	2003	2002	2001	2000	1999	1998	1997
Members	181	220	226	248	249	261	285	292
Students	74	66	80	87	115	116	74	74
Total	255	266	306	335	364	377	359	365
Percentage of final	66%	66%	68%	76%	75%	59%	60%	60%
Total Attendance	381 est	400	456	492	476	501	601	584

Committee: 100a **Committee Name:** Editor's Report

Summary of Progress:
The 2003 Proceedings contained 573 pages, up from 408 and 396 pages in the 2002 and 2001 Proceedings, respectively. This increase in number of pages was the result of a change in font size (from 10 to 12 point) and starting each abstract on a new page. The 2003 Proceedings was available in CD form only, compared to half CD and half book copies in 2002 and book copies only in 2001. The 2003 Proceedings contained all executive board minutes, committee reports, business manager's report, general session presentations, presidential address, award winners, and research reports that were submitted as well as abstracts and full papers. The abstracts and full papers are available via the web from the SWSS home page (www.swss.ws). Following is the distribution of number of presentations and number of pages.

Section	**Number Presented**	**Number of Pages**
Minute of Executive Board, Committee Reports, etc.	---	80
General Session	1	4
Weed Management in Agronomic Crops	59	72
Weed Management in Turf, Pasture, and Rangeland	31	34
Weed Management in Horticultural Crops	9	12
Forest Vegetation Management	14	38
Utility, Railroad and Highway Right-of-Way and Industrial Sites.	7	12
Physiological and Biological Aspects of Weed Control	24	26
Education and Regulatory Aspects of Weed Management	7	19
Developments from Industry	11	12
Application Technology	4	5
Soil and Environmental Aspects of Weed Science	14	14
Research Posters	91	110
Symposiums	13	18
State Extension Publications, Weed Survey, Economic Losses, Index	---	33
Indexes, Registrants, etc	---	84
Total Presentations (General Session, Abstracts & Papers)	272	---
Grand Total	**285**	**573**

Objective(s) for Next Year:
Get the SWSS CD Proceedings in the hands of the membership by mid-summer.
Recommendation or Request for Board Action:
None.
Finances (in any) Requested:
None.
Respectfully submitted;
Peter A. Dotray, Editor

SECRETARY-TREASURER'S REPORT-Tom Mueller

Membership still declining, with decrease in 2003 down to 452. Weed ID guide sales increased to $14,700 during second half of 2003. SWSS in secure financial condition.

Committee Number: 100b **Committee Name:** WSSA Report

Summary of Progress:
The WSSA summer Board meeting was held July 26-27, 2003 in Kansas City, MO at the Westin Crown Center Hotel. Items discussed included:

2004 Annual Meeting: Meeting will be held at the Westin Crown Center Hotel in Kansas City, MO on February 9-12, 2004. Four symposia and one workshop will be held:

* Fate of Agrochemicals in the Environment and Implications for Water Quality
* Remote Sensing and Site-Specific Weed Management
* Second Generation Crop Biotechnology and Predicted Effects on Weed and Pest Management
* Sustainability of Glyphosate and Glyphosate-Resistant Crops
* Invasive Plant Species Workshop

Additionally, a Vegetable Herbicide Roundtable Discussion has been scheduled for 4 hours on February 11.

Future Annual Meetings: 2005 - Honolulu, HI; 2006 - New York City, 2007 – will be held in southern or South Central U.S.

Graduate Students: Cody Gray and Horace Skipper will be preparing a proposal formalizing a WSSA graduate student organization or committee for WSSA Board consideration. Formation of this organization/committee is needed to permit graduate student representation on the Board.

WSSA Publications: Mike Foley, Director of Publications, is in the process of obtaining bids for digitizing back issues of *Weeds*, *Weed Technology* and *Weed Science* for the Board's consideration. The CD project, 1,000 Weeds of North America: An Identification Guide is now being sold for $49.95 + $5.00 for shipping and handling. Phase II of this cooperative project with XID Services, Inc. is underway with a goal of adding 420 additional species, with a scheduled completion date of the 2005 WSSA annual meeting. Submission of weed images by WSSA members to the Phase II project has been low, and WSSA may have to provide funds for photographers. WSSA will be marketing a new book Aquatic and Riparian Weeds of the West as service to members. This decision prompted discussion on the role of WSSA in marketing non-WSSA publications and materials, particularly from the private sector. WSSA is also interested in possibly marketing regional weed science publications as well as regional societies marketing their publications. Additionally, WSSA is partnering with DowAgroSciences and the Center for Invasive Plant Management on a CD entitled "Assessing the Economic, Environmental and Societal Losses from Invasive Plants on Rangeland and Wild Lands."

Director of Education Position: Gerry Stephenson, retired weed scientist from the University of Guelph, has agreed to accept the volunteer (unpaid) position of WSSA Director of Education.

Strategic Planning Session: At the summer Board meeting the WSSA board held a ½ day strategic planning session. Among the issues modeled were: a) WSSA website revision, and b) development of a business/marketing plan for WSSA. The complete report of this effort will be discussed at the February Board Meeting.

WSSA Board Communications: Protocols were established that enable the WSSA Board to conduct business via EMAIL or conference calls at times other than the annual and summer Board meeting. For EMAIL actions, Board members are sent a copy of the issue, and have 48 hours to respond to all Board members. The secretary tallies the votes and reports the results to Board members via EMAIL. For conference calls, a similar protocol is followed except a voice vote is recorded by the Secretary.

Center for Invasive Plant Management: WSSA will include on membership renewal forms an invasive weeds category as an area of specialty for WSSA members. This information will be provided to the Center for Invasive Plant Management to assist them in developing searchable data base of invasive weed researchers. WSSA will be adding a check box to membership renewal forms that the member may check if he/she does not want their name sold to various data bases.

WSSA Past Presidents: The Board decided to give automatic (free) membership in WSSA to WSSA past presidents when they retire from their professional position.

WSSA Facts:
Current membership – 1,734 members in 2003 (down from 1880 in 2002)

Objective(s) for Next Year:
Attend WSSA and SWSS Board meetings, represent SWSS at WSSA Board Meetings.

Recommendation or Request for Board Action:
None

Finances (in any) Requested:
Travel expenses to WSSA summer Board Meeting

Respectfully submitted;

Tim R. Murphy, SWSS Representative to WSSA

Committee Number: 100b **Committee Name:** CAST

Report to SWSS Board, January 25, 2004
Jim Barrentine

Council for Agricultural Science and Technology (CAST)

General Summary:

CAST is struggling financially as receipts from memberships have decreased over $200k since 1999. The CAST staff has done an exceptionally good job in meeting their budget but it is with sacrifices. The director of membership was placed on half time in July and he resigned in September. Since membership is a major source of income, the loss of this position may have some long-term effects. Securing grants to assist with payment of overhead has been effective in assisting with meeting the budget. Through a benchmarking exercise of board members and staff, an annual operating plan, fund raising plan & improved communications among various CAST communities were identified as significant needs. Since the September board meeting, Dr. Maronek, CAST president, has appointed a committee to develop a comprehensive fund-raising plan. Developing an annual plan and improving communications are underway as well.

New Faces At CAST

- Dr. Dale M. Maronek, representative of the American Society of Horticultural Science on the CAST Board of Directors and Head of the Department of Horticulture and Landscape Architecture at Oklahoma State University, served as president for CAST.)
- Jodi Wilson Serving as Membership Coordinator October 2003
- Dr. Sharlene Matten with EPA's Office of Pesticide Program's Biopesticides and Pollution Prevention Division was detailed to CAST from February 10th – June 6th, 2003. (February 2003)
- Lynette Allen joined CAST's Ames office as a part time assistant editor. (February 2003)
- Donal Nugent, from Dublin, Ireland, joined CAST's Washington office for a short-term food and agricultural science journalism fellowship. (March 2003)
- Josh Siepel, a student at Texas A&M University, joined CAST's Washington office as a 2003 summer agricultural policy intern. (May 2003)

Biotechnology Communications Initiative

- CAST hosted more than 100 scientists, regulators, and non-profit organization representatives for a two-day workshop on *Biotechnology-derived, Perennial Turf and Forage Grasses: Criteria for Evaluation* in Baltimore, MD. The workshop provided a forum for discussion of the state-of-the-science of biotechnology-derived perennial turf and forage grasses, and initiated a dialogue on the criteria that could be used to determine the potential benefits and risks of these grasses relative to traditional varieties. The workshop was supported in part by the USDA Animal and Plant Health Inspection Service. (January 2003)

Leadership Development Program

- Two "Shared Leadership I" workshops were held at the Glynwood Conference Center near Cold Spring, NY (June 2003.) and at the Hilltop House in Harper's Ferry, West Virginia (November 2003). Three representatives from each of eight organizations were invited to attend each workshop, sharing experiences and gaining skills to handle leadership challenges in an increasingly complex time.
- The "Shared Leadership II" workshop was held at Asilomar Conference Center near Monterrey, CA. This second-tier workshop included teams of three people from eight organizations (March 2003)

Workshops–Roundtables–Symposiums

- Dr. Teresa A. Gruber made a presentation at the World Mycotoxin Forum in the Netherlands. (February 2003)

- Dr. Teresa A. Gruber participated with a delegation of policy experts for a fact-finding trip to investigate Cuba's transformation from chemical-intensive, industrial agriculture to sustainable and organic agriculture. The Institute coordinated this fact-finding trip for Food and Development Policy/Food First under a grant from the W.K. Kellogg Foundation. (February-March 2003)

- CAST Symposium, *Management of Pest Resistance: Strategies Using Crop Management, Biotechnology and Pesticides*, was held in Indianapolis. This cross-disciplinary dialogue involved diverse stakeholders working on insect, pathogen and weed pest resistance management issues. The 120 participants included representatives from federal and state government, pesticide education programs, industry, crop consultants, public interest groups, grower organizations, and academia. Participants provided suggestions on research, funding, regulatory, and collaborative activities to more directly address proactive pest resistance management. CAST will publish on-line Proceedings in Fall 2003. (April 2003)

- The fifth biotechnology roundtable in a series, *Biopharming and Biosafety Roundtable*, was held in St. Louis and was sponsored by the ABA Section of Environment, Energy, and Resources' Agricultural Management Committee and developed in cooperation with CAST, CropLife America, and the American Agricultural Law Association. (May 2003)

Publications

- *Mycotoxins: Risks in Plant, Animal, and Human Systems*. Cochairs: John L. Richard, Romer Labs, Inc., Union, MO, and Gary A. Payne, Dept. of Plant Pathology, North Carolina State University, Raleigh. This task force report provides policymakers and others with the most complete current information on mycotoxins, along with recommendations for minimizing their risk to plants, animals, and humans. (January 2003)

- *Biotechnology in Animal Agriculture: An Overview*. Chair: Dr. Terry D. Etherton, Department of Dairy and Animal Science, The Pennsylvania State University, University Park, PA. This issue paper, the first in a series, introduces the concept of biotechnology used in animal agriculture, including the risks and benefits to society. (February 2003)

- *Boundless Science for Bountiful Agriculture: Winning Student Essays 2003.* This special publication compiles national, state, and territory winning entries from an essay contest for students in 6th, 7th, and 8th grades. Students wrote essays on one of seven preselected topics dealing with food and agricultural science. (March 2003)

- *Integrated Pest Management: Current and Future Strategies.* Chair: Dr. Kenneth R. Barker (ret.), Dept. of Plant Pathology, North Carolina State University, Raleigh. This report considers new technologies and rigorous government policies that bring both great promise and challenges to today's integrated pest management (IPM). (June 2003)

- *Nutraceuticals for Health Promotion and Disease Prevention.* This issue paper provides background on the scope of today's market; describes regulatory issues; and discusses scientific research issues including safety concerns, "designer foods," production, and funding. (October 2003)

- *Food Safety and Fresh Produce*. This commentary was prepared to address the outbreak of hepatitis A in Pennsylvania that was due to contaminated green onions. Public was reminded that disease-causing microorganisms are not a part of the natural microorganisms found on or in fresh produce. If disease-causing microbes are present on fruits or vegetables, it is due to inadvertent contamination and that the fresh-produce processing industry uses various tools to decrease microbial contamination on products. Consumers were advised of several actions to decrease their risk from disease-causing microbes on fresh fruit and vegetables. (December 2003)

In the Works - Forthcoming Publications

- *Climate Change and Greenhouse Gas Mitigation: Challenges and Opportunities for Agriculture.* This comprehensive report summarizes recent research on the potential to mitigate greenhouse gas (GHG) emissions through changes in agricultural and land management practices. It examines data from U.S. agriculture and provides information useful to government and industry policymakers, agricultural producers, members of environmental and other nongovernmental organizations, and the general public.

- *Intervention Strategies for the Safety of Foods of Animal Origin.* This paper considers production issues (e.g., sources of pathogenic contamination and transmission mechanisms), food processing (e.g., ready-to-cook foods), food retailing (e.g., intervention strategies), and food service (e.g., changes to existing strategies). The intended audience includes decision makers, researchers, consumer advocates, and workers in the food processing and food service sectors.

Committee Number: 102 **Committee Name:** Awards Committee (STANDING)

Summary of Progress:
The annual call for nominations for awards was published in the summer newsletter. There was an outstanding group of nominees this year.

Distinguished Service Award Subcommittee, Industry – Mike S. DeFelice
Distinguished Service Award Subcommittee, Academia – Don S. Murray
Outstanding Young Weed Scientist Award, Academia – David L. Jordan
Outstanding Young Weed Scientist Award, Industry – James C. Holloway
Weed Scientist of the Year Award – Gene D. Wills
Outstanding Educator Award – William K. Vencill
Outstanding Graduate Student Award, M.S. – Walter E. Thomas
Outstanding Graduate Student Award, Ph.D. – Eric F. Scherder

Objective(s) for Next Year:
Clarify process for collecting nomination packages for consideration in following years.

Recommendation or Request for Board Action: Approve a process to forward nomination packages of candidates not receiving awards in the current year to the business manager for consideration by the appropriate award subcommittee in following years. The business manager would hold the packages and send them to the appropriate subcommittee chair when the call for nominations is made. The forwarded packages would be considered with new nominations as specified by the MOP.

Finances (in any) Requested: None

Respectfully submitted: Jerry Wells, Awards Committee Chair

Distinguished Service Award Subcommittee
K.L. Smith, Chair D.M. Simpson T.L. Smith
D.L. Jordan J.L. Yeiser W.K. Vencill

Outstanding Young Weed Scientist Award Subcommittee
A.R. Rhodes, Chair D. Sanders T.R. Murphy
H.S. McLean S.W. Murdock L. Cargill

Weed Scientist of the Year Award Subcommittee
A.C. York, Chair D.R. Shaw J.D. Green
E. Palmer J. Breen L. Nelson

Outstanding Educator Award Subcommittee
A. Wiese, Chair T. Crumby M. Singh
L.L. Whatley J. Doran T.F. Peeper

Outstanding Graduate Student Award Subcommittee
C. Pearson,Chair W. Wells S. Garris
S. Sensemen W.K. Vencill A.W. Ezell

Committee Number: 103 **Committee Name:** Computer Applications Committee(STANDING)

Action Items:

1. Role of computer applications committee in presentations for meetings:

Take a more active role, in conjunction with sections chairs:
- Provide Guidelines for presentations
- Continue to load locally
- Section chairs manage loading, with support from committee

Advantages
- Provides continuity—no loss of institutional knowledge
- Gives active role to section chairs
- Utilizes knowledge on the computer application committee

Formats for presentations:

Require presentations be in Microsoft Powerpoint 2000 or earlier.

- Presentations can become extremely large when converted to earlier formats
- Newer versions are backwards compatible
- Section chairs insure they have Powerpoint 2000

Advantages
- No problems with presentation "blow up"

Other items:

Format of presentations
- Many people using memory sticks

- Continue to require CD-R
- Other Media formats responsibility of presenter

Computer/Ethernet line for internet connection for meeting participants to check email
- Cost of line?
- Equipment (easy to provide)

Standardize laptop arrangement
- Mouse for every computer
- Long cords, computer always on podium
- Useful for students

Committee Number: 104 **Committee Name:** Constitution and Operating Procedures Committee (Standing)

SUMMARY OF PROGRESS: At the annual meeting of the SWSS Executive Board in January and at the Summer Meeting in June 2003, suggestions for changes in the SWSS Operating Procedures were presented to the Executive Board. Following the Summer Board Meeting, all approved revisions and all directives for changes by the Executive Board were made in the SWSS Manual of Operating Procedures (MOP). During October 2003, the revised edition of the MOP was submitted for distribution on the SWSS Web Site, http://www.weedscience.msstate.edu/swss/. Change of concern to the entire membership was that the SWSS Membership voted to add the SWSS Webmaster as an Ex-Officio Member of the Southern Weed Science Society Executive Board.

OBJECTIVE(S) FOR NEXT YEAR: To continue with a timely revision of the SWSS Manual of Operating Procedures following the Summer Meeting of the SWSS Executive Board and placing the revised Procedures on the SWSS Web site.

FINANCES REQUESTED: None

RESPECTFULLY SUBMITTED:
J. A. Dusky, R. M. Hayes, and G. D. Wills, Chairperson

Committee Number: 106 **Committee Name:** Finance (STANDING)

Summary of Progress:
Currently, the SWSS has $190,000 invested in Certificates of Deposit for varying terms, and interest rates ranging from 1.0% to 4.5%. This is in addition to the cash and money market accounts for readily available funds. Annual operating expenses, excluding one-time publication purchases, average $100,000. Thus, reserves approach two years of operating expenses, which is a goal of the SWSS.

The SWSS is currently considering reprinting the Forest Plants of the Southeast book, and developing a new book, Encyclopedia of North American Weeds. Cost for the reprinting is estimated at $40,000 to $60,000, depending on the publisher used and the number printed. Printing the new book is estimated to cost $150,000. Taking on either/both of these publications will require the SWSS to manage its funds carefully in order to preserve fiscal integrity. One option suggested was to contact a university publisher for the Forestry publication to preserve funds for the Encyclopedia publication.

Mike DeFelice has indicated that he is resigning as chair of the Sales Coordination Committee, since he is assuming a major role in the Encyclopedia book. The SWSS President should quickly identify a new chair who will aggressively promote our publications, and prepare an aggressive marketing plan for new publications planned.

Currently, the SWSS includes shipping and handling as a part of the cost of all publications. The Finance Committee recommends that shipping and handling be assessed on each publication as an additional cost.

The Weed Contest Committee funds are not clearly delineated in the SWSS budget. A fairly loose arrangement exists for reimbursing the host of the contest each year. Clarification is sought on accounting of the funds collected, and the liability to the SWSS if deficit spending occurs.

Objectives for Next Year:
- Develop budget with consideration for major expenditures for new publications in mind.
- Activate Sales Coordination Committee to aggressively promote SWSS publications.

Recommendations or Request for Board Action:
- Identify new Sales Coordination Committee Chair; charge Chair with aggressive marketing strategy development.
- Explore publishing the reprinted Forest Plants of the Southeast through a university press.
- Assess shipping and handling charges separate from price of publications.
- Renew Certificates of Deposit as they mature, with the need in mind for funding the Encyclopedia of North American Weeds publication.

Finances (if any) Requested:
As per budget.

Respectfully submitted,
David Shaw, Chair; Tom Mueller; John Harden; Peter Dotray, Ken Smith, James Holloway, Dan Poston, Robert Schmidt, ex officio

Committee Number: 108 **Committee Name:** Legislative and Regulatory Committee (STANDING)

WSSA Director of Science Policy Report -
focus of the SWSS 2004 Legislative and Regulatory meeting

Finances
Highlights of Last Year
- NIWAW IV
- CARAT Transition Workgroup
- EPA Tour
- Bentgrass Project
- IPINAMS

YearAhead
- NRI
- NIWAW 5
- WSWS
- PTI Reviews
- Finish Bentgrass
- Meet with SE EPPC
- ERS Funding for Crop Losses Due to Weeds (The New Century Edition)
- ANPR for ESA

Finances: About $41,000 ahead in DSP Escrow account after 4 years due to external funds. This does not include the contribution yet to come from the Bentgrass project or additional charges against IPINAMS. (There will also be a residual profit form IPINAMS to be shared with ESA). In addition, outside funds have paid for 6 months of Kai Umeda's service, four months of Nelroy's service and about 6 months of professional service from Bentgrass team members.

Last year:
EPA Tour: Worked with DowAgro Sciences, the Nature Conservancy and National Park Service to host a tour for 22 staffers from EPA Office of Pesticide Programs to look at invasive weed problems in the field. Objective was to get them to understand the problem of weeds in natural areas, their role in registering herbicides for this environment and to help them see that invasive weed management is a more productive route to endangered species protection then ad infinitum herbicide consultations. (Invasive species have caused numerous extinctions - Has a herbicide or a pesticide ever caused an extinction?)

NIWAW IV: Over 100 people from 28 states. High level briefings, lots of positive feedback.

CARAT Transition Workgroup: Objective: Build unanimous consensus among diverse and adversarial members that strong support for Pest Management, Research Education and Extension is fundamental to progress towards improved pest management practices. (USDA-CSREES is primary vehicle, USDA-ARS as secondary vehicle for this progress). Audience for potential consensus statement will be a) USDA and EPA administration b) the Hill. Secondary objective: Creation of a long term strategic plan for the pest management research, education and extension infrastructure. Outcome to date: Verbal agreement on the concept; initiation of benchmarking study through USDA Office of Pest Management.

Bentgrass Project: Project on target, team meeting right now to review component first drafts. Team members are Phil Banks, Kent Harrison, Bruce Branham, Ian Heap and Tom Whitson. Plan for first draft to he delivered to reviewers (Carol Mallory Smith, Tim Murphy and Steve Dewey) on March 1, with 2 week turnaround, final draft to be delivered to APHIS on March 31. Objectives: Establish reputation for delivering high quality scientific analysis to client on time; publish results via our journals (or website).

IPINAMS: Objective: Integrate multi-disciplinary science with management (and policy); demonstrate leadership, stature and strength of weed science discipline. Outcome: 800 participants, 100 international, 120 students, 150 invited presentations; 72 contributed oral papers, 240 posters; 20 exhibitors; $300,000 federal support; $50,000 industry support; $150,000 + registration. INCREDIBLE ENTHUSIASM and recognition of our leadership role and the proceedings will be in Weed Technology.
Year Ahead:
NRI: Formal statement from Research/Competitive Grants Committee through Board and to USDA-CSREES by end of next week as the draft 2005 research priorities.

National CFAR: Have stepped down as Chair of Research Committee after successfully launching effort to create a series of compelling, one-page research success stories. Tamara Wagester, CFARE, has taken chairmanship. Next effort is to initiate a series of multi-discipline Ag Science briefings for the Hill. Requesting $500 WSSA contribution to help kick this off.

NIWAW 5: February 23-27. (www.NAWMA.org) officially chairing the committee this year; 84 people registered to date. Strong briefings arranged both with feds and with both Ag and enviro NGO groups. (Last planning meeting: 22 people from 17 different organizations) Exhibits, reception and kids day at US Botanical Garden. Two consensus objectives for all participants: 1) Passage of the Noxious Weed Control Act (Senate version); progress on implementation of national Early Detection and Rapid Response Plan for invasive plants. (Third position for WSSA and INWAC – Establishment of a federal job series for weed science and management. USDA-FS and IS coordinator very supportive).

WSWS: Will be attending WSWS meeting in Colorado Springs in mid March.

PTI Reviews: In late March will be part of panel to review 94 National Fish and Wildlife Foundation (NFWF) Pulling Together Jnititiatve (PTI)grant applications and select projects to fund. My screen is overall quality, reasonable costs, appropriate science and technology and reasonable outreach efforts.

Finish Bentgrass: If needed will jump in to help with word smithing of final draft.

Meet with SE EPPC: Invited to attend Southeast Exotic Plant Pest Council Meeting, Topic: Enhancing coordination between SWSS and SE EPPC.

Crop Losses Due to Weeds (The New Century Edition); Last year USDA-ERS launched a $2.0 million invasive species research effort ($1.5 extramural; 0.5 million internal). (A positive outcome of NIWAW) Expect similar call for proposals this spring and want to have WSSA proposal for updating crop losses due to weeds in the pool. Overall objective: A trilogy of current weed loss data under banner of WSSA and APMS (Aquatics, Range and Crops). (John Wilcut, Len Giannessi?)

Endangered Species Act Consultation: ESA/EPA/FWS/NMFS: The Perfect Train Wreck: Potential return to days of black box pesticide evaluations. Possible avenues to avert disaster: find common ground around managing invasive species to protect endangered species or new charge for CARAT committee. Will need lots of thought, teamwork and effort.

Committee Number: 110 **Committee Name:** Long Range Planning Committee (STANDING)

Summary of Progress:
The committee met the Sunday morning immediately before the SWSS Board meeting and discussed several topics in preparation for presentation to the Board.

Objective(s) for Next Year:
Accept the assignment from the President and Board of Directors.

Recommendation or Request for Board Action:
1. The LRPC agreed that it would be advisable for the Board to consider retaining an attorney for such items as liability issues for both the Board and Endowment Foundation. Some of the attorney's activities could be, but not limited to, feasibility of liability insurance for the both the Board and the Endowment Foundation and copyright issues. The LRPC further recommends that the attorney be in close proximity to the Business Manager's office.

2. The LRPC recommends that the Endowment Foundation have voting rights on the SWSS Board of Directors. The representatives to the Endowment Foundation are elected by the Society membership, and the linkage between SWSS and the Endowment Foundation would be strengthened by representation and attendance on the Board meeting both in January and during the summer. A minor change to the constitution may be necessary to accomplish this.

3. The Society is at a crossroads now - will it grow, flourish, and serve or will it slowly dwindle if changes (some rather dramatic) are not implemented soon? The LRPC recommends, in the strongest terms, that the Board seriously consider actively engaging invasive species working groups and others with similar interests in the management and understanding of unwanted plants to participate in SWSS. If necessary, the Board should consider the use of Society funds to facilitate these groups participating in SWSS. The Board is asked to consider including, specifically, the invasive species groups with the Society and this inclusion does not simply mean that the Society invite them to come to "our" meeting, but rather the Society should ask them to be a partner in "redirecting" or "reshaping" SWSS. The Society may very well need to alter or change the constitution and/or other components of how the Society has functioned over the past 50 years to accomplish this massive task.

The most extreme change to be considered might be changing the name of SWSS (no name proposed), but certainly changes in the constitution are likely. This may even involve altering the structure of the Board where representation is by speciality group (agronomic crops, pasture & range, invasive species, turf, physiology, etc.). Other changes that should be considered are meeting time changes, the structure of the meeting itself, registration fees, and sites with less expensive room rates. The LRPC unanimously agreed that change is inevitable if the Society is to maintain the strong weed science presence in the south.

4. David Shaw, Scott Senseman, and Tom Mueller attended a workshop on "shared leadership". These individuals should certainly be involved with further discussions regarding change in SWSS.

Finances (if any) Requested:
None requested

Respectfully submitted:

Ratliff, R.L. Committee member
Street, J.L. Committee member
Whatley, L.L. Committee member
Wells, J.L. Committee member
Witt, W.W. Committee member
Murray, D.S. Chairperson

Committee Number: 112 **Committee Name:** Nomination Committee (STANDING)

Summary of Progress:
Committee members solicited nominations from the membership for the office of Vice President, Board of Directors for Academia, Board of Directors for Industry, Editor, and Endowment Foundation Trustee. The society is blessed with a large number of capable and supportive members. The Nomination Committee considered each nomination and ranked them by office. The top two ranked nominees for each office were selected to be placed on the ballot. Ballots were mailed to the membership who voted to select their officers. The names appearing on the ballots are shown below. The name of the candidate receiving the most votes is indicated with an asterisk.

Vice President:	Michael DeFelice Jackie Driver*
Board Member for Academia:	Shawn Askew John Byrd*
Board Member for Industry:	Susan Rick* Gary Schwarzlose
Editor:	Henry McLean William Vencill*
Endowment Foundation:	Mike Chandler* Alan York

Objective(s) for Next Year:
Select a new set of candidates to fill open positions.

Recommendation or Request for Board Action:
Approve new officers.

Finances (in any) Requested:
None

Respectfully submitted;
B. Watkins, S. Hagood, L.L. Whatley, S.K. Rick, J.A. Kendig, J.L. Yeiser, G. Schwarzlose, M.A. Thompson, G. MacDonald, and J.W. Wells, chair

Committee Number: 113 **Committee Name:** Placement Committee

Jan. 25, 2004

The placement committee will be set up in the press room at the Peabody Hotel, Jan. 26 -28, 2004, beginning at 7:45 A.M Monday and will be operational by 8:00A.M. Notebooks will provide an outlet for "Positions Desired" and "Positions Available". An easel will be available for writing notes, attaching notes, leaving messages, etc. The placement service will attempt to inform all contributors of the notebooks to enter similar information at the WSSA website, if desirable.

The combining of committee rooms for the 2004 meeting, including the placement service with the pressroom, is a good idea. The placement service will not be manned 8-h/day, as this isn't necessary, due to all the contact information being entered on the placement forms (similar to the WSSA site forms) and the use of the easel for leaving notices. All SWSS attending placement committee members, for 2005 and beyond, should attempt to visit the placement service during the SWSS meeting. C. Youmans, A. Kendig, and C. Bryson will be the primary contacts for the placement service during this meeting. All placement forms, submitted during the 2004 meeting will be destroyed after 5P.M., Jan. 28, 2004 (WSSA web provides a location for storing such information).

The committee suggests all future committees be notified of their 2004/2005 responsibilities, while at the 2004 SWSS meeting.

Members: C. Youmans, N. Buerhing (Student rep), J. Kendig, W. Garbett, R. Jain, C. Brommer, and D. Dodds

Objective(s) for Next Year:
Use the WSSA placement site 100%, delete the placement committee.

Recommendation or Request for Board Action:
Use WSSA placement service. Indicate to all members, the placement service is 100% computerized and all jobs desired advertising are viewable over the WSSA web.

Finances (in any) Requested: None

Respectfully submitted: Clete Youmans, Placement Committee Chair

Committee Number: 114 **Committee Name:** Program (STANDING)

Summary of Progress:
The theme for the 57th annual Southern Weed Science Society Meeting in Memphis, TN will be: "The Changing World of Weed Science". Growers, academia, industry and government are ever adjusting to the presence of GMO crops, new pest detection and application technology as well as new chemistry. Dr Bob Hayes, University of Tennessee, welcomed the membership to Memphis. Leonard Gianessi, Program Director and Senior Research Associate for the National Center for Food and Agricultural Policy provided the keynote address. The address message was "The Value of Herbicides and Biotech Crops". President Bill Witt's address to the membership was "The Changing World of Weed Science: Is the Southern Weed Science Society Meeting This Challenge".

The 2004 program consisted of 101 posters and 227 oral presentations being submitted. The following symposia were presented: Organic Weed Control; Rice Weed Management and Production; and Graduate Student Issues. Graduate Student competition consisted of 19 posters and 26 oral presentations.

Objective(s) for Next Year:
Further refining the process for LCD presentations. Perhaps having the Section Chairs receive the presentations (Federal Express or via email) by Thursday prior to the meeting to ensure the loading of the presentation.

Further refine the title submission process as to poster verses oral presentations. Discuss the need for a keyword entry to help group by topics or crops.

Recommendation or Request for Board Action:
From discussion with Trey Koger, there needs to be a way to prevent the membership from exceeding the 25 MB limit for the PowerPoint presentation. Excessive file size was due to the high-resolution settings for the photos embedded into the presentation.

Finances (in any) Requested:
None

Respectfully submitted;

E.P. Prostko, S.D. Askew, G. Stapleton, D.K. Robinson, H.E. Quicke, J.D. Byrd, C. Tingle, J.T. Ducar, A. Fletcher, T. Adcock, J.H. Massey, J. Mitchell, R.C. Scott, D. L. Jordan, G.L. Steele, J.S. Harden - Chairperson

Committee Number: 117 **Committee Name:** Research Committee (STANDING)

Summary of Progress:

Reports for "Economic Losses Due to Weeds", "State Extension Weed Control Publications", and "Weed Survey – Southern States" were prepared and submitted. No responses have been provided for "Chemical and Physical Properties of New Herbicides" again this year.

Objective(s) for Next Year:

Discuss mechanisms of improving the accuracy of the "Economic Losses Due to Weeds"; also consider reducing the frequency of this report.

Recommendation or Request for Board Action:

None.

Finances (if any) Requested:

None.

Respectfully Submitted:

J.D. Byrd
V.L. Ford
E.P. Webster
T. M. Webster
D. R. Shaw, Chair

Committee Number: 118 **Committee Name:** Resolutions and Necrology (STANDING)

Summary of Progress:
Three necrology reports were submitted, Dr. Kriton Hatzios, Dr. Chester McWhorter, and Dr. Charles J. Scifres.

Objective(s) for Next Year:
Initiate a web-based necrology and resolutions reporting system as suggested by 2002 Resolutions and Necrology Committee and Past President Laura Whatley. Continue necrology reports and consider/draft resolutions as requested by the membership or the Executive Board.

Recommendation or Request for Board Action:

RESOLUTION:
Commendations for an effective meeting
WHEREAS the arrangements and programs for the 57th annual meeting of the Southern Weed Science Society have been of excellent quality, and WHEREAS a well-planned and well-organized meeting is important for the continued development of the society and is appreciated by its officers and members,

THEREFORE BE IT RESOLVED that the officers and membership of the Southern Weed Science Society commend Chairman Dan Poston and members of the local arrangements committee and Chairman John Harden and members of the program committee for their outstanding efforts in behalf of the society.

NECROLOGIES:
Dr. Kriton Hatzios, 54, died February 20, 2003, following a valiant struggle with cancer. The son of Diamado and Kleanthis Hatzios, Dr. Hatzios was born in Florina, Greece on August 6, 1949. He is survived by his wife, Maria K. Hatzios; two daughters, Adamantia K. Hatzios and Stavroula-Artemis K. Hatzios; his sister, Kevi Milona of Greece and a very special family friend, Anna Havelos. He received his B.S. degree from Aristotelian University of Thessaloniki, Greece, majoring in agriculture and minoring in agricultural chemistry. He furthered his education in the United States earning his M.S. and Ph.D. degrees in plant physiology and weed science at Michigan State University, East Lansing in 1977 and 1979, respectively.

Dr. Hatzios began employment at Virginia Tech in 1979 as Assistant Professor of Plant Physiology and Weed Science. He was promoted to Associate Professor in 1984 and to Professor in 1988. In 1997, he rose to the Head of the Department of Plant Pathology, Physiology and Weed Science and in 1999 became the Director of the Virginia Agricultural Experiment Station while continuing to serve as Head of his academic department for over a year. Concurrent to his role as Director, he served as Associate Dean for Research in the College of Agriculture and Life Sciences.

Dr. Hatzios had maintained an active, productive research program aimed at optimizing the use of herbicides in crop production. His work crossed through the plant science disciplines, molecular biology, and computer-aided molecular modeling. His program in herbicide physiology and biochemistry was recognized and respected around the world. During his career at Virginia Tech he generated over $1.25M in grant funds from federal, state and private sources. He authored or co-authored over 360 scholarly publications, including five books, more than 115 refereed journal articles, 24 book chapters, plus monographs, abstracts, reviewed proceedings, and conference publications. In his dedication to publish research results, he had completed the final editing on a manuscript just a few days before his death. He was key in developing the 3-D _ virtual _ dandelion weed that is displayed at the Virginia Tech CAVE (Computer-Aided Virtual Environment) and used for educational purposes. Dr. Hatzios was equally dedicated to the teaching mission with responsibilities for Weed Management and Herbicide Action and Metabolism. Service to students and the community were important to Dr. Hatzios as well.

Numerous professional honors and awards were bestowed on Dr. Hatzios. Most recent and notable are: Fellow Award of the American Association of the Advancement of Science (2001), Outstanding Teacher Award From the Weed Science Society of America (2001), Scientist of the

Year Award from the Southern Weed Science Society (1997), Fellow Award from the Weed Science Society of America (1995), and Outstanding Research Award from the Weed Science Society of America (1994). Dr. Hatzios was especially pleased to learn in early February that he had been selected as the 2003 Sterling B. Hendricks Memorial Lecturer of the USDA Agricultural Research Service and the American Chemical Society. This award recognizes scientists who have made outstanding contributions to the chemical science of agriculture. Thus, in retrospect, the Hendricks Award becomes a fitting tribute to Dr. Hatzios' distinguished career. His contributions to research and teaching, and his service to the profession of agricultural chemistry and society in general will be long lasting.

WHEREAS Dr. Kriton Hatzios served with distinction at Virginia Tech and,

WHEREAS Dr. Kriton Hatzios, one of the true pioneers in weed science, provided numerous significant contributions to weed science and the Southern Weed Science Society,

THEREFORE BE IT RESOLVED that the officers and membership of the Southern Weed Science Society do hereby take special note of the loss of our coworker, Kriton Hatzios, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Chester McWhorter, 76, passed away June 17, 2003 following a stroke. Survivors include his wife, Ann; two sons, Patrick and Walter; granddaughter Anna, and brother John. After serving in the U.S. Navy from 1945 to 1946, he earned his B.S. (1951) and M.S. (1952) degrees in Agronomy at Mississippi State University. He began his career in weed science research at the Delta Branch Experiment Station, Stoneville, MS in 1952, but left in 1956 to obtain his Ph.D. in plant physiology from Louisiana State University, Baton Rouge.

Dr. McWhorter returned to Stoneville to work with ARS in 1958. He directed the Southern Weed Science Laboratory from 1975 to 1987 when he requested that he be allowed to return to fulltime bench research. In 1990, Dr. McWhorter was asked to lead the newly formed Application Technology Research Unit at Stoneville, and he remained in that leadership position until his retirement in 1992.

Dr. McWhorter will be remembered as a leader in weed science research and a great mentor and example to scientists throughout the world. He is also known as the man who has successfully spanned the gap between basic and applied research in this area. The improved weed control technology that he generated is now used on millions of acres of agronomic crops annually in the United States and internationally.

His pioneering research led to the discovery that surfactants and other adjuvants increase herbicide activity and improve selectivity and safety. He discovered that a group of herbicides known as dinitroanilines selectively control the weed johnsongrass from both rhizomes and seed in soybeans when used in a specific regimen. He also discovered that the postemergence activity of another widely used class of herbicides, the s-triazines, was greatly increased when applied in emulsions of paraffinic oil in water. This practice, which reduces herbicide use rates, is widely used on million of acres annually. He invented several innovative herbicide application devices and techniques, including the recirculating sprayer, application of herbicides in foam and wax bars, subsurface application of herbicides in soil with a subsurface blade, and soil injection of herbicides. Dr. McWhorter is recognized internationally as the foremost authority on johnsongrass biology, ecology, taxonomy, physiology, and control. The technology issuing from his research is widely used as a model by extension agents, industry, other scientists, and producers to reduce losses caused by weeds, to control costs of weed control, and to aid in conducting national market surveys. He has shared his research results through more than 200 publications.

During his career, Dr. McWhorter served on the board of directors of the Weed Science Society of America (WSSA) and Council for Agricultural Science and Technology. He was president of both WSSA and the Southern Weed Science Society. A lengthy list of awards is capped by Dr. McWhorter's inclusion in the USDA-ARS Hall of Fame in 1994, USDA's Distinguished Research Scientist of the Year in 1989, a 1990 Research Award from the Southern Weed Science Society, and Research Scientist of the Year 1991 for Outstanding Contributions to Delta Agriculture, by the Delta Council.

WHEREAS Dr. Chester McWhorter served with distinction with the USDA-ARS and,

WHEREAS Dr. Chester McWhorter, one of the true pioneers in weed science, provided numerous significant contributions to weed science and the Southern Weed Science Society,

THEREFORE BE IT RESOLVED that the officers and membership of the Southern Weed Science Society do hereby take special note of the loss of our coworker, Chester McWhorter, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Charles (Charlie) J. Scifres, 62, died July 28, 2003. He is survived by his wife Julia; son Dirk and daughter-in-law Vickie Scifres; daughter Holly and son-in-law Thomas Wooton, and four grandchildren. Dr. Scifres earned Bachelor's and Master's degrees from Oklahoma State University. He earned his doctorate in agronomy (weed science and grazing lands) at the University of Nebraska in 1969.

He was the Associate Vice Chancellor and Associate Dean for Agriculture and Life Sciences and Deputy Director of the Texas Agricultural Experiment Station of The Texas A&M University System. Dr. Scifres was named to his Agriculture Program executive positions on Jan. 1, 2001. His career began at Texas A&M, where he served on the faculty from 1969 to 1987. At the time of his death, Scifres was responsible for statewide oversight and management of the Experiment Station's agricultural research programs throughout Texas. The Experiment Station has more than 460 scientists in 17 academic departments at Texas A&M, 14 regional research and extension centers, and at other state and A&M System universities.

Dr. Scifres served as the lead administrator for both academic programs in the College of Agricultural, Food and Life Sciences at the University of Arkansas, and for the statewide Experiment Station research system. He is credited with restructuring the Arkansas college's academic departments, establishing a distance education program and helping build an effective development program.

Before his tenure in Arkansas, Scifres spent seven years at Oklahoma State University, first as professor and head of the agronomy department. From 1990 to 1994, he was associate director of the Oklahoma Agricultural Experiment Station.

In his first stint with Texas A&M, Dr. Scifres rose from assistant professor to full professor in seven years, and in 1982 became the first Thomas M. O'Connor Professor of Range Science, a post he held for five years until his appointment at Oklahoma State University. Dr. Scifres authored two books on range improvement and fire ecology and published nearly 150 articles in his field. He was a long-time advocate of integrated brush management systems and their ecological impacts. He led an interdisciplinary research team that studied a spectrum of economic, environmental and managerial aspects of range ecosystems in South Texas.

WHEREAS Dr. Charles J. Scifres served with distinction at Texas A&M University, Oklahoma State University, and the University of Arkansas and,

WHEREAS Dr. Charles J. Scifres, provided numerous significant contributions to weed science and the Southern Weed Science Society,

THEREFORE BE IT RESOLVED that the officers and membership of the Southern Weed Science Society do hereby take special note of the loss of our coworker, Charlie Scifres, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Finances (in any) Requested:
N/A.

Respectfully submitted;

M. E. Kurtz
S. Askew
T. Willian
J. C. Holloway
C. Main
G. L. Schwarzlose, Chairperson

Committee Number: 119 Committee Name: Sales Coordination Committee (STANDING)

Summary of Progress:

The committee submitted a set of recommendations for re-pricing the Weed ID book and CD-ROM to the summer meeting of the board. The recommendations were accepted and acted upon. In addition, the sales coordination committee recommended the sell-off of existing inventories of the binder format Weed ID book so the Weed ID Committee can move forward with production of a proper bound Weed ID book. This recommendation was also accepted. The Weed ID Committee is currently evaluating the cost and effort required to produce, print, and sell a new bound version of the Weed ID book.

The Weed ID CD-ROM web site at http://www.thundersnow.com was updated with the new pricing information. The downloadable promotional flyer and order form was also updated. We offered to create a new mailing flyer announcing the new price for the CD and book to be mailed to existing owners of the CD-ROM and SWSS membership, but this offer was declined by the SWSS.

Karen and Mike DeFelice (ThunderSnow Interactive) offered the Weed ID CD-ROM for sale at the Iowa/Midwest Agricultural Expo in Des Moines on January 2-3 at our booth. None of the CD's were purchased, however, we did give out a number of flyers. We donated one copy to the FFA "silent auction" fundraiser. There was very low attendance because of bad weather (1,500 instead of the 15,000 promised). The donated CD sold for $12.00 with two dealer/exhibitors bidding each other for it in one-dollar increments. The general feedback we got from farmers was the price of $69.95 was too high. However, this was a very small sample due to the poor turnout. One obvious problem is the packaging. A small, shrink-wrapped CD does not look like much. There were several comments of the sort "$69.95 for this little thing." Unfortunately, the size and sophistication of a computer program does not show up physically in a CD-ROM package. This is why software companies use big, nearly empty boxes! The larger, flashier DVD packaging should help with the next version.

Objective(s) for Next Year:

The main objective will be to actively promote the new Weed ID DVD-ROM when it becomes available in late summer. We will request the usual 100 promotional copies to be sent to the media (farm magazines, pesticide newsletters, Ag. Education, Horticulture, and other societies, review copies, etc. as was done with Versions 1 and 2). We will also do a "trade booth" at the NCWSS meeting next year.

Current pricing of $69.95 for Version 2.1 of the CD-ROM should be maintained for the Version 3.0 DVD-ROM. Given our feedback at the Expo from farmers and dealers we certainly should not go up in price. The $49.95 price of the WSSA Weed ID CD also makes it hard to price any higher than we currently are. However, the scope and quality of the SWSS DVD-ROM certainly justify the $69.95 price. Also, professionals and students are the main audience, not farmers who are very price sensitive. If the board would like to consider dropping the price of the DVD it should not be dropped below $59.95 as this would probably have the reverse effect of giving the perception that the program is not high quality.

We will evaluate the cost estimate to produce a perfect-bound book and help determine if the project is sound in economic and marketing potential. Several Amazon and antique/used book searches indicate there are currently no weed books covering the southern United States in mainstream publishing circles even though there are a great many weed books covering other regions of the U.S. and Canada or that claim to cover the entire U.S. This indicates a good market opportunity for a book that focuses on the southern U.S. This could be a "fall-back" project if a book covering the entire U.S. and Canada looks to be too expensive. However, of the 414 weeds currently in Version 3 of the DVD project, only 15 species do not grow in the SWSS territory of Virginia to Oklahoma and Texas. So there may not be that much savings although the Weed ID committee is currently

trying to obtain photographs of another 60 weeds, with about one-half being exclusive to the western and northern U.S. and Canada. The diversity of the southern U.S. climate and environments includes most of the habitats of the continent so this is not too surprising.

Recommendation or Request for Board Action:

1. Provide financial support as requested by the Weed ID Committee to fund production of Version 3 of the Weed ID DVD-ROM including 100 promotional copies (1500 copies total).
2. Recommend keeping the current price structure of the DVD-ROM as set by the board for the CD-ROM last summer.
3. Request funding and support to mail a tri-fold promotional flyer for Version 3 of the Weed ID DVD-ROM to all members of the SWSS, and to existing owners of the CD-ROM in Bob Schmidt's database next summer when the DVD is produced.

Finances (in any) Requested:

As needed to print and mail tri-fold, two-color (black and one spot color) promotional flyer for Version 3.0 of the DVD-ROM. Robert Schmidt should be able to give estimate based on previous efforts with Versions 1 and 2.

Respectfully submitted;

Committee member – Jackie Driver
Committee member – W. L. Barrentine
Committee member – D. L. Jordan
Committee member – B. Kline
Committee member – D. R. Reynolds
Committee member – T. Barber
Committee member, Chairperson – M. DeFelice

Committee Number: 120 **Committee Name:** Southern Weed Contest Committee (STANDING)

Summary of Progress:

The 23rd annual Southern Weed Contest was held August 4 and 5, 2003 at the University of Tennessee in Knoxville. Dr. Tom Mueller and the entire staff of the University of Tennessee did an excellent job providing the students with two challenging days. The weed identification, herbicide symptomology, sprayer calibration, and the field problem solving were well prepared and challenging to all of the contestants. The mystery event involved the establishment of a field research study.

A total of 24 contestants from 5 universities competed this year. Universities represented were the University of Arkansas, Louisiana State University, Mississippi State University, Oklahoma State University, and Texas A&M University. The Weed Contest Committee would like to encourage every university affiliated with the Southern Weed Science Society to attend the 2004 contest. The contest is an outstanding educational opportunity and we hope everyone plans to attend.

Winning teams and individuals were as follows:

Team Awards:

1st Place University of Arkansas ($500)
2nd Place Mississippi State University ($300)
3rd Place Louisiana State University ($200)

Individual Awards:

1st Place Jason Bond, University of Arkansas ($400)
2nd Place Brian Otis, University of Arkansas ($250)
3rd Place Nathan Buehring, Mississippi State University ($100)
4th Place Daniel Stephenson, University of Arkansas ($75)
5th Place Cody Gray, Mississippi State University ($50)
6th Place Eric Stiers, University of Arkansas
7th Place Eric Walker, University of Arkansas
8th Place Ronnie Levy, Louisiana State University
9th Place Vinod Shivrain, University of Arkansas
10th Place Jason Alford, University of Arkansas

The traveling "Broken Hoe" trophy was presented to the University of Arkansas at the awards banquet. Plaques and cash awards were also presented to winning teams and individuals, and contestants with the highest scores within each event were also recognized. This was an excellent contest for students to demonstrate their knowledge and talent.

The Southern Weed Contest Committee wishes to thank all sponsors of the 2003 Southern Weed Contest. Sustaining members for this year included: Perennials ($2,000+) - BASF, DowAgro, Monsanto, and Syngenta; Biennials (1,000-1,999) - Bell, Inc. To maintain the excellent tradition of the Southern Weed Contest, the Southern Weed Science Society Contest Committee will again ask each company in 2004 to become, or continue to be, sustaining members of the Southern Weed Contest.

A location has not been determined for the 2004 Southern Weed Contest.

Objective(s) for Next Year:
Find an acceptable site and encourage all eligible students and universities to attend and participate

Recommendation or Request for Board Action:
None

Finances (in any) Requested:
None

Respectfully submitted;

C/ Bryson	S. Askew	D. B. Reynolds	S. Senseman
C. B. Corkern	T. C. Mueller	W. K. Vencill	J. Wilcut
P. A. Dotray	L. R. Oliver	T. Koger	W. W. Witt
J. L. Griffin	M. G. Patterson	J. Ferrell	T. A. Baughman
J. A. Kendig	A. Rankins	N. Burgos	C. Leon (student rep)
Eric Webster, Chair			

Committee Number: 121 **Committee Name:** Student Program Committee (STANDING)

Summary of Progress:
The call for paper and poster titles went out in the August newsletter along with the announcement of the student paper and poster contest. The newsletter also included the revised score sheets for this years contest. There are two sections of posters with 18 total posters in the student contest. There are three sections of papers this year (SECTION VII. PHYSIOLOGY AND BIOLOGICAL ASPECTS OF WEED CONTROL, SECTION I. WEED MANAGEMENT IN AGRONOMIC CROPS, and a combined section consisting of SECTION II. WEED MANAGEMENT IN TURF CROPS, SECTION IV. WEED MANAGEMENT IN HORTICULTURAL CROPS, SECTION V. FOREST VEGETATION MANAGEMENT, SECTION X. INVASIVE SPECIES, ECTION XI. APPLICATION TECHNOLOGY, and SECTION XII. SOIL AND ENVIRONMENTAL ASPECTS OF WEED SCIENCE). We have a total of 26 papers in the student contest. We have a combined total of 44 students entered in the paper and poster contest for the 2004 meeting. Marty Schraer the vice-chair has contacted and assigned judges to the various sections.

Objective(s) for Next Year:
Evaluate the MOP and the score sheets for possible needed revisions. Discuss any additional changes or recommendations.

Recommendation or Request for Board Action:
None at this time.

Finances (in any) Requested:
Not applicable.

Respectfully submitted;

Todd Baughman, Chairperson

Committee Number: 124 **Committee Name:** Weed Identification Committee (STANDING)

Summary of Progress:
SWSS Weed ID Guide set # 2 was reprinted, delivered for distribution, and now for sale.

Weed write-ups and maps for SWSS Weed ID Guide set # 8 were completed and edited, photos were selected, and ready to go to the printers by May 1, 2003, but at the request of the SWSS President, printing was put on hold. The decision was made at the SWSS Summer Board meeting not to print set #8.

Mike DeFelice continues to work steadily on the DVD-ROM version. Weed photos, with the exception of those not transferred to photo CD's yet, have been reformatted. The tutorial has been reworked and data-base descriptions are being inserted. Data-based descriptions were edited and formatted for the development of an interactive key for mature and immature weeds in the DVD-ROM version and are being inserted into the program. A beta copy for review should be ready by May 2004 and the final copy ready for release by late summer 2004.

Objective(s) for Next Year:
Transfer photo slides to digital photo CD's.
Complete DVD-ROM version of the *Interactive Encyclopedia of North American Weeds* during 2004.
Start writing text and selecting the photos for the *Encyclopedia of North American Weeds* during 2004.

Recommendation or Request for Board Action:
1. Request transfer of Arlyn Evans' slides to photo CD's. This group includes several species that were not transferred for set # 8 and additional weeds for the DVD-ROM version now in preparation.
2. Request duplication and packaging the new computer DVD-ROM version to be entitled *Interactive Encyclopedia of North American Weeds*.
3. Approve compilation of set # 1 through # 8 and some additional weed species into a book to be entitled *Encyclopedia of North American Weeds* with a format slightly larger in size than the *Forest Plants of the Southeast and Their Wildlife Uses* and in paperback similar to the *Weeds of the West*. This proposed book will include segregation of species into family groups, species descriptions, distribution maps, photos of mature and immature weeds (minimum of 3 to 4 photos for each weed seed, seedling, and mature flower or inflorescence), brief toxicity statement, habitat information (ie. wet, sandy soils, high nitrogen, etc. to replace the written distribution), and an index. Proposed authorship will be Charles T. Bryson, Clifford H. Koger, and Mike DeFelice.

Finances (in any) Requested:
1. $450.00 to transfer Arlyn Evans' slides to photo CD's (See No. 1 above).
2. $4,500.00 to burn 1,000 DVD-ROM disks and purchase cases, 4-color cover, black and white instructions/copyright pages, shrink-wrap, and registration card (see No. 2 above).

Respectfully submitted;

M. DeFelice 2004
J. D. Green 2004
T. M. Webster 2004
C. H. Koger 2005
M. L. Ketchersid 2006
C. T. Bryson 2005, Chairperson

Committee Number: 124a **Committee Name:** Herbicide Resistant Weeds Subcommittee

To: Meeting participants and members of the Southern Weed Science Society (SWSS) Herbicide Resistant Weeds Committee (HRWC)
Bob Nichols – Chair, Cotton Incorporated, Andy Bailey – Secretary, Univ. of Kentucky, Jim Collins – Bayer CropScience, Keith Vodrazka – Bayer CropScience, Brad Guice – BASF, Vernon Langston – Dow AgroSciences, Ralph Lassiter – Dow AgroSciences, David Heering – Monsanto Co., Les Glasgow – Syngenta Crop Protection, Frank Carey – Valent Corp., Ron Talbert – Univ. of Arkansas, Glen Wehtje – Auburn Univ., Ed Murdock – Clemson Univ., Greg MacDonald – Univ. of Florida, Bill Vencill – Univ. of Georgia, Jim Griffin – Louisiana State Univ., Dearl Sanders – Louisiana State Univ., J. D. Green – Univ. of Kentucky, Andy Kendig – Univ. of Missouri, Dan Reynolds – Mississippi State Univ., John Wilcut – North Carolina State Univ., Alan York – North Carolina State Univ., Case Medlin – Oklahoma State Univ., Tom Peeper – Oklahoma State Univ., Bob Hayes – Univ. of Tennessee, J. Mike Chandler – Texas A & M Univ., Henry Wilson – Virginia Tech, Carroll Walls – UAP Timberland, David Gealy – USDA-ARS, (19) participants at the meeting, as noted below

From: Andy Bailey, Secretary, Univ. of Kentucky, Bob Nichols, Chair, Cotton Incorporated

Date: February20, 2004 (Reviewed by Committee, Pending Matters Updated.)

CC: John Hardin - Pres. SWSS, Bill Witt - Past Pres. SWSS, Ian Heap – Chair, WSSA HRPC, Roy Cantrell – V.P. Ag. Res, Cotton Incorporated, David Shaw, Chair 2005 SWSS Program

Subject: Report of the SWSS – HRWC Meeting held
Monday, January 26, 2004 in Memphis, TN.

Members Present: Bailey – Secretary, Glasgow, Burgos, Kendig, Talbert, Carey, Vodrazka, Guice, Peeper, Lassiter, Griffin, Chandler, Vencill, Wilson, Heering, MacDonald, York, Walls, Gealy (19 of 29 listed above).

1. Special Committee status of SWSS HRWC
Members were notified that our committee (formerly a subcommittee of the SWSS Weed Identification Committee) was granted independent, special committee status by the SWSS Executive Committee immediately following the 2003 SWSS annual meeting. We are not a standing committee, but a special committee with a 5-year term (2005-2009).

2. Update on Herbicide Resistant Weeds
Arkansas: Nilda Burgos and Ron Talbert reported that diclofop-resistant Italian ryegrass (*Lolium multiflorum*) and glyphosate-resistant horseweed (*Conyza Canadensis*) are present in Arkansas.
Oklahoma: Tom Peeper reported that ALS-inhibitor-resistant Palmer Amaranth (*Amaranthus palmeri*) has been documented in Oklahoma.

Missouri: Andy Kendig reported that glyphosate-resistant horseweed (*C. Canadensis*) is suspected in southeast Missouri.

Virginia: Henry Wilson reported that Scott Hagood is working with a common lambsquarters (*Chenopodium album*) population that has shown reduced sensitivity to glyphosate.

North Carolina: Alan York reported that two populations of horseweed (*C. Canadensis*) with suspected glyphosate resistance have been reported in Nash County and Pitt County, NC. Research to verify this suspected resistance will be conducted in 2004.

Georgia: Bill Vencill reported that dinitroanaline-resistant Florida Pusley (*Richardia scabra*) has been identified in Georgia.

Florida: Les Glasgow reported that diquat-resistant duckweed (*Landoltia punctata*) has been identified in Florida. There is one duckweed population with 400-450 X resistance levels.

Bailey suggested that these new reports of herbicide resistance be added to the HRAC website. Those reporting new incidences of resistance agreed to do this.

3. Proposed Mission Statement of SWSS HRWC

Members present made final revisions to the newly-proposed mission statement of the committee. The revised mission of the Herbicide Resistant Weeds Committee of the Southern Weed Science Society is as follows:

1) Report new incidents of herbicide-resistant weeds in the southern region of the United States.
2) Assess situations with potential for emergence of new herbicide-resistant weeds.
3) Support efforts to delay, prevent, manage, and reduce the economic impact of herbicide-resistant weeds in the southern region of the United States.
4) Cooperate with other agencies with similar goals.

5. Mode of Action Labeling

The committee discussed the status of adoption of mode-of-action labeling. Notice of a product's mode-of-action on the product label identifies the biological mechanism whereby the herbicide's active ingredient controls the labeled weed species. Such information enables the user to differentiate among products with different modes of action to help facilitate resistance management practices. Representatives from Syngenta (Glasgow), Monsanto (Heering), Bayer (Vodrazka), and Valent (Carey) stated that their respective companies have already begun implementing their own resistance management language on labels of certain products (glyphosate products and certain others). Also in subsequent communications representatives of Dow (Lassiter) and DuPont (Rick) indicated that their companies had also incorporated resistance management language in certain of their labels. Syngenta's inclusion of symbols will be based on production schedule and other label change/formulation needs.

6. Development of Educational Materials for Herbicide Resistance Management

The SWSS HRWC agreed to continue to support and cooperate with the Weed Science Society of America (WSSA) Herbicide Resistant Plants Committee (HRPC) in its national initiative to develop educational materials to assist growers in managing existing herbicide resistance and prevent/delay the development of additional resistance. Ian Heap, chair of WSSA-HRPC, is currently working with the WSSA committee towards this goal and will be in communication with Bob Nichols and the SWSS committee. Nilda Burgos agreed to attend the 2004 WSSA-HRPC meeting in Kansas City and act as a liaison to report back to the SWSS HRWC on the current status of this project.

7. 2005 SWSS Herbicide Resistant Weeds Symposium

The membership discussed favorably the possibility of organizing a herbicide-resistant weeds symposium during the 2005 SWSS annual meeting in Charlotte.

This symposium will by organized by the SWSS HRWC in conjunction with David Shaw, program chair for the 2005 meeting. Major topics of the symposium would include resistance development and management. Jerry Wells of Syngenta also suggested that regulatory issues regarding herbicide resistance be included as a topic for the 2005 symposium.

Pending Matters

Item	Responsible	Date
Summary of meeting to Witt	Bailey	done 1/31
Report of WSSA HRPC meeting	Burgos after WSSA; RLN request	
Report of HRAC meeting	MacDonald after WSSA: RLN request	
Updated membership list to Hardin	Bailey	done 2/20
Report to Hardin and members	Bailey	done 2/20
Symposium discussion w/ David Shaw	Nichols	done 2/16
Proposal to Shaw	Nichols	due 4/15
Communication with Ian Heap	Nichols	2/18 and on-going
Agenda for next meeting	Bailey/Nichols	11/04

Committee Number: 126 **Committee Name:** Membership Committee (SPECIAL)

Summary of Progress:
Membership Committee members were polled as to comments, recommendations, or suggestions that they may have concerning SWSS membership and how to address the decline in membership. The suggestions and comments by the Membership Committee this year mirrored the last few years' reports. It is apparent that the same challenges and issues face us this year and are likely to continue. I have included comments, suggestions, and questions in this year's report:

1. Query our membership to determine what other annual professional meetings they attend each year, why they attend each of those meetings, and the number of years they have been attending each of them. Perhaps that way we could learn more about the diversity of interests among our members, and hopefully discover some common bonds that could be used to strengthen SWSS by tapping into the membership of other societies identified by our members.
2. I was reading the SSSA President's Message in the latest CSA News earlier and I thought that he did a good job of defining the problem that many of our professional societies are having today, as far as membership and defining what services societies are providing to members. Of course, the Agronomy-Soils society is different, but they too realize that times are changing very fast.
3. As far as the SWSS is concerned, I really don't know what to say. Several of my coworkers have made comments to me that it has been harder for them to recruit graduate students than it was a few years ago. The latest rounds of industry layoffs and reorganizations and buyouts, etc, have left many undergraduate students looking for other fields of study. I don't see a turnaround real soon in that regard. In my own program, I have had only one of my last half dozen or so graduate students go to work for a chemical company (BASF) and it was last year at the SWSS meeting when he found out that he and all the rest of the new employees were fired. So, it seems to me that the old traditional jobs with industry, that really fueled our student programs, are a thing of the past. This hurts the SWSS more than the WSWS, because the WSWS diversified years ago to attract more of the land management type people who were then well positioned to move right into the invasive weed arena, whereas the SWSS has just not been able to get its focus to expand beyond southern row crops. Frankly, if I were a life insurance agent, I probably wouldn't want to issue a policy for the life of the SWSS. In recent years, Oklahoma and Texas have both joined the WSWS. Why? Well, there are several reasons, but they are centered on content of materials presented as well as the diversity of the programs presented as special symposia, etc. My graduate students this year have elected to attend the WSWS rather than the SWSS, so for the first time in the last 25 years, I will not have a graduate assistant presenting a paper at the SWSS. I will have two full time employees presenting papers there, and I will be there, but no graduate assistants. Well, that doesn't really solve any problems I guess, but I'm not sure what the SWSS can do at this point to turn things around. It has always been an industry-university association, and now the industry part has pretty well folded up. If it is going to survive as a vibrant organization, some group is going to have to take the place of industry in that partnership. My thoughts at this point are to get together with the regional CSA organizers and start talking about a merger. That could be a bitter pill to swallow, but we need to be looking ahead. Most agricultural experiment station directors today are really pushing basic research and de-emphasizing applied research, because the big buck grants are in basic research. Not many basic research papers are presented at the SWSS each year. Serious talks also need to be underway about consolidating the regional societies under one WSSA umbrella, and perhaps have only the WSSA annual meeting, and having it continue to rotate in meeting location. For many years, the papers presented at WSSA are also printed at a regional meeting, so why go to two meetings to hear the same paper twice?
4. SWSS, like our sister societies, has continued to decline in membership for reasons that I think we all know. This Committee has struggled with answers to this issue for some time. In my opinion about the only real growth area related to weed science is the area of invasive plants. If there was a way we could get more persons (govt. agencies, etc.) involved with this area involved with SWSS I think it would have a positive impact on membership. While I did not attend, it is my understanding that the joint WSSA/Ecology Society meeting recently held in

Orlando was a success. Whether this translates directly into more WSSA members - I don't know. But perhaps over time it will. So my only suggestion is to look for ways to partner with invasive plant people.

Objective(s) for Next Year:
Continue to explore avenues for redefining and enhancing the membership of SWSS.

Recommendation or Request for Board Action:
Refer comments and suggestions to the appropriate committees for review, e.g., Weed ID, Program, Location.

Finances (in any) Requested:
None.

Respectfully submitted;

M.A. Locke, Chairman

Committee Name: Student Representative Report

Summary of Progress:

1. The Graduate Student Organization (GSO) approved the creation of a representative position to serve on the SWSS Computer Applications Committee. The duties of this position also include assisting the GSO Secretary in posting information on the SWSS website.
2. In order to alleviate SWSS expenses, the GSO postponed plans for continuing the graduate student luncheon at the 2004 Annual Meeting.
3. Plans were made to hold a raffle at the 2004 Annual Meeting for the purpose of raising money for the Endowment Foundation. Raffle items capable of generating the interest required to meet the financial goals could not be obtained in a timely manner. After seeking input from the SWSS Executive Board, the 2004 raffle was cancelled.
4. At the 2003 SWSS Summer Board Meeting, the GSO proposed purchasing SWSS lapel pins designed by Hennen Cummings to be sold to members during registration at the annual meetings. The SWSS approved the purchase of 200 lapel pins.
5. After receiving positive feedback regarding the Graduate Student Symposium at the 2003 Annual Meeting, another symposium was planned for the 2004 meeting in Memphis.
6. The GSO has continued displaying a poster providing information about Weed Science programs at Universities in the SWSS region. During 2003 this poster was updated to reflect any changes that have occurred in recent years.

Objective(s) for Next Year:

The GSO will continue to meet the needs of graduate student members of the SWSS by providing a forum for their requests and concerns, and by providing the opportunity for interaction and knowledge sharing between graduate students. During the upcoming year, the GSO will need to determine the feasibility of continuing the graduate student luncheon. To that end, funding sources will need to be carefully evaluated.

Recommendation or Request for Board Action:

The following recommendations are made in regard to any future raffle plans:

1. Clear goals and objectives should be established and agreed upon by the SWSS Executive Board, SWSS Endowment Foundation, and GSO. Objectives should address what the money will be used for, whether that is general endowment, graduate student activities, etc. Financial goals, made with the objectives in mind, are necessary to determine feasibility, the types of prizes required, ticket price, and number of tickets that need to be sold.
2. A subcommittee made up of GSO officers, and at least one SWSS officer and Endowment Foundation Trustee should contact donors and secure prizes that will meet the financial goals before proceeding with any additional planning.
3. The subcommittee shall proceed with planning only after prizes have been identified. Members of the subcommittee should be able to serve for more than one year in the event that planning and implementation exceeds that time period.

Based on experiences from the previous year, it is suggested that potential donors should be contacted as early in the calendar year as possible.

Finances (if any) Requested:

The GSO requests that the SWSS continue to provide graduate student housing allowances at the annual meetings. If a graduate student luncheon is planned for 2005, a request for funding will be made to the SWSS Executive Board as that information becomes available.

Respectfully submitted;

Greg Steele, GSO President Cody Gray, GSO Vice-President Oscar Sparks, GSO Secretary

GENERAL SESSION

WELCOME, R.M. Hayes, University of Tennessee, Jackson, TN 38301

On behalf of the nearly 6 million residents of the great state of Tennessee—home of the University of Tennessee Volunteers and the Tennessee Titans—it is my distinct honor and pleasure to welcome you to Memphis—The Bluff City, home of Elvis Presley, The Memphis Grizzlies, the Memphis Redbirds, the University of Memphis Tigers, FEDEX, the National Cotton Council and The Peabody Hotel. The Delta is said to begin in the lobby of The Peabody and Cohn wrote, " If you stand by the fountain you will soon meet everybody who is anybody in the Delta."

I recall my first SWSS Meeting in Memphis in January 1975. Your President and I were just beginning our careers and the late Charles Reich was assisting Howard Greer with registration. Howard had to leave early and left Charles to take care of registration. At the end of the meeting Charles turned in the registration receipts and The Peabody wrote him a check for the monies. Upon returning to Lexington, the news broke that The Peabody had filed for bankruptcy. Needless to say that Charles was a bit uptight until that check was cleared and SWSS had its money. We have had some of our highest attendance, largest number of papers and posters, and liveliest discussion at meetings held at The Peabody. If you do not like it here, you might want to try the Heartbreak Hotel—they rock you to sleep!

Tennessee's capital and second largest city is Nashville followed by Knoxville and Chattanooga. Tennessee's population is approximately 6 million and growing at a rate of 1.7 % per year. Tennessee has an area of 41,217 square miles and has an agro-forestry economy of $60 billion, with $40 billion from the agriculture sector. Acreage of the major Tennessee crops are soybean, 1.15 million; corn, 650,000; wheat, 270,000; cotton, 535,000 and pasture and hay, 4.2 million. In 2003, record yields of soybean, corn, wheat, cotton and hay were 41, 134, 52 bushels, 722 pounds, and 2.5 tons per acre.

Farm cash receipts were $2.5 billion and with value-added, reached $5 billion in worth. The state has 218,000 persons employed in agriculture with 114,000 employed in production agriculture. There are 90,000 farms in Tennessee with an average size of 130 acres. Large farms are increasing in size and the number of small farms is increasing. Farmland is being rapidly lost to urbanization. Land values average $2,500 per acre and cash rent is $62 per acre for cropland and $18 per acre for hay and pasture.

No-tillage is now our 'conventional' tillage system with 68 % of corn, 68 % soybeans, 53 % of cotton and 36 % of wheat not plowed. Tennessee has 2 million cattle and calves, 2.2 million chickens, 200,000 head of horses and mules and 220,000 head of hogs. Tennessee has over 300 golf courses, the most notable being "The Bear Trace" designed by Jack Nicholas. When one considers home lawns, sod farms, athletic fields, parks and commercial grounds management, the turf weed management is significant. We also have a floriculture and nursery industry that accounts for almost $200 million to the state's economy. This sector is expected to grow significantly with the introduction of *Anthracnose* resistant dogwoods.

What are the mega-trends in Weed Science in Tennessee? Our producers are using more residual and preemergence herbicides to augment their Roundup Ready ® Systems and to combat weed shifts and weed resistance. Commercial application of herbicides is becoming more commonplace. These translate to increased weed control costs per acre. Producers continue to purchase inputs from local dealers rather than through the internet. We expect our Roundup Ready ® corn acreage to increase, but acreage will remain fairly stable for herbicide resistant cotton and soybean. Consolidation of service/input providers will continue. Smaller volume business will be absorbed or discontinued. There will be opportunities in turf, ornamentals and pasture weed management as demand for weed control increases in these areas. Environmental issues will continue to be at the forefront as we transition from rural to urban communities, especially drift issues. Finally, the new paradigm for funding for research, teaching and extension programs in weed science is shifting from a

combination of public and private funds to competitive grants, resulting in dwindling funds to support graduate students and to conduct research and extension programs for the public good.

THE CHANGING WORLD OF WEED SCIENCE: IS THE SWSS MEETING THE CHALLENGE? William W. Witt. President, Southern Weed Science Society. University of Kentucky, Lexington KY 40546.

The Southern Weed Science Society originated in 1948, originally as the Southern Weed Control Conference, with the first meeting in Stoneville MS. Since its inception, this group faced numerous hurdles to remain a viable organization. The SWSS in 2004 continues to face changes, primarily, the declining number of members participating at our annul meeting. My purpose with this presentation is to describe to you what challenges the SWSS has in its immediate future and to describe programs that SWSS has in place to meet those changes.

Changes in our lives, both personally and professionally, often require much 'soul searching' on our part as we struggle to adapt. We must remember that change is always with us, whether we like it or not. We can either resent and resist change, or anticipate it for our own good. The response of SWSS to the changing world of weed science will define its role in the future of our discipline.

The SWSS has met in Memphis several times in its history and the involvement of membership at this location provides an excellent example of the changes that have occurred over the past 30 years. The second SWSS annual meeting I attended was in Memphis in 1970; there were 852 in attendance and 138 papers presented. SWSS returned to Memphis in 1975 with 1075 attending and 155 papers presented. We did not return to Memphis for 20 years; in 1995 we had 703 attending with 295 papers presented, almost a doubling of presentations with 300 fewer in attendance. This year, we have 383 attending and 325 papers/posters presented. What can we learn from our Memphis history? Membership has been declining steadily for the past 15 years. However, the number of presentations has increased, so much so that we almost have a one to one ratio of attendees and presentations. How does SWSS meet this challenge of membership?

The SWSS membership in the future is 'up in the air' and we need to address this issue now. It is past the time of talking about change, we need to make changes. However, the direction of this change must be thoroughly studied. The following questions must be addressed. Will SWSS stay with its current structure and be satisfied that we will be a much smaller society? Does SWSS need to reach out to other groups as potential members? Does SWSS need to meet concurrently with other societies? Does SWSS move to another date—a move of months, not weeks? As these issues are addressed by SWSS, the input of members attending the annual meeting is of utmost importance. The Executive Board needs your ideas.

As SWSS moves to address these issues of change, it is important for us to persist in this endeavor. Calvin Coolidge describes, what I think is needed, in an essay entitled "Press On". *Nothing in world can take the place of persistence. Talent will not; nothing is more common than unsuccessful people with talent. Genius will not; unrewarded genius is almost a proverb. Education alone will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent.*

The Executive Board was active this past year in meeting the challenges of change as it impacted SWSS. The publications of SWSS have been instrumental in the financial well being of our society. However, the sales of the Weed ID Guides declined significantly over the past few years and the Society had hundreds of copies of each guide on hand. The Executive Board drastically reduced prices of these guides in an effort to spur sales. The Executive Board also decided not to publish Set 8 of the Weed ID Guide—a difficult decision because the Board had agreed previously to publish this set. However, SWSS would have lost a significant amount of money based on sales projections.

Another way in which change has been addressed is the Graduate Student Organization. This active group has brought fresh ideas and enthusiasm to our Society and the graduate student paper and poster contests continue to have great participation at our annual meeting. This organization has started fund raising activities and raised over $900 at this annual meeting from sales of their lapel pins.

The SWSS Endowment Foundation was started many years ago by leaders that envisioned a foundation that would support various SWSS activities. The Endowment Foundation has a purpose of promoting educational and scientific endeavors of SWSS. The dedicated efforts of members, and former members, of SWSS have made a difference—we now have over $280,000 in the Endowment. However, this is not enough money to support our student programs at this time, mostly because of the low income from the earnings of the investments. The largest contribution to the Endowment in 2003 was from the Endowment Foundation. Proceeds from their GLP workshop accounted for over $7,000 being deposited in the Endowment Fund. The debt of gratitude SWSS owes members for dedicated service, such as Ray Smith, is significant. Ray worked tirelessly in establishing, organizing, and moderating the GLP training workshops and his efforts raised the endowment fund substantially. Individual members are not making donations. Only fifteen members contributed to this Endowment in 2003. I urge all of you to make a donation, no matter the size, to help in this most worthy cause.

I have briefly described activities of the past year on addressing change within SWSS. Now I will comment on the future of SWSS, as I see it. I believe the challenge of change can be summed up as "How do we, as SWSS members, maintain the importance of SWSS throughout our region?" One way is the continuation of developing high quality educational materials. The Executive Board is planning the following: reprinting the Forest Plants of the Southeast and Their Wildlife Uses; combine the Weed ID Guides into a book of over 400 weeds to be called "Encyclopedia of North American Weeds"; development of a DVD-ROM, Interactive Encyclopedia of North American Weeds. These significant undertakings are possible because individual members of SWSS are willing to put their time and efforts into such projects.

Leadership development is important for societies and SWSS is no exception. In this regard, SWSS leaders participated in a Shared Leadership Conference--to help them learn how to set priorities and deal with change in today's environment. David Shaw, Tom Mueller, and Scott Senseman represented SWSS. Another part of leadership development for the future is preparing graduate students for careers in Weed Science. SWSS offers paper/poster contests, weed contests, and committee membership to help prepare our students. There are jobs in Weed Science! Yes, the number of jobs available to today is low, but look around the room—there are lots of people in SWSS that will be retiring in the next several years. SWSS experience will not guarantee a student a job, but it will help get you noticed.

SWSS must do better with its current membership, budget and activities. We need more involvement from our membership in promoting SWSS activities and projects—be an active committee member! We must be willing try something new and risky, even if it does not work. In this regard, all of us in SWSS must support the efforts of our officers and board members as they meet the challenges of the changing world of Weed Science. Theodore Roosevelt provides insight into what we might face in the future. *In the Arena—It is not the critic who counts, not the individual who points out how the strong person stumbled, or where the doer of deeds could have done them better. The credit belongs to the one who is actually in the arena; whose face is marred by dust and sweat and blood; who strives valiantly; who errs and comes short again and again; who knows the great enthusiasms, the great devotions and spends oneself in a worthy cause; who, at the best, knows in the end the triumph of high achievement; and who, at the least, if fails, at least fails while doing greatly; so that one's place shall never be with those cold and timid souls who know neither victory nor defeat.*

As we move to the future, I hope this Society and its members are willing to 'get in the arena and get dirty' as we explore ways to improve the SWSS and maintain its importance to agriculture in the southern United States. I have enjoyed serving as the SWSS President during the past year--it was the highpoint of my career.

I want to thank all those that helped me during the past year, especially Jerry Wells and John Harden for their guidance and support. Also, to all my colleagues at the University of Kentucky for their

support, I say thank you. Finally, I want to express gratitude to my wife, Mary, and our children for their love and support during my career.

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HERBICIDE OPTIONS FOR BLACK-EYE PEAS GROWN ON THE TEXAS HIGH PLAINS. R.W. Wallace and R.B. Kesey; Department of Horticultural Sciences, Texas A & M University Agricultural Research & Extension Center, Lubbock, 79403.

ABSTRACT

Black-eye peas (*Vigna unguiculata*) are an important crop on the High Plains region of northwest Texas. However, weeds can significantly decrease yields and the quality of peas, therefore, field trials were conducted to evaluate and compare the efficacy of preemergence (PRE) and postemergence (POST) herbicides on Palmer amaranth (*Amaranthus palmeri*) control, crop injury and yield of black-eye peas.

Two trials were conducted in 2003 at the Texas A & M University Agricultural Research & Extension Center located in Halfway. The first trial evaluated the PRE-applied herbicides s-metolachlor (0.65 and 0.95 lbs ai/A), dimethenamid-P (0.75 and 1.0 lbs ai/A), flumioxazin (0.064 and 0.095 lbs ai/A), flumetsulam (0.1 and 0.15 lbs ai/A), flufenacet (0.25 and 0.50 lbs ai/A) and sulfentrazone (0.2 and 0.4 lbs ai/A). A second trial evaluated halosulfuron applied PRE and/or POST at 0.024, 0.032 and 0.048 lbs ai/A. Black-eye peas (var. "8046") were planted in early June in 2-row plots measuring 6.7' x 20'. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed 20 GPA at 30 PSI. Plots were irrigated overhead as needed and yields were machine harvested in October. The experimental design was a randomized complete block with 4 replications.

Black-eye pea emergence was significantly ($\alpha = 0.05$) reduced in the PRE trial with both rates of flumioxazin when compared to the untreated control. While not significantly lower, plots treated with sulfentrazone (high rate) had a 15% reduction in emergence. Early crop injury (stunting) was greatest with flumioxazin, flumetsulam and sulfentrazone; however, most injury was 15% or less except the high rates of flumioxazin and sulfentrazone. Palmer amaranth control was excellent with all treatments. Yields were significantly reduced only in plots treated with the high rates of flumioxazin, flumetsulam, and sulfentrazone.

Crop injury from PRE-applied halosulfuron at all rates was minor. However, POST applications significantly increased crop injury (stunting + leaf chlorosis) and this increased slightly as the rate of halosulfuron increased. By late season most treatments showed little crop injury as a result of the POST applications. Control of Palmer amaranth was 92% or better with all treatments in the trial. Yields tended to be lower where PRE + POST applications of halosulfuron were made, though in general not significantly less. The results of both trials show that there is sufficient safety in using PRE applications of these herbicides in black-eye peas, but more research is needed in evaluating rates and timing of POST-applied halosulfuron.

CONTROL OF YELLOW NUTSEDGE AS INFLUENCED BY APPLICATION TIMING AND NON-STRUCTURAL CARBOHYDRATE CONCENTRATION. F.E. Groves[1], K.L. Smith[1], N.R. Burgos[2], and J.B. Murphy[3]; [1]University of Arkansas, Southeast Research and Extension Center, Monticello, AR 71656; Department of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR 72704; Department of Horticulture; University of Arkansas, Fayetteville, AR 72704.

ABSTRACT

Greenhouse studies were conducted in 2001 and 2003 to determine if a correlation exists between herbicide efficacy and carbohydrate concentration in yellow nutsedge (*Cyperus esculentus*). Studies were conducted in Fayetteville AR, utilizing a completely randomized design. In study one, plants were collected from the 4- to 9-lf stage, and dissected into various tissues for carbohydrate analysis. Plants were separated into tubers, shoots, old leaves, new leaves (upper three leaves), and secondary tubers. Sugars were quantified by high-performance liquid chromatography (HPLC), and starch was quantified colorimetrically. In study two, plants were collected from the 2- to 9-lf stage and treated with glyphosate at 840 g ae/ha or trifloxysulfuron at 19.5 g ai/ha + 0.25% non-ionic surfactant.

In study one, sugars investigated included fructose, glucose, and sucrose. In 2001, tuber sugar concentrations were greatest at the 6-lf stage, and lowest at the 7-lf stage. Shoot, old leaf, and new leaf sugar concentrations were greatest at the 4-lf stage, lowest at the 6-lf stage, and peaked again at the 7- to 8-lf stage. Secondary tuber sugar concentration was unchanged, except at the 8-lf stage, where an increase was observed. Tuber and shoot starch concentration curves were flat to the 7-lf stage, peaked at the 8-lf stage, and decreased to the 9-lf stage. Old leaf and new leaf starch concentrations were generally unchanged to the 6-lf stage, and slowly declined to the 9-lf stage. No differences were observed in the secondary tuber. In 2003, the tuber sugar concentration curve was bimodal. Tuber sugar was highest at the 4- and 7-lf stages, and lowest at the 6-lf stage. Tuber sugar content was inversely related to that of the old leaf except at the 4-lf stage where sugar was greatest in both plant parts. The sugar concentration of the shoot, and new leaf was greatest at the 4-lf stage and declined to the 9-lf stage. Secondary tuber sugar concentration increased sharply from the 6- to 7-lf stages, then decreased sharply to the 9-lf stage. Tuber and old leaf starch decreased to the 7-lf stage, increased at the 8-lf stage, and decreased again at the 9-lf stage. New leaf starch increased to the 6-lf stage, and decreased to the 9-lf stage. Secondary tuber starch was unchanged to the 8-lf stage, and decreased thereafter. No differences were observed in the shoot starch content.

In study two, glyphosate and trifloxysulfuron was applied postemergence to yellow nutsedge in a spray chamber. Two- to ninth-leaf stage plants were treated, and visually rated for injury on a scale of 0-100 at 14 days after treatment. In 2001, glyphosate and trifloxysulfuron generally provided 70% control until the 5-lf stage. From the 5- to 7-lf stage control provided by glyphosate decreased to less than 30%, while control with trifloxysulfuron remained consistent. Control offered from both herbicides improved to greater than 85% at the 8- to 9-lf stages. In 2003, glyphosate and trifloxysulfuron offered similar levels of control (60 to 70%) across all leaf stages observed.

A possible correlation between herbicide efficacy and carbohydrate concentration from the 4- to 9lf stage of yellow nutsedge was investigated. No correlation was observed when years were compared. Consequently, herbicide efficacy in yellow nutsedge was not influenced by carbohydrate concentration.

COMMON WATERHEMP CHANGES IN TOLERANCE TO THREE HERBICIDES OVER TIME. L.E. Steckel, C.L. Sprague and L.M. Wax. Department of Crop Sciences and USDA-ARS, University of Illinois, Urbana, IL.

ABSTRACT

Growers around the Midwest have reported yearly increases in the amount of glyphosate that is needed to control common waterhemp. Several of these common waterhemp populations have been confirmed resistant to photosystem II and acetolactate synthase inhibitors. A study was initiated in order to estimate if a change had occurred in common waterhemp tolerance to glyphosate, atrazine and imazamox over the last several years This study examined common waterhemp tolerance or resistance from common waterhemp plants that were grown from seed collected over a nine-year period from the same counties. The common waterhemp seed were collected in 1992, 1997 and 2000 from Effingham, Fayette and Champaign counties. Seed was separated from the chaff and stored in a freezer until used. Common waterhemp seed was planted in trays and shortly after emergence plants were transplanted in to pots. Applications were made when the common waterhemp plants were 8 to 12 cm tall. The rates of atrazine evaluated were 1.1, 5.5 and 10.1 kg a.i./ha. The rates of glyphosate were 0.42, 0.84, 1.7, 3.4 and 6.7 kg a.e./ha. The rates of imazamox were 44, 88 and 440 g a.i./ha. Herbicides were applied with a laboratory sprayer equipped with an 8002 E flat fan nozzle calibrated to deliver 234 L/ha at 204kPa. Treatments were replicated four times and the experiment was repeated twice. Visual control ratings were taken 14 and 30 days after application. Plants were clipped at the soil surface dried and weighed to determine aboveground biomass 30 days after application. Data was subjected to nonlinear regression using a logistic model. The amount of atrazine required to reduce common waterhemp biomass by 50% (GR_{50}) was 660 g/ha for seed collected in 1992 compared with 990 g/ha for seed collected in 2000 resulting in a 1.4X increase over 8 years. However, there were no increases in tolerance with imazamox. The amount of glyphosate required to reduce common waterhemp biomass by 50% (GR_{50}) was 0.6 kg/ha for seed collected in 1992 compared with 1.8 kg/ha for the seed collected in 2000, demonstrating a 3-fold increase in the amount of glyphosate needed to reduce common waterhemp growth 50% The variability in response to glyphosate was higher for the seed collected in 2000 (R^2 = 55) and 1997 (R^2 = 64) compared with 1992 (R^2 = 73). Results of this study would indicate that common waterhemp selected in 2000 by growers as being tolerant to glyphosate demonstrated more variability to this herbicide than common waterhemp collected in 1992.

GLYPHOSATE RESISTANCE IN HORSEWEED (*CONYZA CANADENSIS*) POPULATIONS IN ARKANSAS. S.G. Matthews, R.E. Talbert, K.L. Smith, J.L. Barrentine, and M.R. McClelland; University of Arkansas Extension Service, Blytheville, AR 72316 and Monticello, AR 71656 and University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

The presence of glyphosate-resistant horseweed has been confirmed in Mississippi County, Arkansas. With the increased adoption of no-till and reduced-till production systems, producers rely on burndown herbicides for complete control of winter annual weeds. Glyphosate is the most widely used preplant burndown herbicide applied in Arkansas due to the wide spectrum of weed control and no preplant interval restriction. This, coupled with the rapid adoption of glyphosate-tolerant cotton varieties has resulted in multiple applications of glyphosate to control weeds during the growing season. In 2003, populations of horseweed in Mississippi County were not controlled with glyphosate in preplant burndown applications.

A greenhouse study was initiated to determine if horseweed plants were resistant to glyphosate. Horseweed at the 6- to 10-inch growth stage from Northeast Arkansas populations were transferred to a greenhouse and compared to plants from populations collected near Fayetteville that had no history of being treated with glyphosate. In a two-factor factorial, degree of resistance to glyphosate was compared in suspected resistant and susceptible plants. The original population sampled near Osceola, Mississippi County, Arkansas, was found to be resistant to a 4X rate or 3 lb/ae. Approximately one month after the original population was sampled; newly emerged horseweed plants were sampled. The second populations exhibited more variability and a wider range in resistance. Resistance was documented at 8X to 16X or 6 to 12 lb ae/A.

Dicamba and 2,4-D have been shown to be effective for control of horseweed, but each has preplant interval restrictions. A field trial was established in Osceola to examine glyphosate tank mixes or alternatives to glyphosate without preplant interval restrictions. Gramoxone plus Aim or Caparol provided less than 70% control 3 weeks after treatment. Roundup WeatherMax combined with either Aim or Staple also provided less than 70% control. In a Fayetteville field study, Gramoxone, Gramoxone + Direx, Buctril, 2,4-D, Liberty, Clarity, MSMA, Roundup WMax, MSMA + Direx, and Stinger provided greater than 90% control of susceptible horseweed 6 weeks after treatment.

From the perspective of a County Agent with the Cooperative Extension Service, the question of "What will kill this horseweed in my seedling cotton?" proved challenging to answer. Multiple applications of glyphosate only shortened the internodes and caused the plants to appear stacked. Many producers reverted to plows and chopping crews to control the weed in 2003. Future educational and research efforts will be directed to early applications of 2,4-D or dicamba for preplant burndown and examining new burndown chemistry or new early postemergence herbicide products.

EMERGENCE PATTERNS AND EARLY SEASON CONTROL OPTIONS FOR HORSEWEED IN MID-SOUTH AGRICULTURE. C.L. Main, R.M. Hayes, and T.C. Mueller. Department of Plant Sciences, University of Tennessee, Knoxville.

ABSTRACT

Horseweed (*Conyza canadensis* (L.) Cronq. is native to and commonly grows throughout North America. Horseweed has been reported that is resistant to applications of glyphosate. Field studies were conducted in Jackson, Knoxville, and Milan Tennessee during 2002 and 2003 to evaluate germination and emergence characteristics of horseweed. Furthermore, studies were initiated to determine early season management options for horseweed. Horseweed populations at Jackson and Milan are glyphosate resistant, while populations at Knoxville are susceptible to glyphosate.

Horseweed germination research was initiated and all horseweed plants in 1 meter square areas were counted monthly starting in November 2002. Research was conducted to allow for cumulative counts as well as new emerged horseweed counts for each month.

Research was conducted to determine what combinations of pre-plant and premergence herbicides best controlled horseweed. All herbicide studies utilized traditional small plots techniques with herbicides applied in 10 GPA of water carrier. Herbicides evaluated pre-plant burndown included; Roundup UltraMax at 26 or 39 oz/A. Roundup UltraMax at 26 oz/A tankmixed with each of the following; 2,4-D ester 16 oz/A, FirstRate at 0.3 oz/A, Gauntlet at 5.33 oz/A with FirstRate, Valor at 2 oz/A, and Canopy XL at 4oz/A. Gramoxone Max at 16 oz/A tankmixed with each of the following; 2,4-D ester, Linex 16 oz/A, Sencor at 4 oz/A, Canopy XL at 5.2 oz/A. Also included was Liberty at 24 oz/A tank mixed with the following; 2,4-D ester, and FirstRate. Herbicides evaluated for early postemergence horseweed control were; Callisto at 3 oz/A, Callisto + atrazine at 0.25 lb ai/A, Exceed at 1 oz/A, atrazine at 1 and 2 lb ai/A, Distinct at 4 oz/A, Cobra at 12.5 oz/A, FirstRate at 0.3 oz/A, Classic at 0.5 oz/A, Flexstar at 1.5 pt/A, Pursuit at 1.44 oz/A, Staple at 1.2 oz/A, and Envoke at 0.009 lb ai/A.

Horseweed germination happened mainly during March, April and May, when 24 % of the total yearly emergence occurred for each month. A second germination period was observed September October and November, when 9% of the total yearly emergence occurred for each month. However, some horseweed germination was observed for all months except January.

Glyphosate resistant horseweed populations in Jackson were controlled <50% by Roundup UltraMax. The addition of 2,4-D ester, FirstRate, Gauntlet + FirstRate, or Canopy XL increased control to 90% or greater. In Knoxville glyphosate susceptible horseweed was completely controlled by all applications containing glyphosate. Other Pre-plant herbicides that provided >90% horseweed control at both locations were Gramoxone Max + Canopy XL and Liberty + 2,4-D ester. Herbicides applied early postemergence all provided less than 65% horseweed control except for Distinct which controlled horseweed (99%).

NEW TOUCHDOWN® FORMULATIONS FROM SYNGENTA CROP PROTECTION. B. Minton, C. Foresman, and C.A.S. Pearson: Syngenta Crop Protection, Greensboro, NC 27419.

ABSTRACT

Syngenta Crop Protection has been developing and marketing glyphosate products since the introduction of Touchdown 5® in 1996. This product, which was formulated as a 3.45 AE/gal trimethyl sulfonium salt of glyphosate, was soon replaced in the market with a new and improved 3.0 AE/gal, diammonium salt of glyphosate, with the trade name of Touchdown IQ®. Touchdown IQ® is currently registered in over 230 crops including glyphosate tolerant corn, soybeans, and cotton.

In 2003, Syngenta Crop Protection, introduced several new Glyphosate products for testing. A13013M is a 4.17 AE/gal product formulated as the potassium salt of glyphosate with a uniquely built-in, balanced adjuvant system. A13998A is a 5.0 AE/gal product formulated as the potassium salt of glyphosate. This product has no built-in adjuvant system. A13886A is a product containing the potassium salt of glyphosate at 2.25 AE/gal plus s-metolachlor at 3.0 AI/gal.

Control of giant foxtail, common lambsquarters and velvetleaf with A1303M is equal to that of Roundup WeatherMax™ at acid equivalent rates, while control of these same weeds with A13998A is equivalent to that of Roundup Original™ at acid equivalent rates. Control of giant foxtail and to some degree common lambsquarters with A13886A is increased over that glyphosate alone due to the addition of s-metolachlor.

AIM™ (CARFENTRAZONE-ETHYL) HERBICIDE, A MULTIPLE USE BROADLEAF HERBICIDE FOR COTTON AND OTHER CROPS. J.P. Reed, FMC, North Little Rock, AR, H.R. Mitchell, FMC, Louisville, MS and T. Crumby, FMC, Bolton, MS.

ABSTRACT

Post direct, layby application studies in cotton performed in 2002 and 2003 demonstrated commercially acceptable control of various broadleaf weed species in cotton. Other uses for this very versatile herbicide are as a component in a burndown herbicide tankmix that enhances the control of one or more weed species. Last, harvest aid utility as governed by the mode of action of carfentrazone ethyl is a new use for corn and soybeans in 2003 under a Section 24c.

INTRODUCTION

AIM EC™ is the emulsifiable concentrate formulation of carfentrazone ethyl herbicide. AIM™ is registered for use in corn (field and sweet corn), grain sorghum, rice, soybeans, and small grains as a postemergence, layby and burndown herbicide. USEPA granted registration for use as a layby, post direct and defoliant-harvest aid in cotton for the 2001-growing season. The mode of action of carfentrazone ethyl relies upon disruption of plant cell membranes. The specific target of disruption is the inhibition of proto-porphryngin oxidase. Observed symptomology is rapid necrosis of plant tissues. This fast activity makes AIM EC™ and ideal candidate for postemergence and layby applications (Mize et al. 2001). The advent of glyphosate resistant marestail (*Erigeron canadensis*) in Tennessee cotton production systems required finding tankmix partners for glyphosate that would provide complimentary control (Hayes et al. 2003). This lead to the search for tankmix partners that did not have the same mode of action as glyphosate, yet were effective against glyphosate resistant marestail and other broadleaf species.

EXPERIMENTAL METHODS

Preliminary studies were initiated in 1998 and further studies continued into 2001 for development and familiarization of use in postemergence, layby and burndown applications of AIM™. Experimental designs were randomized complete block employing 3 or 4 replicates. Locations were throughout the Southern United States that were agronomically and edaphically best suited to grow cotton, corn and soybeans. Plots measured from 12 to 30 ft wide by 30 to 60 ft long. Spray application volumes ranged from 10 to 20 gallons per acre using small plot sprayer equipment.

The primary weed species tested were as follows: morningglories, entireleaf and ivyleaf (*Ipomea hederacea* and *var.)*; pigweeds *(Amaranthus spp.)*; cutleaf groundcherry *(Physalis angulata)*; hemp sesbania, *(Sesbania exultata)*; annual bluegrass, *(Poa annua)*; broadleaf signalgrass, *(Brachiara pltyphylla)*; and yellow nutsedge, (*Cyperus esculentus*).

The herbicides tested in addition to AIM™(carfentrazone-ethyl) were caparol, cotoran, dicamba, diflufenzopyr, diuron, glyphosate, linuron, paraquat and MSMA. Appropriate labelled and lower rates of tankmix herbicides were used in conjunction with carfentrazone-ethyl. Rates for carfentrazone-ethyl application ranged from 0.008 up to 0.025 lbs ai/A. Adjuvants such as COC, and NIS were used in various treatments.

RESULTS

Postemergence, layby applications of AIM™ 0.025 lbs ai/A applied alone and in tankmixes were well within the range of crop safety in 2002 and 2003. Control of morningglory at 4-9 days after treatment (DAT) by AIM™ (0.016 lbs ai/A) + 1 % COC was 84 and 92% for 2002 and 2003, respectively. As AIM™ has the attribute of no residual activity, later ratings at 11 to 16 DAT saw control settle at 47 and 86% respectively for both years, rrespective of rating date glyphosate (0.56 lbs/A) alone provided unacceptable commercial morningglory control of 56%. This necessistated

the consideration of tankmixes which included use of diuron at either 0.75 to 1 lbs ai/A tankmixed with AIM™ 0.016 to 0.025 lbs ai/A provided not only quick and residual morninngglory control but an economical post layby tankmix as well. The tankmixing of caparol and cotoran with AIM™ also enhanced morningglory residual control. In a similar fashion, pigweed, cutleaf ground cherry, hemp sesbania, broadleaf signal grass control with AIM™ + caparol, or cotoran or diuron was no lower than 86% at either 5-9 DAT or 11-16 DAT. As AIM™ alone does not control annual bluegrass, tankmixes with diuron of 0.75- 1 lbs ai/A or glyphosate were effective in a post layby fashion of controlling this grass.

Studies in 2003 investigating burndowns applied at different timings were driven by the pre-plant interval of the tankmix partner. As noted earlier AIM™ alone does not control annual bluegrass however, in early pre-plant and at plant timings applications there is a fit for controlling certain broadleaves and leaving a grass sod intact, especially in highly erodible land areas. Since conservation tillage is increasing and a detrimental product of reliance upon glyphosate in those conservation tillage systems, no-till or reduced till has been the wide spread selection of glyphosate resistant mares tail. Once again the use of AIM™ alone or tankmixed with glyphosate did not provide as adeqauate control at plant or 30 days before planting of marestail as other tankmixes containing cotoran, 2,4-D LVE, dicamba, diflufenzopyr, dicamba, and linuron. Fall applications of AIM™ tankmixed with glyphosate, tribenuron and 2,4-DLVE, 2,4-D LVE, dicamba and diflufenzopyr provided greater than 95% control of glyphosate resistant marestail at 104-110 days DAT.

In 2003 AIM™ harvest aid studies conclusively showed no differences between the 0.016 and 0.025 lbs ia/A when tankmixed with UAN and 1% COC to control morningglories in corn and soybeans.

SUMMARY

1. Post direct layby studies of AIM™ and tankmix partners indicate crop safety are well within the bounds of safety.
2. There was no difference between the 0.016 and 0.025 lbs ai/A rate of AIM™ in efficacy in post direct layby.
3. There were no differences in post direct layby data from 2001, 2002 and 2003.
4. AIM™ + diuron or fluometuron were equal or superior to glyphosate tankmix in a post direct or layby application for weed control.
5. AIM™ alone does not kill grasses in burndown application and the selection of certain tankmix partners such as 2,4-D LVE,require 21 days before planting while dicamba and diflufenzopyr may be used to burn down marestail 30 days before planting in no-till or reduced areas where grass covers may be managed for erosion control.
6. AIM™ may be tankmixed with cotoran, diuron or gramoxone to control marestails and grass cover crop in a no-till or reduced tillage system as an at plant application.
7. There is no difference between glyphosate or gramoxone harvest aid applications or when AIM™ is tankmixed with UAN and 1% COC as a harvest aid in corn and soybeans.

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PROWL H_2O: A NOVEL WATER-BASED FORMULATION OF PENDIMETHALIN. C.D. Youmans and J.B. Guice, BASF Corporation, Dyersburg, TN and Winnsboro, LA.

ABSTRACT

Prowl® H_2O is a new aqueous capsule suspension formulation of pendimethalin. PROWL H_2O contains 456 grams of active ingredient per liter. The encapsulation of pendimethalin allows for the elimination of organic solvents in the product, reducing odor, staining, volatility and surface residue adhesion, as compared to existing emulsifiable concentrate formulations of pendimethalin. PROWL H_2O is stable under conditions of freezing and thawing and is compatible with liquid and dry fertilizer. Prowl H_2O is registered for use in corn (field, pop, seed and sweet), cotton, edible beans, garlic, grain sorghum, lentils and peas, nonbearing fruit and nut crops, nonbearing vineyards, onions and shallots (dry bulb), peanuts, potatoes, rice, soybeans, sugarcane, sunflowers and tobacco. Prowl H_2O received EPA section 3 registration on March 26, 2003.

PROWL H_2O: FIELD PERFORMANCE. J.S. Harden, J.B. Guice, J.K. Sweat, G.M. Fellows; Biology Group Leader, Biology Area Manager, Technical Market Manager, and Technical Market Manager, BASF Corporation, Research Triangle Park, NC 27709, Winnsboro, LA 71295, BASF Corporation, Research Triangle Park, NC 27709, and BASF Corporation, Research Triangle Park, NC 27709.

ABSTRACT

Field efficacy and crop tolerance trials were conducted with Prowl® H_2O, a new aqueous capsule suspension formulation of pendimethalin from 1998-2003. A consistent trend for improved crop safety was present with Prowl H_20 compared to pendimethalin emulsifiable concentrate (EC) formulations in all crops tested. The absence of organic solvents in the aqueous formulation results in increased tank-mix flexibility and reduced crop response compared with the EC formulations of pendimethalin. Weed efficacy of both grasses (including *Setaria spp., Digitaria spp., Panicum spp*.) and broadleaves (including *Abutilon theophrasti, Chenopodium album, Amaranthus retroflexus, Amaranthus tuberculatus)* with the aqueous capsule suspension formulation of pendimethalin shows a consistent trend for increased weed control compared with the pendimethalin EC formulations. Prowl H_2O was shown to have reduced binding to crop residues in both lab and greenhouse experiments. The reduced binding of the aqueous formulation was reflected in increased weed control in no-till soybean field trials with either fall or early preplant applications when compared to the EC formulation.

EFFECT OF DEFOLIATION ON WINTER CANOLA YIELD. F.S. Kelley, T.F. Peeper, and J.P. Kelley; Department of Plant and Soil Sciences, Oklahoma State University, Stillwater, Oklahoma 74078.

ABSTRACT

A field study was conducted at the Stillwater Agronomy Research Farm during the 2002-2003 growing season to determine the effects of defoliation on winter canola growth and yield. Before seeding canola, 0.84 kg ai ha^{-1} trifluralin was applied preplant incorporated to entire study area. 'Abilene' winter canola was drilled on 19 cm rows at 7.2 kg A^{-1}. To simulate grazing, canola plots were mowed with a lawn mower with a two inch cutting height. The treatments included mowing at two, four, and five dates, and unmowed check. Mowing treatments began on January 8, 2003 and continued at approximately two week intervals until March 24, 2003, the time canola began to bolt. Prior to mowing, one-meter row of canola was hand clipped from four random locations from the border. Mean forage weight was 3790 kg ha^{-1}. In addition, stand counts and plant height were recorded prior to harvest.

The results indicate there were no significant differences in final plant height between unmowed check and two mowing treatments. However, there was a trend in decreasing plant height from two through five mowing treatments. In addition, the data does not show a difference between two, and four mowing treatments, yielding about 2691 kg ha^{-1}. However, two mowing treatments decreased yield approximately 21 percent as compared to the unmowed check. This research suggests that it may be possible to use canola as a dual purpose crop in Oklahoma as winter wheat is currently used.

WINTER WEED MANAGEMENT IN EARLY-PLANTED MISSISSIPPI SOYBEAN. D.H. Poston, C.H. Koger, M.A. Blaine, and B.L. Spinks. Delta Research and Extension Center, Stoneville, MS 38776; USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS 38776; and Plant and Soil Science Department, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Field studies were conducted in 2002 and 2003 to determine the efficacy of twelve glyphosate-based herbicides programs applied at various timings for winter weed management in April-planted soybean and to determine which of these programs was the most profitable program to use in a three-pass production system that includes a pre-plant herbicide application, soybean planting, and one in-season glyphosate application. Glyphosate in the form of the isopropylamine salt was applied alone a 0.75 and 1.0 lbs ai/A. Glyphosate at 0.75 lbs ai/A was also tank mixed with 0.75 lbs ai/A 2,4-D, 0.078 lbs ai/A flumioxazin, 0.016 lbs ai/A thifensulfuron + 0.008 lbs ai/A tribenuron, 0.094 lbs ai/A sulfentrazone + 0.019 lbs ai/A chlorimuron, 0.008 lbs ai/A carfentrazone, 0.013 lb/A carfentrazone, 0.1 lbs ai/A oxyfluorfen, 0.25 lbs/A oxyfluorfen, 0.5 lbs/A oxyfluorfen, and 0.1 lbs/A oxyfluorfen + 0.75 lbs/A 2,4-D. Applications were made in early February, late February, and late March each year at 15 gpa using flat fan nozzles. Soybean was planted in mid April and one in-season glyphosate was made approximately 4 wk after planting. No at-planting burndown application was made. The rate of the in-season glyphosate application was adjusted to control the weeds present in the plots at the time of application. Weed control and percent green groundcover were determined at planting. Weed control ratings reflected the control of weeds that were present at the time of application and did not assess residual benefits of herbicide treatments. Percent green groundcover ratings were used to assess the residual benefits of each program. Net returns above weed management costs including application cost were determined for all treatments.

Averaged across years and application timings, cutleaf eveningprimrose (*Oenothera laciniata* Hill) control greater than 90% at planting was achieved only when 2,4-D was added to glyphosate treatments. Horseweed (*Conyza canadensis* (L.) Cronq.) control greater than 90% was achieved with glyphosate + 2,4-D, glyphosate + sulfentrazone + chlorimuron, and glyphosate + 2,4-D + oxyfluorfen. These same treatments and glyphosate + flumioxazin were the only four treatments that produced greater than 90% control of all winter vegetation by planting in mid April. In addition, plots receiving these four treatments were the only plots that had less than 10% green groundcover present at planting. Reductions in green groundcover compared to the nontreated control were 88, 93, 95, and 89% for glyphosate + 2,4-D, glyphosate + flumioxazin, glyphosate + sulfentrazone + chlorimuron, and glyphosate + 2,4-D + oxyfluorfen, respectively. Maximum soybean yields were 62, 62, and 59 bu/A in plots treated with glyphosate + flumioxazin, glyphosate + sulfentrazone + chlorimuron, and glyphosate + 0.5 lbs/A oxyfluorfen, respectively. This suggests a yield benefit from residual herbicides using this three pass production system and also suggests that limited weed competition between planting and in-season glyphosate applications can reduce yields even in early-planted soybean. Maximum net returns above weed management costs were achieved with glyphosate + flumioxazin and glyphosate + sulfentrazone + chlorimuron where net returns of $343 and $342/A were recorded with each treatment, respectively. These findings suggest an economic benefit to residual herbicide programs in early-planted soybean where no burndown is used at planting and where the cost of residual programs is not excessive.

Weed control, soybean yield, and net returns generally decreased the later pre-plant burndown applications were made in 2002. In 2003, application date had little impact on any of these parameters. Averaged across both years, the best application date appeared to be late February. For most treatments, acceptable herbicide performance was observed at this timing. Although the best efficacy was always observed with the early February application, the window between application and planting was often too long with the early February timing and weed resurgence was often problem, especially with non-residual programs. Economically, glyphosate + flumioxazin and glyphosate + sulfentrazone + chlorimuron programs performed well across all application timings.

SOYBEAN POSTEMERGENCE WEED CONTROL WITH FLUMICLORAC (RESOURCE). J.L. Alford, L.R. Oliver, and R.C. Scott. Department of Crop, Soil, and Environmental Sciences and Cooperative Extension Service, University of Arkansas, Fayetteville and Little Rock, AR.

ABSTRACT

Weed competition prevent crops from reaching their yield potential. Therefore, it is necessary to find the most efficient control methods to reduce future weed interference problems. Flumiclorac provides the opportunity to broaden weed control and reduce yield loss. Experiments were conducted in 1999, 2001 to 2003 at four locations across the state of Arkansas to evaluate the benefit of tank-mixing flumiclorac with glyphosate postemergence. Secondly, the research evaluated weed control differences for flumiclorac at three rates (0.014, 0.020, and 0.027 lb/A). Roundup Ready® soybeans were planted at 9 to 10 seed/ row foot with four rows/ plot. Treatments were replicated four times in a factorial arrangement in split-plot design. Applications were made using a backpack or sequential plot sprayer. Postemergence treatments (POST) applied at the V3 stage included flumiclorac (Resource) (0.014, 0.020, and 0.027 lb/A) + glyphosate (Roundup Ultra), chlorimuron (Classic) + Roundup Ultra followed by Roundup Ultra, Roundup Ultra, and Roundup followed by Roundup Ultra. All treatments in 2001 to 2003, except the sequential Roundup treatment, were treated with a preemergence metolachlor (Dual Magnum) application. Data recorded were visual evaluations of soybean injury and control of pitted morningglory (*Ipomoea lacunosa*), entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula*), barnyardgrass (*Echinochloa crus-galli*), hemp sesbania (*sesbania exaltata*), prickly sida (*Sida spinosa*), and Palmer amaranth (*Amaranthus palmeri*).

Metolachlor preemergence controlled barnyardgrass during the growing season. Palmer amaranth and entireleaf morningglory were susceptible to all treatments (≥ 85% control) and effectively controlled throughout the season. At 6 weeks after emergence, pitted morningglory was controlled ≥ 74 % by all treatments, except sequential applications of Roundup Ultra. However, late-season ratings suggested the sequential Roundup Ultra applications were most effective with control of ≥ 90%, where as all other treatments were less effective, but provided ≥ 79 % control. Hemp sesbania was controlled effectively early by all treatments ≥ 78 % and throughout the season with sequential Roundup Ultra applications at 97 %; however, all other had lower control than sequential Roundup Ultra applications, but still maintained ≥ 85 % hemp sesbania control. Prickly sida was also controlled most effectively by Roundup Ultra sequential applications throughout the season, all other treatments had lower control than Roundup Ultra early. Late-season evaluations suggested Resource and Classic provided greater control than Roundup Ultra alone. Yield was highest with Roundup Ultra sequential applications, due to effective weed control throughout the season, and there were no differences between Resource, Classic, and Roundup alone.

AN OVERVIEW OF HARVEST AID RESEARCH IN SUGARCANE, SOYBEANS, AND CORN. J.L. Griffin, C.A. Jones, L.M. Etheredge, W.E. Judice, and D.Y. Lanclos. Louisiana State University AgCenter. Baton Rouge, LA.

ABSTRACT

Studies were conducted in 2003 to evaluate the potential use of harvest aids as weed desiccants. Aim and ET-751 at various rates were applied with either 1% crop oil concentrate (COC) or 0.25% nonionic surfactant (NIS). Spray volume was 8 to 15 gallons per acre. Studies were conducted in non crop areas and in corn and sugarcane.

Three experiments were conducted in non crop areas where maximum coverage of weeds with the spray solution would be expected. In the first experiment herbicide treatments were applied July 21 to red morningglory (*Ipomoea coccinea* L.) with 12 to 20 inch runners. At 10 days after treatment (DAT) weed control was 72 and 86% with Aim at 1.5 and 2 oz/A plus NIS, respectively, and 47% with ET-751 at 1 oz/A plus COC. In a second experiment herbicide treatments were applied August 8 to morningglory with 3 to 4 foot runners. Both pitted (*Ipomoea lacunosa* L.) and red morningglory were present in the experimental area but red morningglory was only in one replicate. At 3 DAT pitted morningglory control was 85 to 90% with Aim at 1, 1.5, and 2 oz/A plus COC and around 35% with ET-751 at 0.5 and 1.0 oz/A plus COC. Red morningglory control 3 DAT was 75 to 80% with the Aim treatments and around 40% for ET-751. It appears that pitted morningglory may be more sensitive than red morningglory to Aim. In a third experiment herbicide treatments were applied August 8 to red morningglory with 2 to 4 foot runners. At 10 DAT weed control was 53 to 78% with Aim at 1, 1.5, and 2 oz/A plus COC and 35 and 46% with ET-751 at 0.5 and 1 oz/A plus COC.

Two experiments were conducted in corn. In the first experiment Gramoxone Max (1.33 pt/A) plus NIS, sodium chlorate (4 qt/A of 6 lb ai/gallon material), Aim (1.4 and 1.9 oz/A) plus COC, and ET-751 (0.5 and 1.0 oz/A) plus COC were evaluated. At the time of application morningglory plants had climbed corn and had 4 to 6 foot runners. Morningglory plants were wilted at application and at 8 DAT pitted morningglory control was no more than 33%. In another experiment in corn Gramoxone Max (10.7 oz/A) plus NIS, Roundup WeatherMax (23.3 oz/A), and Aim (1.4 and 1.9 oz/A) plus 2.5% liquid nitrogen (28%) and COC were evaluated. Morningglory plants at application had climbed corn and had 3 to 6 foot runners and hemp sesbania (Sesbania exaltata (Raf.) Rydb. ex A.W.Hill) was 6 to 8 feet tall. At 10 DAT pitted morningglory was controlled around 80% with Aim but no more than 43% with Gramoxone Max and Roundup WeatherMax. Hemp sesbania was controlled no more than 42%.

In sugarcane, entireleaf morningglory (*Ipomoea hederacea* L. Jacq.) 6 to 12 feet tall at application on August 26 was controlled no more than 55% with Aim (1.4 and 1.9 oz/A) or ET-751 (0.5 and 1.0 oz/A) plus COC 13 DAT. In another experiment red morningglory 7 feet tall was treated on September 5 and 13 DAT was controlled 73% with Aim at 1.9 oz/A plus COC but no more than 56% with Aim at 1.4 oz/A or ET-751 at 4 oz/A plus COC.

Results from these studies indicate that spray coverage is critical for contact-type herbicides like Aim and ET-751. Control of morningglory with these herbicides can be reduced when weeds are stressed. Results show that under the best conditions morningglory can be controlled 10 DAT around 80% with Aim, 43% with Roundup, and 35% with Gramoxone, but they were ineffective on hemp sesbania or prickly sida.

SOIL APPLIED HERBICIDE PROGRAMS FOR FLORIDA SUGARCANE. A.C. Bennett; Everglades Research and Education Center, University of Florida, Belle Glade, FL 33430.

ABSTRACT

Florida is a major producer of sugar in the United States. Approximately 50% of the sugar from sugarcane, and 25% of the total sugar produced in the US is grown in the Everglades Agricultural Area (EAA). The EAA is an area of predominantly organic soils located south of Lake Okeechobee in southern Florida. A relatively limited number of herbicides are available for use in Florida sugarcane production. Currently available herbicides with preemergence activity include atrazine, metribuzin, diuron, pendimethalin, and ametryn. Most current soil-applied herbicide programs rely on atrazine, with relatively limited use of pendimethalin and ametryn. Very little metribuzin or diuron is currently used. Two new products are being evaluated for use as preemergence herbicides for Florida sugarcane, Valor (flumioxazin) and K4 (hexazinone + diuron). Our objectives were to determine how these products compared with current standards, and to evaluate how they could be used in conjunction with a newly labelled postemergence herbicide, Envoke (trifloxysulfuron).

Two trials were conducted during the 2003 growing season, one at 20 Mile Bend, and the other on Duda Road. Trials were established in November, 2002 and January, 2003, and harvested approximately 1 year later. Plots were 20 feet by 40 feet, and replicated four times. Standard application procedures were used. Treatments included atrazine (3 lb ai/A), atrazine (3 lb ai/A) + ametryn (0.8 lb ai/A), atrazine (3 lb ai/A) + flumioxazin (0.250 lb ai/A), hexazinone (0.52 lb ai/A) + diuron (1.9 lb ai/A), and pendimethalin (4 lb ai/A) or pendimethalin (3.3 lb ai/A) + metribuzin (0.8 lb ai/A). At 20 Mile Bend, pendimethalin + metribuzin controlled fall panicum 78%, greater than all other treatments except atrazine + ametryn 12 weeks after treatment (WAT). All treatments containing atrazine controlled alligatorweed at least 59%, while pendimethalin + metribuzin and hexazinone + diuron controlled alligatorweed less than 30%. At Duda Road, atrazine + flumioxazin controlled spiny amaranth more effectively than all other treatments with 82% control, while hexazinone + diuron controlled spiny amaranth 70%. All other treatments controlled spiny amaranth less than 50% 12 WAT. Fall panicum control was at least 88% with atrazine + flumioxazin, hexazinone + diuron, or pendimethalin.

When the preemergence treatments at 20 Mile Bend were followed by a postemergence application of trifloxysulfuron (0.0141 lb ai/A) + asulam (1.65 lb ai/A), all weeds were controlled at least 80%, with no differences between treatments 12 WAT. At Duda Road preemergence treatments were followed by trifloxysulfuron (0.0141 lb ai/A) applied. Similar to the results at 20 Mile Bend, all weeds were controlled at least 94%, with no differences between preemergence treatments 12 WAT.

Yields of sugarcane (tons/A) were highest following hexazinone + diuron at 20 Mile Bend, but only significantly different from atrazine alone. POST applications of trifloxysulfuron + asulam increased yield when they followed atrazine or atrazine + ametryn, but did not increase the yields of the other treatments. At Duda Road, yields were highest following atrazine + flumioxazin when no postemergence treatments were applied. Yields were increased for all treatments when trifloxysulfuron was applied following the preemergence treatment, compared to the preemergence treatment alone.

Results indicate both hexazinone + diuron and flumioxazin have potential for use in Florida sugarcane weed control systems, as they were generally better than the atrazine-based systems that are considered the standard. Further research will be conducted to determine their best fit in sugarcane weed control systems.

REDUCED TILLAGE WEED CONTROL PROGRAMS IN FALLOWED SUGARCANE FIELDS. L.M. Etheredge, Jr., J.L. Griffin, C.A. Jones, and W.E. Judice; Louisiana State University Agricultural Center, Baton Rouge, LA.

ABSTRACT

Sugarcane is a perennial crop and three to five harvests are made from a single planting. Weed problems especially the perennial weeds bermudagrass [*Cynodon dactylon* (L.) Pers.] and johnsongrass [*Sorghum halapense* (L.) Pers.] increase in the successive crops and over time sugarcane plant populations are reduced to the point that replanting is warranted. Sugarcane fields are then fallowed and tillage and glyphosate programs are used to reduce weed infestation levels. A study was conducted in Donaldsonville, Louisiana, to evaluate various weed control programs in fallowed sugarcane fields specifically to compare mechanical destruction of sugarcane stubble followed by tillage, soil applied herbicide, and/or Roundup UltraMAX applications (conventional programs) with a no-till system where Roundup UltraMAX was used to kill sugarcane stubble. Another similar study was conducted in Henderson, Louisiana, to evaluate only the conventional programs. At planting, at both locations, DuPont K4 (4 lb/A) was applied broadcast across all treatments to evaluate the effects of the various weed control programs implemented during the fallow period.

At the Donaldsonville location, 14 days prior to planting on August 28, weeds were present in all plots with the population depending on when a tillage or Roundup UltraMAX application was performed. The most important determinant of the effectiveness of the various fallow programs, however, would be the level of weed reinfestation that would occur after sugarcane was planted. One month after planting, as expected, differences in sugarcane shoot emergence were observed and results showed numerically less shoot emergence for the conventional system where only tillage was used or when only tillage and one Roundup UltraMAX application was used. At 50 d after planting (DAP) purple nutsedge (*Cyperus rotundus* L.), bermudagrass, and johnsongrass were controlled 72 to 82% for the no-till programs compared with less than 60% purple nutsedge and bermudagrass control for the conventional programs. These data suggest that a no-till system can be used in fallow fields to manage weeds equal to or better than conventional tillage programs without negatively affecting soil preparation prior to planting or sugarcane stand establishment.

At the Henderson location, bermudagrass present at planting where only tillage operations were performed resulted in some difficulty in opening rows and in covering planted sugarcane stalks. However, sugarcane shoot emergence 36 DAP was not negatively affected by any of the conventional fallow programs. Bermudagrass ground cover 36 and 86 DAP showed that tillage alone provided little control of bermudagrass. Bermudagrass control, however, was excellent where tillage was followed by Roundup UltraMAX 7, 28, or 47 days ahead of planting. Results also show that even though DuPont K4 programs were effective in controlling bermudagrass when used in conjunction with Roundup UltraMAX, they were no more effective than when DuPont K4 was substituted by a tillage operation. However, use of a soil treatment such as DuPont K4 may offer advantages in years when wet soil would prevent field activities.

REDUCED TILLAGE WEED CONTROL PROGRAMS IN PLANT AND STUBBLE SUGARCANE. W.E. Judice, J.L. Griffin, C.A. Jones, L.M. Etheredge, and J.D. Siebert. Louisiana State University Agricultural Center, Baton Rouge, LA.

ABSTRACT

Sugarcane is a perennial crop and in Louisiana four to six harvests are made from a single planting. The first harvest year is the plant cane crop and consecutive years are stubble crops. Sugarcane row shoulders and middles are tilled to promote crop growth, eliminate ruts, incorporate fertilizer, and control weeds. The row top (24 inch wide area) is not disturbed over the entire crop cycle. Although, some form of reduced tillage is used in most agronomic crops, sugarcane growers have been slow to adopt reduced tillage practices. This is partially due to concerns over the negative effect on crop growth and on weed control. In a typical sugarcane production system three tillage operations are performed during the growing season. The first operation in mid to late March is known as off-bar tillage, the second tillage operation is conducted when fertilizer is applied in mid April, and the third tillage operation is at layby in mid to late May.

In 2002 preliminary studies at three locations in both plant and stubble sugarcane were conducted to evaluate the feasibility of eliminating the off-bar tillage operation. The experimental design was a randomized complete block with a factorial arrangement of treatments. Factor A represented tillage or no tillage in March. Factor B was herbicide treatments, which included Velpar plus Direx (11 oz/A + 2.25 lb/A), Prowl plus Direx (4 qt/A + 2.25 lb/A), Prowl plus Sencor (4 qt/A + 1.5 lb/A), Command plus Direx (2.7 pt/A + 2.25 lb/A), and atrazine (2 qt/A). Results showed that spring herbicide application and reduced tillage were not limiting factors to early season sugarcane growth and at one location sugarcane growth was improved by eliminating the off-bar tillage operation.

Experiments were conducted in St. Gabriel, LA, in 2002 and 2003 and in Glencoe, LA, in 2003 to evaluate the effect of tillage throughout the growing season on weed control and sugarcane growth. Early season herbicide application method was also evaluated to determine the effect on weed control when tillage was reduced or eliminated. The experimental design was a randomized complete block with a factorial treatment arrangement and four replications. Factor A was off-bar tillage (with or without) and factor B was layby tillage (with or without). Factor C represented early season herbicide application method (band or broadcast). The sugarcane variety used in the study was 'LCP 85-384' and the herbicide used in the study was Dupont K4 (4 lb/A). Data collected included soil temperature, shoot and stalk population, plant height, and sugarcane yield and sugar yield. Weed control was not a detriment to sugarcane growth or yield in the three experiments. Soil temperature in the sugarcane drill was not affected by spring tillage. Early season sugarcane shoot population and late season stalk population in both years were each equivalent for the full tillage (off-bar plus layby) and the no tillage program. Sugarcane tonnage and sugar yield were not negatively affected when tillage operations were eliminated.

EVALUATION OF VALOR IN SUGARCANE. C.A. Jones, J.L. Griffin, L.M. Etheredge, W.E. Judice and J.D. Siebert; Department of Agronomy, Louisiana State University AgCenter, Baton Rouge, LA 70803.

ABSTRACT

Valor (flumioxazin) was first evaluated in Louisiana sugarcane in 1997. In 2003, sugarcane injury associated with Valor (0.25 lb ai/A), Gramoxone Max (0.47 lb ai/A), and Valor plus Gramoxone Max applied in March and April was evaluated. Sugarcane was treated from March 12 to April 22 when the crop was 6 to 15 inches tall. Sugarcane treated on March 12 was injured 56 and 58% 8 days after treatment (DAT) of Valor alone and in combination with Gramoxone Max, respectively, but was injured 33% with Gramoxone Max. By 34 DAT sugarcane injury with these treatments was 24% and was around 11% 49 DAT. Valor applied on March 25 injured sugarcane around 40% 21 DAT whether applied alone or with Gramoxone Max compared with 28% for Gramoxone Max applied alone. Injury for these treatments was around 20% 36 DAT. Fifteen days after the April 15 application sugarcane was injured 24 to 28% with Valor or Gramoxone Max applied alone and with the combination and injury was 14 to 23% 29 DAT. When the herbicides were applied April 22, sugarcane was injured 10 to 14% 8 DAT and 4 to 7% 22 DAT. The lower crop injury observed for the later applications may have been due to growing conditions at the time that were more conducive to sugarcane recovery.

In another study, sugarcane was injured 30% 21 days after Valor was applied at 0.25 lb/A in late March. By 36 DAT injury from Valor was 10 to 15%. On June 4 sugarcane height data indicated that the crop had recovered from the early season injury and also that the directed layby application of Valor (0.125 lb/A) 8 days earlier following a March application of Valor was not detrimental to sugarcane growth. This response was further substantiated in that sugarcane injury, height reduction, or stalk population reduction among treatments was not observed later in the growing season. Entireleaf morningglory (Ipomoea hederacea var. integriuscula) control 24 days after layby (DAL) was around 94% for Valor compared with 81% for atrazine. At 64 DAL application morningglory was controlled 75% with Valor and around 60% with atrazine.

A study also evaluated sugarcane response to an over-the-top March application of Valor and layby directed application from May 1 to June 17. Sugarcane injury 21 days following the March 25 over-the-top application was around 35% for both rates of Valor (0.188 and 0.25 lb/A). Injury was not observed for Direx (2.4 lb ai/A) applied at the same time. By 36 DAT sugarcane injury with Valor was not observed, again indicating the ability of sugarcane to recover from initial injury. Sugarcane injury 13 days following the first directed layby application on May 1 was only 4% where Valor was applied at 0.25 lb/A without a surfactant but was 19% where Valor was applied at the same rate with either 1% crop oil concentrate or 0.25% nonionic surfactant. Direx applied on May 1 did not injure sugarcane. In early June sugarcane height was equal regardless whether Valor was applied over-the-top or directed.

From 1997 through 2003 several studies evaluated sugarcane tolerance and weed efficacy with Valor. The consensus of these studies is that Valor will effectively control morningglories and many broadleaf weeds when applied as either a soil or foliar treatment. Application of Valor to sugarcane as it is emerging in early spring can be very phytotoxic but the crop has been able to recover with no adverse effect on sugarcane or sugar yield. Based on cost and injury concerns that will influence grower acceptance, use of Valor should be limited to a soil application at planting and a postemergence directed application after sugarcane has jointed.

INFLUENCE OF CLARITY, DISTINCT, OR 2,4-D APPLIED PREPLANT ON COTTON GROWTH AND YIELD. J.D. Everitt, J.W. Keeling, and L.L. Lyon, Texas Agricultural Experiment Station, Lubbock, TX.

ABSTRACT

Cotton producers on the Texas Southern High Plains have been utilizing conservation tillage practices successfully for several years because of the increased yields, reduced input cost, and decreased soil erosion. However, these practices have created some difficult new weed problems, including horseweed (*Conyza canadensis*) and Russian thistle (*Salsola iberica*). These two weeds are more prevalent in the early spring prior to planting. Herbicides that control these weeds; such as 2,4-D, Clarity, and Distinct all have current label restrictions limiting their use in cotton. The objectives of this study were: to evaluate cotton injury and yield from Clarity, 2,4-D, and Distinct applied six, four, two, and one week before planting (WBP); and to determine the minimum interval between application and planting to apply these herbicides without effecting yield.

Studies were conducted in 2003 at AG-CARES research facility near Lamesa, TX on an Amarillo fine sandy loam, and at Texas Agricultural Experiment Station near Halfway, TX on an Olton clay loam; however, severe weather events destroyed the Halfway trial. Clarity at 0.125 lb ai/A and 0.25 lb ai/A, Distinct at 0.088 and 0.175 lb ai/A, and 2,4-D at 0.50 lb ai/A were applied six, four, two, and one WBP. Cotton (PM 2326 RR) was planted on May 5 at AG-CARES. Cotton injury ratings were recorded at monthly intervals during the growing season. Plots were mechanically harvested on October 13. Samples were collected and ginned to calculate lint yield per acre.

Clarity and Distinct applied six or four WBP did not injury cotton. No injury was observed when 2,4-D was applied as close as one WBP. Early season injury was observed (<18%) with Clarity at both rates applied two WBP, and this injury declined to <5% late season. Significant crop injury (15 to 40%)resulted from Clarity applied at both rates one WBP, but no late season injury was observed. Distinct at either rate applied one or two WBP resulted in early season cotton injury (40 to 90%), but declined to <5% by late season. Cotton yields ranged from 750 to 925 lbs lint/A. No treatment adversely affected yield, even those that resulted in significant early season injury. Above average heat unit accumulation and excellent fall conditions appeared to allow cotton to compensate for early season injury. Although injury observed in this study did not result in yield loss, in most years, significant early season injury could be expected to reduce yield. The timing of rainfall or irrigation must be considered in conjunction with the interval between herbicide application and planting.

COMPARISON OF CHLOROACETAMIDE AND DINITROANALINE HERBICIDES AND APPLICATION TIMING FOR WEED CONTROL IN COTTON. L.T. Barber, D.B. Reynolds, M.T. Kirkpatrick, N.W. Buehring and J.J. Walton. Mississippi State University, Mississippi State, MS.

ABSTRACT

Glyphosate can be applied topically on Roundup Ready cotton, until cotton reaches the fourth leaf stage. For this reason, preemergence residual treatments have decreased due to the efficiency of early post treatments. In order to maximize the use of residual herbicides in the Roundup Ready system, cotton tolerance and herbicidal efficacy must be determined when applied postemergence with glyphosate. A new formulation of pendimethalin (Prowl H_20) will be introduced in 2004. Prowl H_20 is an encapsulated formulation of pendimethalin that is water-based. It does not stain as bad as the former Prowl 3.3 EC and has a decreased rate of photodegradation. The purpose of this study was to evaluate two different formulations of pendimethalin (Prowl 3.3 EC and Prowl H_20) and chloroacetamide herbicides such as metolachlor (Dual II Magnum) and dimethenamid (Outlook) in terms of crop safety and weed control when tank-mixed with glyphosate and applied postemergence over cotton.

Research was conducted in 2003 at the BlackBelt Branch Experiment Station near Brooksville, MS on a silty clay loam, and at Starkville, MS on a silt loam. Stoneville 4892 BR was planted at both locations and experimental units were 12.6 by 40 feet. Herbicide treatments were arranged in a two factor factorial. Herbicide timing was the first factor composed of a preemergence and two postemergence timings with 0.75lb ae/A glyphosate. The second factor was composed of 6 residual herbicide treatments. These treatments consisted of; Prowl (pendimethalin) 3.3 EC at 1.0 and 2.0 lb ai/A, Prowl H_20 (pendimethalin) at 1.0 and 2.0 lb ai/A, Dual II Magnum at 1.25 lb ai/A and Outlook at 0.75 lb ai/A. All herbicides were applied at 15 gallons per acre (GPA). Data evaluated consisted of cotton injury, large crabgrass (*Digitaria sanguinalis*) control, and pitted morningglory (*Ipomoea lacunosa*) control. Visual ratings for cotton injury and weed control were taken 7 days after early post applications, 14 days after late post applications and 28 days after late post applications. Cotton yield data were collected on the center two rows of each plot. Data were pooled across locations, subjected to analysis of variance, and means separated by least significant difference at the 0.05 level of significance ($LSD_{0.05}$).

Prowl 3.3 EC at 2.0lb ai/A and Outlook at 0.75lb ai/A resulted in 30% cotton injury 7 and 14 DAT (days after treatment) when applied preemergence. Prowl H_20 at 2.0 lb ai/A injured cotton 6% at 28DAT and Prowl H_20 at 1.0 lb ai/A gave less than 6% injury at all rating periods when applied preemergence. Postemergence applications of these compounds resulted in less than 10% injury when tank-mixed with Roundup Weathermax at 0.75lb ae/A and applied over 1 leaf cotton. Applications of Prowl 3.3 EC at 2.0lb ai/A at the four leaf stage, increased cotton injury to 20%. Prowl H_20, Dual II Magnum and Outlook injured cotton less than 10% when applied with Roundup Weathermax over 4 leaf cotton. Large crabgrass control was 75% at 28 DAT with Roundup Weathermax applied alone. Large crabgrass control was increased to 91% at 28 DAT with all residual herbicides applied. Preemergence applications of Outlook, Dual II Magnum and Prowl increased pitted morningglory control to 89, 85 and 87%, respectively, at 7 DAT over Roundup Weathermax applied alone. Residual herbicides did not improve control of pitted morningglory when tank-mixed with Roundup Weathermax and applied post on 1-leaf cotton. However Dual II Magnum, Outlook and Prowl did increase control over Roundup Weathermax alone, when applied at 4 leaf cotton. The results of this study indicate that these residual herbicides can be applied post emergence with minimal injury to cotton. Prowl H_20 provided equivalent control with less cotton injury than Prowl 3.3EC, when applied PRE at equivalent rates. Post emergence applications of these residual herbicides could have a fit in a Roundup Ready system during wet years, or a system that lacks in grass control such as BXN or Liberty Link cotton varieties. Further research is needed, however, to fully assess crop tolerance.

EARLY SEASON WEED COMPETITION IN ROUNDUP FLEX™ COTTON. B.R. Walden, W.K. Vencill, A.S. Culpepper, Crop and Soil Science Department, University of Georgia, Athens, GA 30602, and W.M. Braxton, Monsanto, Marianna, FL 32446.

ABSTRACT

Field studies were conducted to examine the impact of weed competition on cotton from delaying the first glyphosate application in Roundup Ready Flex® cotton. Studies were established at the Attapulgus Research Farm near Attapulgus, GA and the Plant Sciences Farm near Athens, GA in 2003. Cotton was exposed to 2, 3, 4, 5, and 6 weeks of weed competition after emergence with and without pendimethalin applied preemergence. At the Athens location, cotton mapping and yield data indicated no impact of weed competition. This is possibly due to lower than anticipated weed populations at this site. At the Attapulgus location, first and second position boll counts declined from 25 to 5 at nodes 11-15 in cotton exposed to 3 to 5 weeks of weed competition. Third position boll numbers declined at nodes 5-10, 11-15, and at all nodes >15. Seed cotton data were regressed against weeks of competition with associated weeds. When pendimethalin was applied PRE at 0.84 kg ai/ha, 80 kg seed cotton yield were lost for each week cotton was exposed to weed competition beyond three weeks after emergence. When pendimethalin was not applied, 107 kg seed cotton yield was lost for each week cotton was exposed to competition. These data indicate the need for growers to control weeds during early season cotton growth.

WEED CONTROL SYSTEMS FOR CUTLEAF EVENINGPRIMROSE IN REDUCED TILLAGE COTTON. D.G. Wilson Jr., and A.C. York, Department of Crop Science, North Carolina State University, Raleigh, NC 27695; A.S. Culpepper, Department of Crop and Soil Sciences, University of Georgia, Tifton, GA 31793.

ABSTRACT

Conservation tillage is becoming increasingly more common in cotton production. As a result, effective control of weeds before planting is necessary to optimize cotton stand establishment and to reduce early season weed interference. Cutleaf eveningprimrose can be one of the most troublesome weeds to control in burndown situations. Two studies were conducted to determine the most effective herbicidal treatment to maximize cutleaf eveningprimrose control and to investigate other possible options that could be applied close to planting.

The first study was conducted at Rocky Mount, NC and Tifton, GA in 2003 to evaluate cutleaf eveningprimrose response to various burndown combinations applied in mid-March and mid-April. Treatments were arranged in a randomized complete block design and replicated four times. Mid-March applications included the following: Gramoxone Max at 2 pt/A applied alone and mixed with Caparol at 2 pt/A, Direx at 2 pt/A, or Caparol at 2 pt/A plus 2,4-D amine at 4 fl oz/A; Roundup WeatherMax at 16 fl oz/A applied alone and mixed with 2,4-D at 4 or 8 fl oz/A, Valor at 1.0 oz/A plus 0.25% (v/v) nonionic surfactant (NIS), or Valor at 1.0 oz/A plus 2,4-D at 4 fl oz/A plus NIS; 2,4-D alone at 4, 8, 12, and 16 fl oz/A; and Liberty alone at 32 and 40 fl oz/A. Mid-April applications included the following: Gramoxone Max at 2 pt/A applied alone and mixed with Caparol at 2 pt/A or Direx at 2 pt/A; and Liberty applied alone at 40 fl oz/A. At 7 weeks after mid-March application, 2,4-D at 4 fl oz/A or more applied alone or mixed with Gramoxone Max or Roundup WeatherMax controlled cutleaf eveningprimrose at least 98%. Gramoxone Max plus Direx controlled cutleaf eveningprimrose 91%. This later treatment could be an option for producers not wishing to apply 2,4-D. At 4 weeks after mid-April application, Gramoxone Max plus either Caparol or Direx, and Liberty applied alone controlled cutleaf eveningprimrose at least 97%. These treatments could be options for producers who, for various reasons, need to treat closer to planting than is allowed with 2,4-D.

The second study was conducted in 2002 near Kenansville, NC. Treatments were applied in mid-April and were arranged in a randomized complete block design. Treatments included Roundup UltraMax at 1.6 pt/A applied alone and mixed with the following: 2,4-D amine at 8 fl oz/A; Valor at 1.0 oz/A; Valor at 1.0 oz/A plus COC at 1.0% (v/v); Valor at 2.0 oz/A plus COC; or Aim EC at 0.8, 1.2, or 1.6 fl oz/A plus COC at 1.0%. At 4 WAT, Roundup UltraMax alone and mixed with 2,4-D controlled cutleaf eveningprimrsoe 73 and 99%, respectively. Valor at 1.0 oz/A mixed with Roundup UltraMax controlled cutleaf eveningprimrose 76 and 93% when applied without and with COC, respectively. Aim mixed with Roundup did not improve control.

WEED CONTROL AND HELIOTHINE MANAGEMENT IN TRANSGENIC COTTON.

O.C. Sparks, J.L. Barrentine, N.R. Burgos, and M.R. McClelland. Department of Crop, Soil, and Environmental Sciences. University of Arkansas, Fayetteville, 72704.

ABSTRACT

The pending release of glyphosate-resistant cotton with longer window of glyphosate applications could bring unique opportunities for both weed control and insect management in a single application. Studies were conducted to evaluate the effects of glyphosate plus insecticide mixtures on survival and growth of cotton bollworm, *Helicoverpa zea* (Lepidoptera:Noctuidae) and glyphosate activity on selected weed species. A completely random design was used with 20 larvae per treatment for *H. zea* survival studies. Six weed species, replicated four times, were used for herbicide efficacy studies. Studies were conducted twice. Treatments used to evaluate *H. zea* survival consisted of reduced (0.5x) rates of spinosad, 0.038; cyhalothrin, 0.014; methoxyfenozide, 0.17; indoxacarb, 0.062; cyfluthrin, 0.014; emamectin, 0.0057; and cypermethrin, 0.013 kg ai/ha applied alone or in combination with a full rate of glyphosate, 0.84 kg ae/ha. Treatments to evaluate weed control consisted of a reduced rate (0.5x) of glyphosate, 0.42 kg ae/ha, applied alone and in combination with full rates of spinosad, 0.075; cyhalothrin, 0.028; methoxyfenozide, 0.34; indoxacarb, 0.1232; cyfluthrin, 0.028; emamectin, 0.0112; cypermethrin, 0.0253; imidacloprid, 0.047; acephate, 0.2; carbaryl, 2.4; and a pre-mixture of imidacloprid/cyfluthrin, 0.079 kg ai/ha. Pesticides were applied at 187 L/ha spray volume with water as carrier. Pesticide applications to *H. zea* and diet were made when larvae were 20 mm in length and head capsules were 2 mm. Pesticides were applied to hemp sesbania, pitted morningglory, and sicklepod at the two-leaf stage and applications to prickly sida, velvetleaf, and barnyardgrass were made at the three-leaf stage. *H. zea* survival was visually assessed at 24 and 48 hours after treatment (HAT) with a rating of 1 as alive and actively feeding, 0.5 as alive no feeding, and 0 as dead. The average weight of 10 larvae were recorded 96 HAT. Visual ratings of weed control were taken 1, 3, 7, and 14 days after treatment (DAT) on a scale of 0 to 100. Plant height and dry weight reductions were recorded 14 DAT. Data presented are *H. zea* survival 24 and 48 HAT, *H. zea* larvae weights 96 HAT, and weed control 14 DAT. All data were subjected to analysis of variance. Mean survival and larvae weights of *H. zea* were separated using Fisher's protected LSD at the 0.05 level of significance. Weed control means were compared using Dunnett's multiple range test with glyphosate applied alone serving as the control. Survival of *H. zea* 24 HAT was less when spinosad was mixed with glyphosate compared to spinosad applied alone. There was greater survival of *H. zea* on artificial diet when the full rate of glyphosate was applied with reduced rates of cyhalothrin or methoxyfenozide as compared to reduced rates of cyhalothrin or methoxyfenozide applied alone. Although there was greater larvae survival when the full rate of glyphosate was applied in combination with reduced rates of methoxyfenozide, the survivors were smaller than those treated with reduced rates of methoxyfenozide alone. *H. zea* survival at 48 HAT and larvae weights 96 HAT were lower with glyphosate applied alone as compared to untreated larvae. Combinations of glyphosate plus emamectin increased control of hemp sesbania as compared to glyphosate alone. Combinations of glyphosate plus indoxacarb, emamectin, or cypermethrin resulted in greater height reductions of velvetleaf as compared to the reduced rate of glyphosate alone. Applications of the reduced rate of glyphosate in combination with the full rate of carbaryl resulted in decreased control of hemp sesbania, pitted morningglory, prickly sida, sicklepod, and barnyardgrass as compared to the reduced rate of glyphosate applied alone. Mixing glyphosate with insecticides illustrates the potential for decreased/increased control of *H. zea* and reduced/increased glyphosate efficacy on certain weed species. Caution should be taken in using reduced rates of glyphosate combined with insecticide applications. The labeled rate of glyphosate applied in combination with labeled rates of insecticides may overcome reductions in pesticide efficacy on *H. zea* and weeds. Additional laboratory and field studies are needed to validate these findings.

CONTROLLING RUSSIAN THISTLE IN A ROUNDUP READY® COTTON SYSTEM. S.W. Murdock, Monsanto Company, Lubbock TX.

ABSTRACT

Russian thistle (*Salsola iberica*) is a common weed in the Texas Southern High Plains. Russian thistle has the ability to germinate and emerge all season-long, it is extremely drought tolerant, it is competitive to cotton for water, it produces large numbers of seeds, and has little leaf surface area. These characteristics can lead to high populations and may cause difficulty in controlling this weed in West Texas Roundup Ready cotton systems. The objectives of these trials were: 1) to determine the effectiveness of glyphosate in a burn-down situation; 2) to evaluate the control of glyphosate when Russian thistle is drought stressed; and 3) to evaluate how different spray nozzles (coverage) effect control of Russian thistle with glyphosate.

Excellent Russian thistle control (>99%) was achieved with 0.75 lbs a.e./A in the three burn-down trials. The weeds were 4-8 inches tall and actively growing at the time of application. Two trials were established with large (16 inches tall), drought stressed (no rain in 31 days) Russian thistle. This resulted in 9, 42, 58, 76, 93, and 98% control with glyphosate rates of 0.25, 0.5, 0.75, 1.0, 1.25, and 1.5 lbs a.e./A, respectively. Two trials were conducted to determine the effect of nozzles (spray coverage) on Russian thistle control with glyphosate at 0.56 lbs a.e./A. The nozzles TeeJet® Extended Range Flat Fan, Turbo TeeJet, and TeeJet Air Inducted, resulted in 80, 71, and 64% control, respectively.

To achieve effective Russian thistle control with Roundup WeatherMAX, the weed should be sprayed when it is small and actively growing. Drought stressed and larger Russian thistle are more tolerant and may require higher rates of glyphosate to achieve optimal control. Nozzle type did affect Russian thistle control; the nozzles that produce better spray coverage did increase Russian thistle control.

GLYPHOSATE DRIFT ON IRRIGATED AND DRYLAND COTTON. L.L. Lyon, J.W. Keeling, J.D. Everitt, and P.A. Dotray, Texas Agricultural Experiment Station, Lubbock, TX.

ABSTRACT

On the Texas Southern High Plains, 50 to 60% of the cotton planted in 2002 and 2003 was glyphosate-tolerant. Drift or misapplication is a potential when non glyphosate-tolerant varieties are planted in the vicinity of glyphosate-tolerant varieties. Growing conditions in the area usually require the addition of in-season irrigation, which is not always available, and dryland cotton production averages 47% of the total acreage planted. The objective of this study was to determine the effects of glyphosate drift on irrigated and dryland cotton. Experiments were conducted at the Texas Agricultural Experiment Station near Lubbock in 2002 and 2003. Glyphosate was applied at 0.75, 0.38, 0.19, 0.09, 0.05, and 0.02 lb ae/A postemergence-topical (POST) to cotton at the cotyledon to 2-leaf (COT-2 lf), 4- to 5-leaf (4-5 lf), pinhead square (PHSQ), and first bloom (FBLM) growth stages. Paymaster HS26 was planted in irrigated and dryland trials in both years. Visual injury was recorded at 14, 21, and 28 days after treatment (DAT), and at the end of the season. Plants were mapped at harvest and lint yields and quality were determined.

In the 2002 irrigated trial, glyphosate at 0.05 lb ae/A and greater applied at COT-2 lf, 4-5 lf, and PHSQ injured cotton 8 to 95% at 14 DAT. Only applications made at 0.09 lb ae/A and greater at FBLM injured cotton (60 to 95%). At the end of the season, injury was observed from glyphosate rates of 0.19 lb ae/A and greater applied at all growth stages, but when applied at PHSQ or FBLM, these rates caused ≥70% cotton injury. Injury was also noted from applications of 0.05 and 0.09 lb ae/A applied at FBLM (20 and 48%, respectively). Cotton lint yields were reduced nearly 50% from glyphosate applications of 0.19 lb ae/A and greater when applied at all growth stages. Additional yield reductions were observed from 0.05 and 0.09 lb ae/A applied at the 4-5 lf and FBLM growth stages. All glyphosate rates applied at PHSQ, including the 0.02 lb ae/A rate, reduced cotton lint yields in 2002.

In the 2003 irrigated trial, cotton injury was observed from glyphosate at 0.09 lb ae/A and greater applied at all growth stages (25 to 92%). The 0.05 lb ae/A rate applied at the 4-5 lf and PHSQ growth stages also injured cotton. Injury observed from FBLM applications was less in 2003 compared to 2002. However by the end of the season, all injury observed was similar to what was observed in 2002. Glyphosate applied at COT-2 lf and PHSQ growth stages at 0.19 lb ae/A and greater showed end of season injury >45%. Only the 0.38 and 0.75 lb ae/A rates caused late-season injury when applied at the 4-5 lf stage, and rates ≥0.05 lb ae/A applied at FBLM injured cotton 25 to 95%. Lint yields were decreased 20 to 83% following glyphosate applications at 0.19 lb ae/A and greater applied over all growth stages. Glyphosate at 0.09 lb ae/A applied at FBLM reduced cotton lint yields 50%.

In the 2002 dryland trial, injury was observed from glyphosate applications at 0.19 lb ae/A and greater applied over all stages (50 to 85%) at 14 DAT. Glyphosate at 0.05 lb ae/A applied at the COT-2 lf stage injured cotton 10%, and injury was observed following glyphosate at 0.09 lb ae/A when applied at the 4-5 lf and FBLM stages (45 and 16%, respectively). By the end of the season, any injury observed from rates less than 0.19 lb ae/A was no longer apparent. Injury was observed from 0.38 and 0.75 lb ae/A applied at all stages (>70%), and the 0.19 lb ae/A rate applied at the COT-2 lf, 4-5 lf, and PHSQ stages also caused injury. The 2002 growing season was not favorable for dryland cotton. The untreated in this trial yielded 140 lb lint/A; however, glyphosate applications of 0.09 lb ae/A and greater applied at all growth stages reduced yields 25 to 100%.

In the 2003 dryland trial, applications of glyphosate at 0.19 lb ae/A and greater injured cotton 45 to 90% at all growth stages, which was similar to the injury observed in 2002. Injury was also observed from glyphosate at 0.09 lb ae/A applied at COT-2 lf and 4-5 lf cotton. Injury at the end of the season was different than the injury observed in 2002, probably due to the different growing conditions. Early applications of glyphosate (COT-2 lf, 4-5 lf) at 0.19 lb ae/A and greater injured cotton 100%, while the 0.05 lb ae/A rate applied at the 4-5 lf stage injured cotton 90%. Later

applications (PHSQ, FBLM) caused 30 to 100% injury following glyphosate at 0.19 lb ae/A and greater. Growing conditions in 2003 favored later planted cotton and the untreated in this trial yielded 320 lb lint/A. Yields were reduced from all glyphosate rates applied at all growth stages, except following the 0.02 and 0.05 lb ae/A rates applied at the COT-2 lf stage and the 0.02 lb ae/A rate applied at FBLM. Yield reductions of 30% (0.02 lb ae/A at 4-5 lf and PHSQ) to 100% (0.75 lb ae/A at all growth stages) were observed.

In both years, cotton injury was affected by application timing and glyphosate rate; however, crop conditions at the time of application influenced the level of injury and yield reduction. In the irrigated trial, glyphosate at 0.19 lb ae/A and greater decreased yields while the 0.09 lb ae/A and greater rates decreased yields in the dryland study, regardless of growth stage or year. Injury tended to overestimate yield loss, especially from early season application, and initial visual injury did not always result in a yield reduction. Later applications (PHSQ and FBLM) reduced yield more than earlier applications in irrigated cotton and glyphosate injury was difficult to quantify in dryland cotton.

EARLY AND LATE-SEASON SUPPRESSION AND CONTROL OF TEXAS SMELLMELON IN COTTON. S.D. Livingston, J.D. Janak and A.Z. Matthies Jr., Texas Cooperative Extension, Texas A&M Research and Extension Center, Corpus Christi, TX 78406.

ABSTRACT

In Victoria County, Texas, 2003, six OT and 3 early PE chemical treatments were evaluated to control seedlings of Texas Smellmelon (*Cucumis melo dudaim*) in RR cotton. OT treatments included 22 oz/A Roundup Ultramax, 1.2 oz/A Staple, 4 pt/A Cotoran, 0.1 oz/A and 0.15 oz/A Envoke. Early PE hooded applications included 1 qt/A Direx, 1 pt/A Caparal and 1.2 lb/A Suprend. Five Direx and Linex combinations were evaluated with COC as mid-season treatments at the same location. At a second location in Calhoun County, seven PE treatments were made to smellmelon vines as they were growing into the cotton canopy. Applications of 1 qt/A Direx, 1.5 pt/A Linex, 1 qt/A Direx + 1.5 pt Linex, 1 qt/A Roundup Ultra, 1 pt/A Goal, 1 pt/A Gramoxone and 1 qt/A Liberty were applied with Redball layby hoods using COC and/or with AMS. Plots were four rows by 40 ft with four replications. All OT and late season applications were made with a Lee Spider Sprayer. Early PE hooded treatments were made with Pachen Weedseeker units covering 30 inches of the 38-inch row planting system. Control and suppression was rated at 7-day intervals for 4 weeks following treatment.

Of the smellmelon seedlings sprayed OT and with early PE treatments, 97-99% control was observed at 28 days, but new seedlings were emerging weekly from and below treated zones.

Roundup UltraMax was the most economical treatment ($8.08/A per treatment), of the OT treatments, proving excellent weed control but providing no residual. Envoke and Staple were effective only on seedlings receiving spray or which grew from treated zones. Escapes emerged from under clods in the treated zone, and several new seedlings emerged after treatment.

The early season PE treatments provided 99+% control of emerged smellmelon seedlings, but only the Suprend and Caparal provided residual control. New smellmelon seedling emerged from under sprayed smellmelon clusters.

Mid-season smellmelon control at Victoria varied from $6.22 (1 qt/A Direx) to $11.88 (1.5 pt/A Linex 4L + 1 oz/A Aim EC), including COC. The ½ -rate of Direx + Linex (68% control) and the 1 qt/A Roundup UltraMax (30% control) rates provided unsatisfactory results, while all other treatments were significantly better with 90-99% mid-season control.

Late-season PE control with hoods ranged from $6.22 (1 qt/A Direx) to $15.03 (1 qt/A Liberty). Only the RU UltraMax treatment provided unsatisfactory control (38.8%). Liberty, Direx/Linex and Goal provided significantly better results (82.3-96.9% control) than Direx, Linex or Gramoxone with COC (88.0-88.4%).

Texas smellmelon presents season-long problems in producing vines which interfere with harvest and melons which provide new seed and contamination of other fields. The use of base herbicides is recommended to reduce smellmelon seedling numbers during the first 6 weeks of cotton growth. Two or more subsequent PE treatments may be required to keep vines from growing into the canopy and interfering with spindle picking of cotton.

WEED MANAGEMENT IN LIBERTY-LINK COTTON. W.K. Vencill, Department of Crop and Soil Sciences, University of Georgia, Athens, GA 30602-7272.

ABSTRACT

Field studies were conducted at the Southwest Georgia Branch Experiment Station near Plains, GA and at the Plant Sciences Farm near Athens, GA to examine weed management systems with glufosinate-resistant (Liberty-Link®) cotton. Cotton injury (20-30%) was observed when glufosinate was applied with either pyrithiobac or trifloxysulfuron at 4-leaf stage. This injury dissipated by 14 days after treatment (DAT) and no yield effects were observed at either location. When pyrithiobac or trifloxysulfuron were applied two weeks after glufosinate application, no injury was observed. Cotton injury was not observed with any other glufosinate combination. Split applications of glufosinate and glufosinate tank mixes provided better wild poinsettia, Palmer amaranth, sicklepod, and tall morningglory control than a single early application of glufosinate. Glufosinate provide ~50% yellow nutsedge control. Tank-mixes of glufosinate with flumioxazin, carfentrazone, diuron, or trifloxysulfuron plus prometryn provided >97% control of all weeds 30 DAT at both locations. Seed cotton yields were reflective of weed control differences.

COTTON WEED MANAGEMENT SYSTEMS WITH IGNITE. P.A. Dotray, T.A. Baughman, K.M. McCormick, and J.W. Keeling. Texas Tech University, Lubbock; Texas Agricultural Experiment Station, Lubbock; and Texas Cooperative Extension, Vernon, TX.

ABSTRACT

The use of Ignite (glufosinate ammonium) herbicide in LibertyLink cotton will be an option for growers in 2004. Ignite is a postemergence herbicide that has broad-spectrum activity on a variety of annual and perennial grass and broadleaf weeds. Ignite is a fast-acting herbicide that has limited systemic movement in plants. Previous studies have shown that cotton tolerance to Ignite is excellent. Research in LibertyLink cotton is underway to examine weed management systems and economic returns using Ignite in LibertyLink cotton compared to other transgenic and non-transgenic cotton systems. Research was conducted in the Texas High Plains in 2003 to investigate the residual benefits of Staple (pyrithiobac) or Caparol (prometryn) in LibertyLink cotton. Additional studies in the High and Rolling Plains examined Ignite efficacy at different rates (0.42 and 0.52 lb ai/A or 32 and 40 ounces) applied to weeds at 2-, 4-, 6-, 8-, 10-, and 12-inches and examined Ignite efficacy using the following adjuvants: non-ionic surfactant, crop oil concentrate, methylated seed oil, organosilicone surfactant, ammonium sulfate, water conditioning agent, and a drift control agent. Traditional small plot techniques were used at all locations.

Near Lamesa, ivyleaf morningglory (*Ipomoea hederaceae*) was controlled 92% by Staple PRE at 0.0312 lb ai/A (0.6 oz) followed by (fb) Staple (0.6 oz) + Ignite at 0.42 lb ai/A (32 oz) applied postemergence (POST) at 4-leaf cotton. Similar control was observed following Staple (0.4 oz) + Ignite (32 oz) applied POST at cotyledon cotton fb Staple + Ignite POST to 4-leaf cotton. Lint yield from FiberMax 958 LibertyLink ranged from 1348 to 1463 pounds per acre in plots that received these PRE fb POST or POST fb POST combinations. Plots that received one Staple + Ignite POST application (0.6 + 32 oz or 0.9 + 40 oz) or the weedy check produced 1059 to 1250 or 354 pounds of lint per acre, respectively. Near New Deal, common cocklebur (*Xanthium strumarium*) was controlled at least 88% following the PRE fb POST or POST fb POST Staple/Ignite combinations in the LibertyLink cotton system. At several other locations, Caparol PRE at 1.2 lb ai/A (1.2 qt) fb Ignite (32 oz) or Ignite fb Ignite + Staple controlled lanceleaf sage (*Salvia reflexa*), ivyleaf morningglory, and Palmer amaranth (*Amaranthus palmeri*) at least 80% and devil's-claw (*Proboscidea louisianica*) nearly 70%.

Palmer amaranth was controlled at least 90% 1-week after treatment (WAT) when Ignite was applied to 2-inch weeds. Ignite applications to larger plants controlled Palmer amaranth less than 90%. Increasing the rate of Ignite from 32 to 40 ounces did not increase activity. At 1 WAT, devil's-claw was controlled at least 90% following Ignite at 32 ounces applied to 2- or 4-inch weeds and following Ignite at 40 ounces applied to 2- to 6-inch weeds. By 2 WAT, Ignite at either rate applied to 2-inch weeds and Ignite at 40 ounces applied to 4-inch weeds controlled devil's-claw at least 90%. Ivyleaf morningglory was controlled at least 90% regardless of Ignite rate or plant size at 1 WAT. By 2 WAT, ivyleaf morningglory was controlled at least 90% following Ignite at 40 ounces regardless of weed size and following Ignite at 32 ounces when applied to 2 to 8-inch weeds. Common cocklebur plants up to 6 inches in size were controlled at least 90% at both 1 and 2 WAT regardless of Ignite rate. Ignite at 40 ounces controlled 12-inch common cocklebur at least 90% 2 WAT. Initial burndown of lanceleaf sage was 90% when Ignite was applied at the 2-inch growth stage; however, control decreased to less than 70% following Ignite applications regardless of weed size 2 WAT.

Ignite efficacy was not affected by spray additives when applied to Palmer amaranth or carpetweed (*Mollugo verticillata*) 4-inches or less or to larger Palmer amaranth and stinkgrass (*Eragrostis cilianensis*). In another study in the Texas Rolling Plains, the addition of any additive except the drift control agent and ammonium sulfate increased Palmer amaranth control when compared to Ignite applied alone. In another study in the Texas High Plains, a sequential application of Ignite plus ammonium sulfate controlled Palmer amaranth more effectively than a sequential application of Ignite alone.

This research suggests that Ignite in LibertyLink cotton weed management systems that include Staple or Caparol can effectively control ivyleaf morningglory and other difficult to control annual broadleaf weeds. Ignite is most effective when applied to small weeds and coverage at the time of application appears to be very important. The addition of various spray additives had little or no effect on Ignite performance.

WEED CONTROL AND YIELD WITH VARIOUS LIBERTY-LINK COTTON WEED MANAGEMENT SYSTEMS. W.J. Everman, I.C. Burke, J.W. Wilcut[1], and J. Collins[2]. [1]North Carolina State University, Raleigh, NC; [2]Bayer CropScience, RTP, NC.

ABSTRACT

Recently Ignite has been registered for postemergence (POST) use in Liberty-Link cotton. The introduction of Liberty-Link cotton gives growers another tool in their arsenal for POST weed management. Trials were conducted at Kinston, NC and Goldsboro, NC in 2003 to investigate how Ignite application timing affects weed control and to evaluate potential tank-mix partners for use with Ignite. Treatments were arranged in a randomized complete block design with 48 treatments arranged in a factorial with one additional treatment added as a standard comparison plus a weed-free check. Treatment options were EPOST, POST, and LAYBY. EPOST options were 1) no EPOST, 2) Ignite at 2 pt/A, or 3) Ignite at 2 pt/A + Dual II Magnum at 1 pt/A. POST options were 1) no POST, 2) Ignite at 2 pt/A, 3) Ignite at 2 pt/A + Envoke at .05 oz/A, or 4) Ignite at 2 pt/A + Staple at .6 oz/A. LAYBY options included 1) no LAYBY, 2) Caparol at 2 pt/A + MSMA at 2.67 pt/A, 3) Ignite at 2 pt/A + Caparol at 2 pt/A, or 4) Ignite at 2 pt/A + MSMA at 2.67 pt/A. Visual ratings were taken to determine crop injury due to stand reduction, stunting, and discoloration. Visual weed control ratings were taken approximately 7 days after EPOST and POST applications and 2 to 3 weeks after LAYBY application. Cotton was harvested to determine yield. Data were analyzed to reflect the factorial arrangement and means were separated using Fisher's Protected LSD. No injury was seen with Ignite at any application stage. Envoke injured cotton 23 to 31% mid-season with injury not apparent 3 to 4 weeks later.

Ignite EPOST controlled Palmer amaranth, sicklepod, and pitted and ivyleaf morningglory $\geq$80% at mid-season. Mid-season grass control was 61 to 70% when Ignite was applied alone EPOST. The addition of Dual II Magnum to Ignite EPOST improved control to 77 and 85% for large crabgrass and goosegrass, respectively. Ignite applied sequentially EPOST and POST controlled large crabgrass, goosegrass, Palmer amaranth, sicklepod, and morningglory species at least 98% when evaluated mid-season. The addition of Envoke or Staple to Staple was of no benefit in 2003. Ignite + Caparol LAYBY treatments were comparable to Caparol + MSMA LAYBY treatments for weed control. Ignite plus MSMA LAYBY was less effective than Ignite plus Caparol for control of Palmer amaranth, large crabgrass, and goosegrass. Separate efficacy trials (no crop) found that MSMA antagonized Ignite control of goosegrass, large crabgrass, broadleaf signalgrass, slender amaranth, and Palmer amaranth. Cotton yields were similar for all systems containing both an EPOST and LAYBY treatment.

EFFICACY AND ECONOMICS OF GLUFOSINATE-TOLERANT COTTON. K.M. McCormick, P.A. Dotray, J.W. Keeling, E. Segarra, T.A. Baughman, and W.R. Perkins. Texas Tech University, Lubbock, TX; Texas Agricultural Experiment Station, Lubbock, TX; Texas Cooperative Extension, Vernon, TX; and Bayer CropScience, Idalou, TX.

ABSTRACT

Neither visible injury nor reductions in yield were observed in studies conducted since 1995 when glufosinate was sprayed over the top of glufosinate-tolerant cotton. Glufosinate provides broad-spectrum control of various weeds, is fast acting, but has limited translocation. The objectives of this research were to compare the efficacy and costs of weed control systems in glufosinate-tolerant, glyphosate-tolerant, and conventional cotton. A randomized block design with split-plot arrangement and four replications was used in studies conducted in 2003 at the Texas Agricultural Experiment Station near Lubbock, TX. The variety of cotton was the main plot factor, which included FM 989, FM 989 RR, and FM 981 LL. The treatment within a variety was the subplot factor, which included weed control system, weed-free, and weedy check. Applications for each weed control system within a variety were applied as needed according to labeled recommendations; therefore, applications were made independent of the other varieties. Weed-free plots were maintained by hand-hoeing, plus minimal cultivation. Trifluralin was applied preplant incorporate to the entire trial area. Control of devil's-claw (*Proboscidea louisianica*), Palmer amaranth (*Amaranthus palmeri*), and silverleaf nightshade (*Solanum elaeagnifolium*) was recorded, and net returns above weed control costs was calculated based on lint yields and weed control costs.

The treatments for the conventional weed control system included trifluralin preplant incorporated (PPI) at 0.75 lb ai/A followed by (fb) pyrithiobac at 0.06 lb ai/A + MSMA at 0.75 lb ai/A postemergence-topical (POST) fb cultivation fb cultivation fb hand hoeing. The glufosinate-tolerant weed control system included trifluralin PPI at 0.75 lb ai/A fb glufosinate POST at 0.42 lb ai/A fb glufosinate POST at 0.42 lb ai/A fb cultivation fb hand hoeing, while the glyphosate-tolerant weed control system included trifluralin PPI at 0.75 lb ai/A fb glyphosate POST at 0.75 lb ae/A fb glyphosate postemergence-directed (PDIR) at 0.75 lb ae/A. The glyphosate-tolerant weed control system attained the highest control of silverleaf nightshade (90%), followed by the glufosinate-tolerant (49%) and conventional (3%) systems. Devil's-claw and Palmer amaranth were controlled at least 95% by all systems. Lint yields from the glyphosate-tolerant system, glufosinate-tolerant system, and conventional system were 1050 lbs/A, 821 lbs/A, and 736 lbs/A, respectively. Seed costs plus technology fees, herbicide and application costs, and mechanical inputs were used to calculate overall weed control system costs. The system costs for glyphosate-tolerant, glufosinate-tolerant, and conventional cotton were $69/A, $88/A, and $99/A, respectively. The glyphosate-tolerant system had the highest net returns above weed control costs ($522/A), followed by conventional ($374/A) and glufosinate-tolerant ($291/A) systems. The glyphosate-tolerant system needed the least number of inputs and had the highest lint yields and net returns above weed control cost when compared to glufosinate-tolerant or conventional systems. However, additional studies over years are needed to determine the consistency of these findings.

COMPARISON OF ROUNDUP READY, LIBERTY LINK, AND NONTRANSGENIC COTTON WEED MANAGEMENT SYSTEMS. W.E. Thomas, W.J. Everman, J.W. Wilcut, Department of Crop Science, North Carolina State University, Raleigh, NC; and J. Collins, Bayer CropScience, Research Triangle Park, NC.

ABSTRACT

Studies were conducted at the Upper Coastal Plain Research Station near Rocky Mount and the Cherry Research Station near Goldsboro, NC to evaluate weed management systems in Rounup Ready, Liberty Link, and nontransgenic cotton. Cotton varieties included Fibermax 989, Fibermax, 989RR, and Fibermax 958LL. Preemergence (PRE) options for all systems included no herbicide or Prowl at 0.84 kg ai/ha. For Liberty Link systems, early postemergence (EPOST) options included no herbicide, Ignite at 0.47 kg ai/ha or Ignite at 0.47 kg/ha plus Dual Magnum at 1.12 kg ai/ha. Similarly, Roundup Ready EPOST options included no herbicide, Roundup WeatherMax at 0.84 kg ae/ha, or Roundup WeatherMax at 0.84 kg/ha plus Dual Magnum at 1.12 kg/ha. For nontransgenic systems, EPOST options included no herbicide, Envoke at 5.4 g ai/ha, Staple at 72 g ai/ha, or Envoke at 2.7 g/ha plus Staple at 36 g/ha. A non ionic surfactant (NIS) (Induce) at 0.25% v/v was included in all treatments containing Envoke or Staple. LAYBY options for all systems were no herbicide or Caparol at 1.12 kg ai/ha plus MSMA at 2.24 kg ai/ha plus NIS at 0.25% v/v. A mid-POST application of Select at 0.28 kg ai/ha plus crop oil concentrate (Agridex) at 1.0% v/v was applied to nontransgenic systems for annual grass control. Systems were evaluated for early, mid, and late season cotton injury, weed control, yield, and fiber quality parameters. Weeds present included purple nutsedge (*Cyperus rotundus*), common ragweed (*Ambrosia artemisiifolia*), sicklepod (*Senna obtusifolia*), Palmer amaranth (*Amaranthus palmeri*); entireleaf (*Ipomoea hederacea* var. *integruiscula*), pitted (*Ipomoea lacunosa*), and tall morningglories (*Ipomoea purpurea);* large crabgrass (*Digitaria sanguinalis*), and goosegrass (*Eleusine indica*).

Early season injury for Liberty Link and Roundup Ready systems was less than 5% for all treatments and injury was only seen in Dual Magnum containing systems. Injury was a surfactant-type cosmetic speckling that was transitory. For conventional systems, Envoke at 5.4 g/ha and Envoke at 2.7 g/ha plus Staple at 36 g/ha caused 35 and 21% early season cotton injury, respectively. Staple alone at 72 g/ha caused less than 6% early season cotton injury. Early-season injury was transitory and not evident 3 to 4 weeks after treatment. Ignite or Roundup WeatherMax alone provided at least 93% early-season control of common ragweed, large crabgrass, entireleaf morningglory, tall morningglory, and sicklepod. Early-season control with Ignite or Roundup WeatherMax alone provided 89 and 92% control of Palmer amaranth, respectively. Ignite alone (96%) provided greater control of pitted morningglory than Roundup WeatherMax alone (84%). Conversely, Roundup WeatherMax alone (92%) provided greater control of goosegrass than Ignite alone (84%). The addition of Dual Magnum to either Ignite or Roundup WeatherMax EPOST only systems increased late-season control of Palmer amaranth, common ragweed, sicklepod, entireleaf morningglory, pitted morningglory, tall morningglory, purple nutsedge, goosegrass, and large crabgrass by 38, 9, 5, 4, 8, 8, 11, 41, and 33 percentage points, respectively. Ignite or Roundup WeatherMax (with or without Dual Magnum) followed by a LAYBY treatment controlled all weeds at least 95%. For late-season weed control in nontransgenic systems, Envoke alone controlled common ragweed, purple nutsedge, sicklepod, entireleaf morningglory, pitted morningglory, and tall morningglory 67, 79, 52, 76, 51, and 80%, respectively. Staple alone provide 62% control of Palmer amaranth. The addition of a LAYBY treatment to any conventional EPOST system increased control $\geq$ 95% for sicklepod and all morningglory species. In nontransgenic systems, adequate control (> 95%) of common ragweed and purple nutsedge required an Envoke containing treatment plus a LAYBY treatment. Conversely, a Staple containing treatment plus a LAYBY treatment was required for excellent (> 96%) control of Palmer amaranth. Liberty Link and Roundup Ready systems yielded similarly with systems with the equivalent input of herbicides. For example, Prowl PRE fb Ignite EPOST fb LAYBY and Prowl PRE fb Roundup WeatherMax EPOST fb LAYBY yielded 1,077 and 1,130 kg/ha at Rocky Mount and 643 and 629 kg/ha at Goldsboro, respectively. Conventional systems yielded less which was attributed to early season grass

interference. Cotton fiber quality characteristics were similar among the Fibermax varieties at Rocky Mount. Fiber quality data has not been generated for the Goldsboro location.

THE POTENTIAL ROLE OF CGA-362622 IN GLYPHOSATE-TOLERANT AND BROMOXYNIL-RESISTANT COTTON WEED CONTROL SYSTEMS. J.W. Branson, K.L. Smith, and J.L. Barrentine. University of Arkansas, Rice Research and Extension Center, Stuttgart, AR, Southeast Research and Extension Center, Monticello, AR, Department of Crop, Soil and Environmental Science, University of Arkansas, Fayetteville, AR.

ABSTRACT

Experiments were conducted at the University of Arkansas Southeast Branch Research Station at Rohwer, AR, on a Hebert silt loam, (fine-silty, mixed, thermic Aeric Ochraqualfs) with 1% organic matter with a soil pH of 6.4. Experiments were conducted under conventional-tillage practices normal for the region and sprinkler irrigated when a soil moisture deficit of 3.8 cm was obtained. Glyphosate-tolerant cotton 'DP 451 B/RR' and bromoxynil-resistant cotton 'BXN 47' were planted 3 cm deep with a vacuum planter on May 1, 2000, and June 4, 2001, at a seeding rate of 14 kg/ha. The experimental design was a randomized complete block with four replications. Plots were four 96-cm rows 6.1 m in length. Sethoxydim at 420 g/ha was applied as needed to all studies for control of annual grass weeds. Postemergence applications were applied over-the-top at the two- to three-leaf (EP) and three-to four-leaf (MP) cotton growth stages. CGA-362622 at 2.7 and 5.3 g ai/ha and pyrithiobac at 70 g ai/ha were applied at EP and MP timings. A non-ionic surfactant was added at 0.25% v/v with postemergence treatments.

Glyphosate at 560 g ae/ha was applied alone and in combination with CGA-362622 at 2.7 and 5.3 g ai/ha and at the EP and MP timings. Bromoxynil at 560 g ai/ha was applied alone and in combination with CGA-362622 at 2.7 and 5.3 g ai/ha at the EP and MP timing. All herbicides were applied broadcast over-the-top at 140 l/ha volume with a CO_2 backpack sprayer equipped with flat fan nozzles spaced 48 cm apart. Weed species evaluated included Palmer amaranth, pitted morningglory, prickly sida, sicklepod, and hemp sesbania. Weed size at EP applications ranged from two- to five-leaves, and from two- to eight-leaves at MP both years. Visual estimates of weed control and crop injury were recorded using a scale of 0 to 100%, with 0 = no control or crop injury, and 100% = complete control or crop death. Data were analyzed using ANOVA, and means were separated by Fisher's protected LSD at P = 0.05.

Pitted morningglory control was greater both years with either rate of CGA-362622 applied EP than with pyrithiobac 14 DAA. No rate response was observed between rates of CGA-362622. Prickly sida control was greater with pyrithiobac than with either rate of CGA-362622 both years and at each application timing. Sicklepod control was greater with either rate of CGA-362622 than with pyrithiobac. CGA-362622 applied POST failed to control prickly sida, but provided good control of sicklepod. Conversely, prickly sida control was better with pyrithiobac than with CGA-362622, but sicklepod control with pyrithiobac was poor.

Glyphosate alone controlled sicklepod, prickly sida, and pitted morningglory greater than 80%. The addition of CGA-362622 at either rate increased control of pitted morningglory and hemp sesbania over glyphosate alone 14 DAA. Bromoxynil at 560 g/ha controlled pitted morningglory and hemp sesbania at all application timings; however, sicklepod and Palmer amaranth control was less than 50% with bromoxynil applied alone. When bromoxynil was combined with CGA-362622 at either rate, control of sicklepod and Palmer amaranth increased to 80% or greater at both application timings.

PALMER AMARANTH INTERFERENCE WITH ROUNDUP READY® FLEX COTTON.

J.B. Willis, B.J. Fast, S.W. Murdock, and D.S. Murray. Oklahoma Sate University Department of Plant & Soil Sciences, Stillwater, OK 74078.

ABSTRACT

Current Roundup Ready cotton cultivars allow producers to make over-the-top applications of glyphosate from ground cracking through the four-leaf growth stage. After cotton has exceeded the four-leaf growth stage, producers have three predominant weed control options. Glyphosate can be applied through a hooded sprayer, weed control can be accomplished with a non-glyphosate herbicide that is labeled for POST use in cotton beyond the four-leaf growth stage, or glyphosate can be applied as a salvage treatment. If glyphosate is applied as a salvage treatment, boll loss, delayed maturity, and/or yield loss will result. Although it has not been released for sale to the public at the time of this publication, Monsanto has developed Roundup Ready Flex cotton, which can potentially receive over-the-top applications of glyphosate from ground cracking through lay-by or later. The objective of this experiment was to quantify lint yield reductions caused by Palmer amaranth when the first over-the-top glyphosate application of the season was delayed.

Roundup Ready Flex cotton was planted on June 3, 2003 at the Agronomy Research Station near Stillwater, Oklahoma in plots that were 50 ft long and four rows wide with 36 in row spacing. Plots were replicated four times and had an average Palmer amaranth density of 100 plants/100 ft^2. Treatments consisted of one weedy check, two weed-free checks, and times of Palmer amaranth removal ranging from one week after crop emergence (WAE) to nine WAE. No herbicide treatments were applied to the weedy check and the weed-free checks received a preemergence tank-mixed application of 0.83 lb ai/A pendamethalin and 1.3 lb ai/A *S*-metolachlor. Palmer amaranth removal began with the one WAE treatment on June 16, 2003, and subsequent treatments were applied in increments of exactly one week. Removal was accomplished with an over-the-top application of 1.5 lb ae/A glyphosate and plots remained weed-free for the remainder of the growing season after removal. Cotton from the middle two rows was harvested on December 4, 2003 with a one-row roller-brush stripper. A grab sample of snapped cotton was then de-burred and ginned and lint yields were calculated using the appropriate lint conversions.

When Palmer amaranth removal was delayed beyond five WAE, significant decreases in lint yield began to occur, as did significant increases in Palmer amaranth biomass. Based upon the 2003 results, Palmer amaranth removal should not be delayed beyond five WAE when removal is accomplished with the first over-the-top glyphosate application of the season. Regression analysis of this data indicated that cotton lint yield was reduced 16.6%/wk after five WAE.

COMPARISON OF GLYPHOSATE TOLERANCE IN FOUR COTTON VARIETIES. J.J. Walton, N.W. Buehring, D.B. Reynolds, N.W. Buehring, and M.T. Kirkpatrick. Mississippi State University, Mississippi State, MS.

ABSTRACT

The recent patent expiration on glyphosate has resulted in the availability of numerous new glyphosate herbicides, some of which are labeled for use in Roundup Ready cotton. This has lead to more options for cotton producers; however, it has also increased their concerns about Roundup Ready cotton tolerance to all glyphosate herbicides. The objectives of this research was to compare Roundup Ready cotton tolerance and cotton variety sensitivity to different glyphosate formulations. The first objective was conducted at Black Belt Branch Experiment Station in Brooksville, MS, North Mississippi Research and Extension Center in Verona, MS, and the Plant Science Research Center in Starkville, MS in 2003. The experimental design was a randomized complete block. Cotton, Stoneville 4892 BR, was planted into 13 by 50 ft plots. The glyphosate herbicides used in this objective are as follows: ClearOut 41, ClearOut 41 Plus, Glyfos, Glyfos X-tra, Glyphomax, Glyphomax Plus, Gly Star Original, Gly Star Plus, Roundup Original, Roundup D-Pak, Roundup UltraMax, Roundup WeatherMax, Touchdown IQ, and Touchdown K (A13013) For comparison purposes, an untreated check was also included in the experiment. The glyphosate herbicides were applied at 0.75 lbs ae/A of glyphosate with a spray volume of 15 GPA. If an additional surfactant was required, Latron AG-98 at 0.5% v/v was added to the spray solution. All glyphosate herbicides were applied topically at the 2-leaf stage followed by another topical application at the 4-leaf stage. Data were collected for visual injury (7, 14, 28 DAT), plant height reduction (14 DAT) and seed cotton yield. Also, plant mapping data were collected from ten plants within each plot. Plant mapping data were analyzed by two different methods: percent boll retention at each fruiting position (1, 2, and 3); and percent boll retention at zone 1 (all positions between nodes 6 through 10), zone 2 (all positions between node 11 through 15), and zone 3 (all positions greater than node 15). The second objective was conducted at the Black Belt Research Center in 2003. The experimental design was a randomized complete block. Four different cotton varieties, DP 451 BR, PM 1218 BR, DP 555 BR, AND ST 4892 BR, were used in this objective. The plot size was 13 by 50 ft, where each variety was planted on a 38" row. The glyphosate herbicides used in this objective were ClearOut 41 Plus (Lot # CP0303), ClearOut 41 Plus (Lot # C1041P), Express Chem Glyphosate, Roundup WeatherMax, and Touchdown IQ. The glyphosate herbicides were applied at 0.75 lb ae/A of glyphosate with a spray volume of 15 GPA. All glyphosate herbicides were applied at the 1- to 2-leaf stage. Visual injury ratings were taking at 3 and 7 DAT.

In the first objective, visual injury was observed with ClearOut 41 Plus (12%), Glyfos (6%), Glyphomax (6%), Gly Star Original (6%), Roundup Original (8%), and Roundup UltraMax (5%) at 7 days after the 2-leaf application. Visual Injury was also observed with ClearOut 41(4%), ClearOut 41 Plus (11%), Gly Star Original (4%), and Roundup Original (4%) at 7 days after the 4-leaf application. No visual injury was observed with any of the glyphosate formulations at 14 and 28 days after the 4-leaf application. A height reduction was observed with Gly Star Plus, Roundup Original, and Roundup UltraMax at 14 days after the 4-leaf application. All of the glyphosate formulations resulted in no decrease in percent boll retention from the untreated at position 1, 2, and 3. At zone 1, Gly Star Original resulted in lower percent boll retention (52.3%) than the untreated (59.3%). At zone 2, Glyfos and Gly Star Original resulted in lower percent boll retention (40.4 and 42.0%) than the untreated (46.8%). At zone 3, Roundup Original resulted in lower percent boll retention (22.4%) than the untreated (30.6%). All of the treatments responded similarly in yield when compared to the standard treatment.

In the second objective, there was no difference in variety tolerance between the two ClearOut 41 Plus formulations. The cotton variety, PM 1218 BR, was more tolerant to ClearOut 41 Plus ($\leq$ 14%) and Express Chem Glyphosate ($\leq$ 21%). Visual injury ratings for DP 451 BR, DP 555 BR, and ST 4892 BR were higher for Express Chem Glyphosate (30 to 60%) than ClearOut 41 Plus (15 to 35%), Roundup WeatherMax (0 to 9%), and Touchdown IQ (0 to 16%) at 3 and 7 days after treatment.

REMOVAL OF ROUNDUP READY AND LIBERTY LINK COTTON WITH GLYPHOSATE AND GLUFOSINATE IN REPLANT SITUATIONS. J.D. Siebert, A.M. Stewart, P.R. Vidrine, D.K. Miller, Louisiana State University AgCenter, Baton Rouge, LA; A.C. York, North Carolina State University, Raleigh, NC; and A.S. Culpepper, University of Georgia, Tifton, GA.

ABSTRACT

Less than optimal weather conditions at, and shortly following cotton planting can result in a cotton stand failure. Growers may wish to destroy the existing cotton and replant to soybeans. In production areas under a Boll weevil Eradication Program (BWEP), 100% of the cotton must be removed to eliminate potential oviposition sites for boll weevils and to eliminate the need for monitoring and potential treatment by BWEP personnel. In Louisiana alone, there were 26 requests to have the eradication fee waived on acres with a stand failure in 2003. Although various control methods were employed, trappers and BWEP personnel reported 100% cotton destruction in only one of the 26 cases. Growers with less than 100% cotton destruction were required to pay part of or the entire eradication fee. This illustrates that killing Roundup Ready and Liberty Link cotton is a real problem that plagues some farmers each year.

A field experiment in Tifton, GA; Alexandria, LA; and Rocky Mount, NC; in 2003 evaluated the effect of rate and application timing of glufosinate on Roundup Ready and glyphosate on Liberty Link cotton stand, biomass production, and fruit production. Liberty (glufosinate 1.67 lb ai/gal) at 28 and 42 oz/A (0.37 and 0.55 lb ai/A) and Roundup Weathermax (glyphosate 5.5 lb ai/gal) at 22 and 33 oz/A (0.95 and 1.41 lb ai/A) were applied to Roundup Ready and Liberty Link cotton, respectively, in the 2-, 6-, and 10-leaf growth stages. No crop was replanted following application of glufosinate or glyphosate. Reduction in plant stand and visual injury evaluations were made 14 days after treatment. At the end of the season, the total number of reproductive structures (squares, flowers, and bolls) and cotton plant biomass were determined.

Treatment by location interactions were noted for all variables. In Georgia, Liberty at 28 or 42 oz/A completely killed 2- and 6-leaf Roundup Ready cotton. Ten-leaf cotton was controlled 78% by Liberty at 42 oz/A, and cotton biomass and fruit production were reduced 28 and 24%, respectively. A Liberty rate response was noted in Louisiana. Liberty did not kill all Roundup Ready plants, but no reproductive structures were produced when Liberty at 28 oz/A was applied to 2-leaf cotton or when Liberty at 42 oz/A was applied to 2- or 6-leaf cotton. Liberty at 42 oz/A applied to 10-leaf cotton reduced fruit production 38%. In North Carolina, Liberty at both rates killed all 2-leaf cotton. Liberty at 42 oz/A reduced biomass and fruit production 70 to 93% and 32 to 86% respectively, when applied to 6- or 10-leaf cotton.

A Roundup rate response was noted at each location. In Georgia, complete control of Liberty Link cotton was obtained with 33 oz/A of Roundup applied to 2- or 6-leaf seedlings. Ten-leaf cotton was controlled 60% by Roundup at 33 oz/A and fruit production was reduced 50%. Roundup at 22 oz/A controlled 2-, 6-, and 10-leaf cotton 93, 85, and 46%, respectively, and reduced fruit production 88, 93, and 38%, respectively. No Roundup treatment killed all seedlings in Louisiana. However, Roundup at 33 oz/A applied to 2-, 6-, and 10-leaf Liberty Link cotton inhibited fruit production 100, 100, and 76%, respectively. In North Carolina, no Roundup treatment killed all cotton plants. Roundup at 33 oz/A controlled 2-leaf Liberty Link cotton 70% and reduced fruit production 95%. Roundup at 33 oz/A controlled 6- and 10-leaf cotton 81 to 50% and reduced biomass 84 to 98%.

These results demonstrate the difficulty in completely controlling cotton in replant situations. Liberty adequately controlled 2-leaf Roundup Ready cotton at all locations and 6-leaf cotton at two of three locations. Roundup adequately controlled 2- and 6-leaf Liberty Link cotton at two of three locations. Neither Roundup nor Liberty adequately controlled 10-leaf cotton at any location. Hence, with many of the treatments, fields would still need to be monitored under BWEP guidelines. Additional control measures, such as tillage or herbicides that control cotton in the replanted crop,

will be needed. Making an early decision to replant and acting rapidly is key to successful destruction of a cotton crop in a replant scenario.

WEED CONTROL IN LIBERTY-LINK COTTON IN LOUISIANA. S.T. Kelly, D.K. Miller and M.S. Matthews. LSU AgCenter, Winnsboro and St. Joseph, LA.

ABSTRACT

Two experiments were initiated at the Macon Ridge Research Station at Winnsboro, LA to evaluate Ignite in a weed control system with commonly used residual herbicides. Treatments in each experiment were identical, but two varieties were used; FiberMax 958LL or FiberMax 832LL. Each variety was planted on May 29, 2003 in plots two rows wide by 40 feet long. PRE herbicides were applied immediately after planting. Early post treatments were applied when cotton was 2 leaf. Any Ignite treatment was applied at 0.375 lb ai/A. Treatments included a total post program of Ignite followed by (fb) Ignite; Prowl (0.75 lb ai/A) PRE, Ignite fb Ignite; Prowl + Cotoran (0.75 + 1.0 lb ai/A, respectively) PRE, Ignite fb Ignite; Prowl (0.75 lb/A) PRE, Ignite fb Ignite fb Ignite; Prowl (0.75 lb/A) PRE, Ignite fb Ignite fb Ignite + Direx (1.0 lb ai/A); and Prowl (0.75 lb/A) PRE, Ignite + AMS fb Ignite + AMS + Direx (1.0 lb/A). Pigweed (*Amaranthus* spp.) control was at least 80% with any system evaluated. Crabrass (*Digitaria* spp.) control was at least 80% if Prowl was used, but not when a total post program was used. FiberMax 958LL seedcotton yield was 1500 lb/A or greater with any system evaluated. Seedcotton yield of FiberMax 832LL ranged from 1450 to 1610 lb/A with any system evaluated, with no differences between the systems.

A "two-pass" weed control program was evaluated at the Northeast Research Station near St. Joseph, Louisiana. Experimental design was a factorial arrangement of treatments in a randomized complete block with four replications. Factor A was herbicide combinations that included Ignite (0.375 lb/A) applied in combination with Prowl (1.0 lb/A), Envoke (0.0047 lb ai/A), Staple (0.063 lb ai/A), or Dual II Magnum (0.95 lb ai/A). Factor B was application timings that included 2 to 3, 6 to 8, or 10 to 12 leaf cotton. To exclude potential early season weed competition from the experiment, all plots received an application of Ignite at the 2 to 3 leaf stage. FiberMax 981LL was planted on May 1, 2003. Plot size was two rows 40 feet in length. Treatments were applied in 15 gpa using a CO_2-powered backpack sprayer. Weeds present included redroot pigweed (*Amaranthus retroflexus*), goosegrass (*Eleusine indica*), and barnyardgrass (*Echinochloa crus-galli*). ANOVA was conducted and means separated at the 5% level of significance using Fisher's Protected LSD. ANOVA indicated that application timing was the significant variable in this experiment, therefore data are averaged over the Ignite tank-mixes. Redroot pigweed control was at least 83% from 66 to 98 DAP. Goosegrass control was greater at 66 DAP with treatments applied at the 2 to 3 leaf stage compared to the later application timings. However, from 85 to 98 DAP, control was greater with the 2 to 3 or 6 to 8 leaf applications. Barnyardgrass control was greatest from 66 to 98 DAP when treatments were applied at the 2 to 3 leaf stage. Seedcotton yield was greatest (1150 lb/A) when treatments were applied at the 2 to 3 leaf stage, compared to 600 or 900 lb/A with the 6 to 8 or 10 to 12 leaf application timings, respectively.

An additional experiment was conducted at the Northeast Research Station near St. Joseph, Louisiana to evaluate Ignite tank-mixes applied early post (epost), and followed by one of two layby tank-mixes. Experimental design was a factorial arrangement of treatments in a randomized complete block with three replications. Factor A consisted of the epost treatments and included: Ignite (0.375 lb/A) alone or in combination with Dual II Magnum (0.95 lb/A), Staple (0.032 lb/A), Envoke (0.0047 lb/A), or no epost treatment. Factor B was the layby treatment and consisted of Caparol + MSMA (1 + 2 lb ai/A, respectively), Valor + MSMA (0.063 + 2 lb ai/A, respectively), or no layby. Epost treatments were applied at 3 to 4 leaf cotton and layby treatments applied to 10 to 12 leaf cotton. FiberMax 981LL was planted on May1, 2003. Plot sizes were two rows, 40 feet long. Soil type was a silt loam. ANOVA was conducted and means separated using Fisher's Protected LSD at the 5% level of significance. ANOVA indicated an interaction between the epost and layby treatments for weed control, but no interaction was observed for seed cotton yield, with the main effect of epost treatments being significant. Weeds present in this experiment included pitted morningglory (*Ipomoea lacunosa*), entireleaf morningglory (*Ipomoea herderacea* var. integriuscula), hemp sesbania (*Sesbania exaltata*), redroot pigweed, sicklepod (*Cassia obtusifolia*),

crabgrass (*Digitaria* spp.), goosegrass, and barnyardgrass. Pitted or entireleaf morningglory, hemp sesbania, and crabgrass control was at least 80% with any treatment except the untreated through 66 DAP. Redroot pigweed control was greater with Valor + MSMA at layby if no residual was used epost or if no epost was applied. Sicklepod control was greatest if Caparol + MSMA was combined with any epost treatment, or if Ignite + Staple or Envoke was used in combination with Valor + MSMA at layby. Goosegrass control was very erratic at 52 DAP, but was 83% or greater by 98 DAP with any treatment except the untreated.

REDUCED HERBICIDE INPUTS IN FLORIDA PEANUT (*Arachis hypogaea*) PRODUCTION. S.D. Willingham, B.J. Brecke, J.T. Ducar, G.E. MacDonald; Department of Agronomy, University of Florida, Gainesville, Fl 32611, West Florida Research and Education Center, Jay, Fl 32565, and Department of Animal and Horticultural Sciences, Berry College, Mt. Berry, GA 30149.

ABSTRACT

Field studies were conducted at two locations in 2003 to evaluate weed control in peanuts planted on conventional row spacing using reduce rate combinations of imazapic, diclosulam, and flumioxazin. Treatments were arranged in a randomized complete block design with four replications and herbicides were applied with a CO2 pressurized backpack sprayer. Pendimethalin was applied PPI at the rate of 1.12 kg ai/ha to all treatments to control grasses and small seeded broadleaf weeds. Diclosulam was applied PRE at three rates; 0.027 kg ai/ha (1X), 0.013 kg ai/ha (1/2X), and 0.006 kg ai/ha (1/4X). Flumioxazin was applied at three rates; 0.105 kg ai/ha (1X), 0.052 kg ai/ha (1/2X), and 0.026 kg ai/ha (1/4X). Imazapic was applied EPOST at four rates; 0.072 kg ai/ha (1X), 0.048 kg ai/ha (2/3X), 0.036 kg ai/ha (1/2X), and 0.018kg ai/ha (1/4X). Applications were applied alone and in different combinations.

Weed control was based on late season control of *Cyperus rotundus, Desmodium tortuosum, Cassia obtusifolia, Jacquemontia tamnifolia Commelina banghalensis, Euphorbia heterophylla,* and *Physalis angulata.* At Citra, *Cassia obtusifolia, Indigofera hirsute, and Physalis angulata* was controlled greater than 85% using all treatment combinations. All treatments provided greater than 90% control for *Cyperus rotundus* except for Flumioxazin at 1/4X and Imazapic at 1/4X rate. Diclosulam at all rates and flumioxazin at 1/4X PRE alone, diclosulam fb imazapic at 1/4X and imazapic alone at 1/4X controlled *Desmodium tortuosum* less than 85%. Treatments that achieved greater than 83% control for *Commelina bangalensis* were diclosulam and flumioxazin tank mixed at 1/4x and 1x fb imazapic at 1x rate, diclosulam and flumioxazin tank mixed fb imazapic at 1/2x, and diclosulam fb imazapic at1x rate. Based on untreated checks, this area contained low weed pressure. At Jay, where the weed pressure was higher, *Cassia obtusifolia* was controlled greater than 85% with the 1x rates except diclosulam. All rate combinations controlled *Jacquemontia tamnifolia* and *Euphorbia heterophylla* greater than 85%. *Cyperus rotundus* was controlled greater than 85% by all treatments except diclosulam 1/4x and flumioxazin at all rates PRE alone. Diclosulam applied 1/4x rate PRE alone and fb 1/4x rate imazapic POST, imazapic at 1/4 and 1/2x rate POST alone provided less than 78% control of *Desmodium tortuosum.*

Using reduce rates of these herbicides can provide adequate weed control however it is weed and environmentally dependent.

A COMPARISON OF FULL AND REDUCED RATE WEED MANAGEMENT PROGRAMS IN PEANUT. E.P. Prostko* and T.L. Grey, Department of Crop & Soil Sciences, University of Georgia, Tifton, GA 31793.

ABSTRACT

It has been estimated that agri-chemicals account for 34% of the cost of production for peanut. Additionally, U.S. price support levels for peanut were reduced from $610/ton to $355/ton. Consequently, there is a need for less expensive weed management strategies. Strongarm (diclosulam) and Valor (flumioxazin) are two newer soil-applied herbicides registered for use in peanut. Both herbicides provide good to excellent control of many troublesome broadleaf weeds in peanut but many growers are reluctant to spend $13-17/A on preemergence herbicides. The objective of this research was to determine if the combination of 0.25X reduced rates of Strongarm + Valor would provide weed control equivalent to full rates of either herbicide applied alone. Replicated field trials were conducted from 2001-2003 at several locations in south Georgia. All tests were conducted under irrigated conditions. Preemergence treatments included Strongarm 84WG at 0.45 ozs/A, Valor 51WP at 3.0 ozs/A, and Strongarm at 0.113 ozs/A + Valor at 0.75 ozs/A. The preemergence treatments were followed by postemergence applications of Cadre 70DG (imazapic) at 0.72, 1.0, and 1.44 ozs/A. In comparison to Valor applied at the full rate, less peanut injury was observed with the combination of Strongarm + Valor at 0.25X rates. The 0.25X reduced rate combination of Strongarm + Valor provided equivalent control of several weed species including hophornbeam copperleaf (*Acalypha ostryifolia*), Florida beggarweed (*Desmodium tortuosum*), smallflower morningglory (*Jacquemontia tamnifolia*), common ragweed (*Ambrosia artemisiifolia*), and bristly starbur (*Acanthospermum hispidum*). The reduced rate combination was less effective than the full rates of either Strongarm or Valor in controlling tropical spiderwort (*Commelina benghalensis*) and annual morningglory (*Ipomoea* spp.). When used in a total program (PRE followed by POST Cadre at any rate), Strongarm + Valor at 0.25X rates provided peanut yields equivalent to full rate programs.

INFLUENCE OF FUNGICIDES ON EFFICACY OF CLETHODIM AND SETHOXUDIM IN LARGE CRABGRASS (*DIGITARIA SANGUINALIS L.*). S. Hans, D. Jordan, D. Monks, J. Spears, J. Wilcut, A. York, F. Corbin, and B. Sheldon; Department of Crop Science, North Carolina State University, Raleigh.

ABSTRACT

Peanut producers apply a wide range of agrichemicals throughout the growing season to control pests and to optimize crop growth and development. Previous research suggests that some commercially available fungicides may reduce efficacy of herbicides. Field experiments were conducted in 2002 and 2003 to evaluate the influence of fungicides on large crabgrass control by clethodim and sethoxydim. Clethodim (0.14 kg ai/ha) and sethoxydim (0.21 kg ai/ha) were applied alone or with azoxystrobin (0.43 kg ai/ha), chlorothalonil (1.26 kg ai/ha), pyraclostrobin (0.16 kg ai/ha), and tebuconazole (0.22 kg ai/ha). Crop oil concentrate (2.4 L/ha) was included with all treatments. Visual estimates of percent large crabgrass control were recorded two weeks after application. Additionally, studies were conducted to determine the role of fungicides on absorption of ^{14}C-clethodim and ^{14}C-sethoxydim into large crabgrass at 2 and 8 hours after application. Ring labelled ^{14}C-clethodim and ^{14}C-sethoxydim were applied to large crabgrass plants in combination with the azoxystrobin, chlorothalonil, pyraclostrobin, and tebuconazole at the rates previously described. Crop oil concentrate was included with all treatments. The treated leaf was subjected to a 1-minute water wash followed by a 1-minute chloroform wash. Treated leaves, the shoot above and the shoot below the treated leaf were oxidized to determine ^{14}C-label distribution. Large crabgrass control by clethodim and sethoxydim was reduced when these herbicides were applied with chlorothalonil, azoxystrobin, and pyraclostrobin. Tebuconazole did not reduce control by either graminicide. Absorption of ^{14}C-clethodim and ^{14}C-sethoxydim were reduced by chlorothalonil. Azoxystrobin reduced absorption of ^{14}C-clethodim but did not affect absorption of ^{14}C-sethoxydim. Tebuconazole and pyraclostrobin did not affect absorption of either graminicide. These data indicate that reduced control of large crabgrass by clethodim and sethoxydim applied with chlorothalonil may be associated with decreased absorption. Although azoxystrobin did not affect absorption of ^{14}C-sethoxydim, less control by this combination was noted in field experiments. Reduced control caused by pyraclostrobin could not be attributed to reduced absorption of herbicides.

COST AND EFFICACY OF ALTERNATIVE SCOUTING METHODS IN PEANUT. B.L. Robinson, J.M. Moffitt, G.G. Wilkerson, D.L. Jordan, J.R. Pearce, R.W. Rhodes, B.L. Simonds, L.P. Smith, C.E. Tyson, S.N. Uzzell, and F.C. Winslow; Crop Science Department, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Intensive weed scouting efforts are often minimal in field crops due to time constraints of the early growing season and questionable accuracy of scouting methodology. Due to current changes in the peanut quota system, profit margins have become narrower and the importance of making the most economical herbicide decision is increasing. The objectives of this study were to obtain estimates of scouting times and quality of recommendations while using four different scouting methods. Additional objectives were to compare decisions made by County Extension Agents to those generated in HADSS (Herbicide Application Decision Support System), and to acquaint the agents with the current capabilities of HADSS for use in the peanut growing counties of North Carolina. Eight on-farm experiments were completed in North Carolina counties in 2003 to assess scouting efficiency and cost using economic thresholds based on HADSS. Extension agents in each county identified an 8-10 acre peanut field to be scouted approximately 4 weeks after planting. Four different scouting methods were employed: 1) "windshield" (estimating weed densities from the edge of the field); 2) loop (walking through the field in a loop and estimating weed densities upon exiting the field); 3) ranges (classifying density of each species in six random locations according to a very low to very high scale); and 4) counts in six random locations. Each scout completed the four methods separately, and time was recorded and averaged for each of the eight sites. Data from each scout and scouting method were entered into HADSS to generate a recommendation. Recommendations were compared in terms of theoretical net return over herbicide investment (TNR). We assumed the optimal treatment was the one recommended by HADSS when count data from all 18 stops (six per scout) were used to estimate weed densities for each field. TNR for the optimal treatment (calculated using herbicide prices, estimated weed-free yield, and a selling price of $500/ton) averaged $343/a, but ranged from $131 to $546/a for all eight counties. Loss in TNR averaged $3, $8, $13, and $19/a for the count, range, loop, and windshield scouting methods, respectively, when data from only one scout were used to determine a recommendation. HADSS recommended a treatment with a TNR within 10% of that of the optimal treatment 100%, 91%, 83%, and 78% of the time for the count, range, loop, and windshield scouting methods, respectively. Average time required for each method were 9, 23, 27, and 35 minutes per scout for the count, range, loop, and windshield scouting methods, respectively. These results show that even minimal scouting efforts in a field will frequently result in a herbicide recommendation within 10% of the optimal recommendation. However, theoretical losses as high as $93/a were observed in some situations. More intensive scouting efforts tended to result in more accurate herbicide recommendations.

WEED CONTROL STRATEGIES FOR A TRIPLE-CROP PRODUCTION SYSTEM. C.E. Brewer and L.R. Oliver; Department of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR.

ABSTRACT

The triple-crop production system avoids mid-season water deficit stress, which coincides with the fragile reproductive development of full-season crop plants, by timing crop maturity so that the most sensitive stages occur before the onset of drought or after it. The system comprises the monocrop cultures of corn, soybean, and winter wheat compressed into a period of fourteen months. Few herbicides can be used in this system because of the short rotation interval between crops. Experiments were conducted in Fayetteville, AR, on a Taloka silt loam soil in 2002 and 2003 to determine if current herbicide technology was sufficient to control common Arkansas weeds. Velvetleaf (*Abutilon theophrasti*), prickly sida (*Sida spinosa*), Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), and entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula*) were overseeded prior to the last tillage operation. Pioneer 39M27Bt corn was planted on a 20-inch row spacing to a final plant density of 75,000 plants/A on April 15, 2002, and April 8, 2003. Treatments arranged in a randomized complete block design with four replications included: (1) weed-free check, (2) metolachlor (1.27 ai lb/A) + atrazine (0.75 ai lb/A) preemergence (PRE) followed by (fb) postemergence (POST) application of atrazine (0.75 lb/A) at 2 leaf (lf) corn fb 2,4-D (0.5 lb ai /A) 7 days later, (3) metolachlor (1.27 lb/A) + flumetsulam (0.063 lb ai /A) PRE fb 2,4-D (0.5 lb/A) POST 3 weeks after emergence (WAE), (4) metolachlor (1.27 lb/A) PRE fb carfentrazone (0.008 lb ai /A) POST 7 WAE, and (5) flufenacet (0.4 lb ai /A) + metribuzin (0.1 lb ai /A) fb 2,4-D (0.5 lb/A) POST 3 WAE. After corn harvest, Asgrow 2201RR soybeans were no-till drilled into the corn residue on a 7-inch row spacing to a final population of 350,000 plants/A on August 1, 2002 and July 25, 2003. Glyphosate (0.75 lb ae/A) was broadcast 2 WAE to control volunteer corn. After soybean harvest, Pioneer 2684 wheat was no-till drilled on a 7-inch row spacing to a final population of 1,200,000 plants/A on November 6, 2002 and October 22, 2003. Visual weed control ratings and crop injury were recorded at 2, 4, 8 and 10 WAE. Crop yield and stand count were recorded for each crop.

There were no significant differences in control of prickly sida, Palmer amaranth, and entireleaf morningglory among herbicide treatments at any rating date, with control >95%. At 4WAE treatment 4 controlled velvetleaf and pitted morningglory <95%, but control was >95% with other treatments. At 10 WAE treatments 2, 3, and 5 controlled all species >95%, but treatment 4 only controlled pitted morningglory 70% and velvetleaf 85%. There was no crop injury in either year. Corn or soybean yields were unaffected by herbicide treatment, winter wheat yield was lower in 2002 for treatment 4 due to lack of activity of carfentrazone on Italian ryegrass (*Lolium multiflorum*).

These data show that current herbicide technology is sufficient to control these weed species in this triple-crop system. The crop rotation restrictions for treatments 3, 4, and 5 would allow them to be used in this triple-crop system. However, the lack of residual grass activity of treatment 4 would require the use of a wheat herbicide. Although treatment 2 did not cause crop injury or yield reduction and provided full season weed control, the crop rotation restriction for atrazine is too long to legally use in the triple-crop production system.

TOLERANCE AND ECONOMICS OF SPANISH PEANUT TO SOIL-APPLIED COTTON HERBICIDES AFTER CROP FAILURE. L.L. Lyon, P.A. Dotray, J.W. Keeling, and K.M. McCormick. Texas Agricultural Experiment Station and Texas Tech University, Lubbock, TX.

ABSTRACT

In 2003, 3.5 million acres of cotton were originally planted on the Texas Southern High Plains, but weather events in late May/early June destroyed approximately 1.4 million acres. Sorghum has traditionally been the crop of choice in a crop failure situation. In the past, other options have included sunflowers, soybean, guar, peas, beans, and sesame; however, crop tolerance to cotton herbicides with these crops is unknown. Spanish peanut can be planted about three weeks later than runner varieties, with no adverse affects on yield, and has the potential as a replant crop. The objectives of this study were: to determine the tolerance of Spanish peanut to cotton herbicides planted after a crop failure and to compare the economics of replanting with Spanish peanut or cotton.

Cotton was originally planted on May 12 at the Western Peanut Growers Research Farm near Denver City, TX on a loamy, fine sand. Herbicide treatments were applied preemergence at 10 GPA and included: Prowl at 0.50 lb ai/A, Staple at 0.063 lb ai/A, Dual Magnum at 1.0 lb ai/A, Caparol at 0.80 lb ai/A, Caparol + Staple at 0.80 + 0.032 lb ai/A and an untreated check. All treatments, six by 50 ft were replicated three times. The trial was to be destroyed with paraquat; however, high winds and hail on June 3 destroyed the cotton. Cotton (PM 2280RR) and Spanish peanut (Olin) were replanted in the test area on June 5. Half of the plot was re-bedded and rod-weeded (tilled) prior to replanting, while the other half was planted no-till. Injury ratings were recorded at 13, 28, 31, 62, and 123 days after planting (DAP). Plots were harvested and samples were collected to calculate yields and gross returns were determined.

At 13 DAP, Dual Magnum was the only herbicide that injured peanut (5%) in both tilled and no-tilled plots. By mid-season (62 DAP), 6% peanut injury was observed in the tilled plots from Staple and Dual Magnum. Staple, Dual Magnum, and Caparol + Staple injured peanut in the no-till (10, 12, and 6%, respectively); however, by the end of the season, only Dual Magnum in the tilled plots injured peanut (7%). No herbicide treatment, either tilled or no-tilled, affected Spanish peanut yield or gross returns.

Dual Magnum caused 8 and 12% early season injury in tilled and no-tilled cotton, respectively. Dual Magnum injury increased to 37% (tilled) and 28% (no-tilled) by mid-season, but by 123 DAP, injury for both tillage systems had decreased to 15 and 13%. Cotton lint yield and gross returns were reduced by preemergence applications of Staple, Dual Magnum, and Caparol + Staple when the plot area was tilled, but no differences in lint yield or gross returns were noted in the no-till areas.

These data indicate that Spanish peanut is tolerant to most cotton herbicides and tillage had no affect on injury. Visual injury from cotton herbicides did not result in a reduction in peanut yield or gross returns. Herbicide injury in cotton was increased in tilled as compared to no-tilled plots. Cotton injury, lint yield, and gross returns were not affected by herbicide in the no-till situation. In 2003 with above average temperatures and heat unit accumulation in the fall, later planting did not reduce cotton yield; therefore cotton was a better replant choice than Spanish peanut.

EVALUATION OF TEXAS PANICUM (*PANICUM TEXANUM* BUCKL.) CONTROL IN CORN (*ZEA MAYS* L.)WITH SEVERAL WEED MANAGEMENT SYSTEMS. K.W. Bradley, H.P. Wilson, and T.E. Hines; Eastern Shore Agricultural Research and Extension Center, Virginia Polytechnic Institute and State University, Painter VA 23420.

ABSTRACT

Texas panicum is a large-seeded annual grass weed that commonly occurs on sandy, well-drained soils of agronomic crops in the southern United States. Texas panicum has historically been a very troublesome weed of agronomic crops in Texas, Oklahoma, Georgia, Alabama, Florida, and South Carolina, but now extends as far north as Virginia. Over the past several years in Virginia, infestations of Texas panicum have been reported in corn fields where this weed was not previously identified as a problem. Previous research has indicated that Texas panicum is capable of germinating from greater soil depths than most annual grasses, and can germinate throughout most of the corn growing season. Both of these factors may contribute to the erratic control of Texas panicum observed with standard preemergence (PRE) corn herbicides.

Separate field experiments were conducted in 2003 to 1) evaluate Texas panicum control with herbicide strategies appropriate for use in glyphosate-tolerant and glufosinate-tolerant corn systems, and 2) evaluate Texas panicum control and corn yield in response to residual herbicide applications made PRE and delayed PRE (2-leaf Texas panicum) in conventional corn systems. Both experiments were established in no-till corn fields with severe Texas panicum infestations in Northampton County, Virginia.

In the first field experiment, there were no differences between the herbicide strategies evaluated in the glufosinate-tolerant corn system, and all strategies provided from 84 to 93% Texas panicum control 3 months after planting (MAP). In the glyphosate-tolerant corn system, greater than 95% Texas panicum control was achieved with the PRE followed by the early postemergence (E-POST) followed by the late postemergence (L-POST) herbicide strategy. Overall, there were few differences in the Texas panicum control achieved with each herbicide strategy in glyphosate- and glufosinate-tolerant corn systems.

In the second field experiment, applications of residual herbicides to 2-leaf Texas panicum provided higher levels of Texas panicum control than PRE applications of these same treatments. PRE applications of atrazine plus metolachlor at 1.25 plus 1 lb/acre and atrazine plus acetochlor at 1.25 plus 1.5 lb/acre provided less than 60% Texas panicum control while applications of these same treatments to 2-leaf Texas panicum provided 71 and 75% control at 3 MAP, respectively. The addition of pendimethalin at 0.8 lb/acre to these residual herbicide treatments also provided higher levels of Texas panicum control than applications of these herbicides alone. All residual herbicide treatments increased corn yields compared to the untreated control, but corn yields were not influenced by the timing of residual herbicide applications.

WEED MANAGEMENT SYSTEMS IN ROUNDUP READY AND CONVENTIONAL CORN (*Zea mays* L.) HYBRIDS. R.G. Parker, A.C. York, and D.L. Jordan North Carolina State University.

ABSTRACT

Approximately 95% of the cotton (*Gossypium hirsutum* L.) and 80% of soybean (*Glycine max* (L.) Merr.) acreage in North Carolina is planted to glyphosate-resistant varieties. Growers have been slower in adopting Roundup Ready corn (Zea mays L.), but interest in the technology is increasing. Soil-applied herbicide use in glyphosate-resistant cotton and soybean has been greatly reduced or eliminated. A similar trend has been noted as growers adopt glyphosate-resistant corn. Previous research has shown that early season weed competition can reduce cotton and soybean yields if postemergence (POST) application of glyphosate is not timely. However, use of preemergence (PRE) herbicides can compensate for lack of timely POST application. Timely POST application can be a problem for corn growers as other crop commitments are common at the time POST herbicides should be applied. This study was designed to determine how lack of timely POST herbicide application in glyphosate-resistant corn would affect weed control and crop yield and to determine the value of PRE herbicides in systems with varying times of POST herbicide application.

Experiments were conducted at Clayton, Goldsboro, and Plymouth, NC in 2002 and at two locations in Clayton and one in Plymouth in 2003. DK 687 RR and DKC 69-71 RR corn hybrids were planted in 2002 and 2003, respectively. Corn was planted on conventionally tilled seedbeds in 91-cm rows. Treatments were replicated four times in a randomized complete block design. Treatments consisted of a factorial arrangement of two PRE herbicides, two POST herbicides, and three timings of POST application. PRE treatments were no herbicide or alachlor + atrazine (Lariat) at half the labelled rate for the particular soils. POST treatments were glyphosate at 0.8 kg ae/ha or nicosulfuron at 35 g ai/ha + atrazine at 0.5 kg ai/ha + crop oil concentrate at 0.5 % (v/v). Application timings were on-time (5- to 7-cm weeds), a 7-day delay, and a 14-day delay. Each treatment received a glyphosate lay-by application 2 wk after the last POST treatment, and a non-treated check was included. Applications were made with a backpack sprayer calibrated to 140 L/ha and 160 kpa. Percent weed control was estimated visually 14 d after POST and lay-by herbicide applications and again 2 wk before harvest. Data were subjected to ANOVA with partitioning for the factorial treatment arrangement; non-treated checks were excluded from the analysis. Means were separated using Fisher's Protected LSD test at P = 0.05.

Control of Palmer amaranth (*Amaranthus palmeri* S.Wats.), common lambsquarters (*Chenopodium album* L.), and prickly sida (*Sida spinosa* L.) was similar with all treatments. Pooled over locations, Palmer amaranth, common lambsquarters, and prickly sida were controlled 93, 97, and 94%, respectively, 14 d after POST application and 99, 98, and 100% 14 d after lay-by application. A PRE by POST herbicide interaction was noted for annual grass control [mixtures of large crabgrass (*Digitaria sanguinalis* (L.) Scop.), fall panicum (*Panicum dichotomiflorum* Michx.), goosegrass (*Eleusine indica* (L.) Gaertn.), and broadleaf signalgrass (*Brachiaria platyphylla* (Griseb.) Nash)]. Regardless of POST application timing, grasses were controlled at least 96% by both POST herbicides when a PRE herbicide was included. In the absence of a PRE herbicide, glyphosate controlled grasses 94% or more regardless of application timing. In contrast, nicosulfuron + atrazine controlled grasses 88, 67, and 56% when applied timely, delayed 1 wk, and delayed 2 wk, respectively. Sicklepod (*Senna obtusifolia* (L.) Irwin & Barneby.) control was similar with all PRE and POST combinations, but control was reduced from 94 to 79% when application timing was delayed 14 d. In 2002, morningglory (*Ipomoea* spp.) control was similar with both POST herbicide herbicides when applied timely. However, when herbicide application timing was delayed, nicosulfuron + atrazine controlled morningglory 98, 96, and 78% while glyphosate controlled 98, 84, and 61%, respectively. Yield was similar with both POST herbicides but was affected by application timing when no PRE was present. All plots which received a PRE herbicide yielded similarly, with yields ranging from 8280 to 8590 kg/ha. In the absence of PRE herbicides, yields were 8470, 7590, and 7280 kg/ha with timely, 1-wk delayed, and 2-wk delayed POST applications,

respectively.

These experiments demonstrate that a total POST weed management program can produce similar weed control and grain yield to weed control programs that include residual soil-applied herbicides followed by a POST herbicide application. However, systems, which include soil-applied herbicides, give the grower more flexibility in timing of POST applications.

ECONOMICS OF WEED MANAGEMENT IN CLEARFIELD AND ROUNDUP READY CORN SYSTEMS. J.R. Simmons and W.T. Willian; Department of Agriculture, Western Kentucky University, Bowling Green, KY 42101.

ABSTRACT

Decreased commodity prices and rising production costs have pressed corn producers to focus on choosing weed control programs that are both efficacious and economical. Herbicide resistant corn hybrids are an increasingly popular instrument for management of annual and perennial weed species.

Field studies were conducted at the Agricultural Research and Education Complex in Bowling Green, KY, in 2002 and 2003. Four field corn (*Zea mays* L.) hybrids were planted into adjacent conventionally tilled (CT) and no-till (NT) silt loam soils. Field corn consisted of: (1) a Roundup Ready (RR) hybrid with high yield potential, (2) a stress-tolerant RR hybrid, (3) a Clearfield (CL) hybrid with high yield potential, and (4) a stress-tolerant CL hybrid. A split-split plot design was utilized with tillage serving as the main plots and hybrid and herbicide treatment as subplots. Five herbicide treatments were replicated four times in each tillage regime with a plot size of four 30-inch rows wide by 25 feet long. Crop response was visually evaluated at 2 and 4 weeks after post-emergence (POST) treatments (WAT) and weed control was evaluated visually at 4 and 12 WAT. Grain yield was obtained and an economic analysis was performed utilizing the formula: Return = [yield (bu/A) * price of corn] – productions costs. Data were subjected to analyses of variance using treatment, tillage, and hybrid as the factors. Means were separated using Duncan's Multiple Range Test at the 5% level of significance.

Crop injury due to herbicide treatment was minimal (<5%). In 2002, CT plots with Harness Xtra followed by (f.b.) Yukon provided greater control of ivyleaf morningglory (*Ipomoea hederacea*) 4 WAT than did Bicep II Magnum f.b. Exceed. In 2003, Degree Xtra f.b. Roundup WeatherMax provided less common cocklebur (*Xanthium strumarium*) control 4 WAT than other treatments in conventional tillage. Corn grain yield among treatments ranged from 111.5 bu/A to 130.8 bu/A in 2002. In 2002, Degree Xtra f.b. Roundup Ultramax treated plots had higher yields and ROI than plots treated with either Harness Xtra f.b. Yukon or Atrazine f.b. Lightning + Atrazine. Corn grain yields were not significantly influenced by treatments in 2003. No-till plots had a significant influence on grain yield in 2002 (14.9 bu/A advantage) and 2003 (21.6 bu/A advantage) when compared to conventionally tilled plots. As a result, return on investment (ROI) for NT plots were $38.75/A (2002) and $50.60/A (2003) greater than CT plots. Corn hybrid had a significant influence on grain yield and ROI in 2002, but not in 2003. In 2002, the stress-tolerant RR hybrid provided an 8.5 bu/A yield advantage and a $ 21.23/A advantage in ROI when compared to the RR hybrid with high yield potential. The stress-tolerant CL hybrid also provided a 17.7 bu/A yield advantage and a $44.24/A advantage in ROI when compared to the CL hybrid having a high yield potential. This may have been attributed to the inadequate moisture levels and corn borer feeding likely to favor stress-tolerant varieties. These results suggest that in choosing a weed management system, corn producers should place particular emphasis on selection of corn hybrids that are best suited to their particular soils and tillage systems.

WEED CONTROL, CROP TOLERANCE, AND GRAIN YIELD IN LIBERTY-LINK CORN.

S.B. Clewis, W.E. Thomas, J.W. Wilcut, and J. Allen, Department of Crop Science, North Carolina State University, Bayer Crop Science, Raleigh, NC 27695-7620.

ABSTRACT

Experiments were conducted at the Upper Coastal Plain Research Station near Rocky Mount, the Peanut Research Station near Lewiston-Woodville, the Caswell Research Station, near Kinston, and the Tidewater Research Station, near Plymouth, North Carolina in 2003. This research was conducted to compare corn tolerance, weed control and corn yield in Liberty-Link corn with Liberty and various residual herbicides early-postemergence (EPOST), postemergence (POST) and late post-directed (LAYBY). The corn cultivar Pioneer 34A55 LL was planted between April 23 to May 5 on sandy loam soils. Plots were 12 ft by 20 ft on 36 in and 38 in row spacing. The experimental design was a randomized complete block with a factorial treatment arrangement with three replications. The EPOST treatment options were 1) Liberty alone at 0.42 lb/ac, 2) Liberty plus Dual Magnum at 1.0 lb/ac, 3) Liberty plus Aatrex at 1.0 lb/ac, 4) Liberty plus Aatrex plus Dual Magnum, or 5) Liberty plus Dual Magnum plus Callisto at 0.094 lb/ac. The POST treatment options were 1) Liberty or 2) no POST. The LAYBY treatment options were 1) no LAYBY, 2) Liberty alone, 3) Liberty plus Evik at 1.0 lb/ac plus NIS at 0.25% (v/v), or 4) Evik plus NIS.

Early-season corn injury and discoloration was minimal (6%) with injury characteristic of Callisto (chlorosis and shortening of internodes). Liberty EPOST controlled goosegrass [*Eleusine indica* (L.) Gaertn] and large crabgrass [*Digitaria sanguinalis* (L.) Scop.] ≥95% early-season with the addition of Dual Magnum, Aatrex, or Callisto EPOST. Late-season goosegrass and large crabgrass control was increased 12-15% points with the addition of a Liberty, Evik, or Liberty plus Evik LAYBY treatment and averaged ≥95% for Liberty EPOST and LAYBY systems. Excellent control of early-season yellow nutsedge (*Cyperus esculentus* L.), purple nutsedge (*Cyperus rotundus* L.), and tropic croton (*Croton glandulosus* var. *septentrionalis* Muell.-Arg.) was seen regardless of the EPOST application. However, the addition of a LAYBY application increased late-season nutsedge species and tropic croton control by 9-12% points to >97% control compared with systems without a LAYBY treatment. Liberty EPOST alone controlled early-season entireleaf morningglory [*Ipomoea hederacea* (L.) JACQ. var. *integriuscula* GRAY], pitted morningglory (*Ipomoea lacunosa* L.), tall morningglory {*Ipomoea purpurea* (L.) Roth], common lambsquarters (*Chenopodium album* L.), eclipta (*Eclipta prostrata* L), spurred anoda [*Anoda cristata* (L.) Schlecht], and Palmer amaranth (*Amaranathus palmeri* S. Wats.) at least 90%. The addition of a Dual, Aatrex, or Callisto increased early-season control to >95%. Late-season control of morningglories, common lambsquarters, eclipta, spurred anoda, and Palmer amaranth was >95% with Liberty plus LAYBY treatments. Based on early-season EPOST applications, corn yields were similar (ranging from 144-146 bushels/ac) regardless of the tank-mix partner. However, the addition of any LAYBY treatment increased corn yields by 16 bushels/ac (from 132 bushels/ac to 148 bushels/ac) compared to herbicide systems without a LAYBY. Timely applications of Liberty are needed for effective goosegrass and pigweed control as seen with morningglory control with Roundup. Liberty does add another very effective EPOST option for North Carolina corn growers. Also, other modes of action need to be included in a cropping system to preclude development of resistant biotypes.

COMPARISON OF GLUFOSINATE-TOLERANT, GLYPHOSATE TOLERANT, AND NONTRANSGENIC CORN WEED MANAGEMENT SYSTEMS. I.C. Burke, S.B. Clewis, J.W. Wilcut, Department of Crop Science, North Carolina State University, Raleigh, NC 27695; and J. Allen, Bayer Crop Science, Research Triangle Park, NC 27709.

ABSTRACT

Field experiments were conducted in 2003 near Kinston, Lewiston-Woodville, and Plymouth, NC, to evaluate weed management systems in Liberty-Link, Roundup-Ready, Clearfield, and conventional corn herbicide systems. Treatments were a factorial arrangement of preemergence (PRE) by postemergence (POST) by late post-directed herbicide options (LAYBY) arranged in sub-blocks of corn varieties. PRE herbicide options included no PRE or Dual II Magnum (S-metolachlor) (1.5 lbs ai/A). POST treatment options were dependent on corn variety. In Liberty-Link systems POST treatments were no POST, Liberty (glufosinate) (0.42 lbs ai/A), Liberty EPOST (0.42 lbs/A) + POST (0.42 lbs/A), or a tank mixture of Liberty plus Dual (1.0 lbs/A). In Roundup-Ready systems POST treatments were no POST, Roundup Weathermax (glyphosate) (0.75 lbs ae/A), Roundup Weathermax EPOST (0.75 lbs/A) + POST (0.75 lbs/A), or a tank mixture of Roundup Weathermax plus Dual II Magnum (1.0 lbs/A). A prepackaged mixture of imazapyr and imazethapyr (Lightning) was used in Clearfield corn systems. In Clearfield systems POST treatments were no POST, Lightning (0.056 lbs ai/A), Lightning EPOST (0.056 lbs/A) + POST (0.028 lbs/A), or the tank mixture of Lightning (0.056 lbs/A) plus Dual II Magnum (1.0 lbs/A). In conventional systems POST treatments were no POST, Accent (nicosulfuron) (0.031 lbs ai/A) POST, Accent EPOST (0.031 lbs/A) + POST (0.031 lbs/A), or the tank mixture of Accent (0.031 lbs/A) plus Dual II Magnum (1.0 lbs/A). LAYBY herbicide options included no herbicide or Evik (ametryn) (1.0 lbs/A). All EPOST and POST treatments were applied with ammonium sulfate (AMS) at 3 lbs/A. In addition to AMS, Accent and Lightning were applied with a non-ionic surfactant at 0.25% (v/v). LAYBY treatments were applied with a non-ionic surfactant at 0.25% (v/v).

Weed species evaluated included common lambsquarters (*Chenopodium album*), entireleaf morningglory (*Ipomoea hederaceae* var. *integriuscula*), ivyleaf morningglory (*Ipomoea hederacea*), goosegrass (*Eleusine indica*). large crabgrass (*Digitaria sanguinalis*), Palmer amaranth (*Amaranthus palmerii*), pitted morningglory (*Ipomoea lacunosa*), spurred anoda (*Anoda cristata*), sicklepod (*Senna obtusifolia*), tropic croton (*Croton gladulosus* var. *septentrionalis*), and yellow nutsedge (*Cyperus esculentus*).

Single and sequential applications of Liberty and Roundup Weathermax controlled the aforementioned weeds >87% 4 wks after EPOST treatment. However, a single application of Liberty, Roundup Weathermax, Lightning, or Accent were not sufficient for season long control of the aforementioned weeds. Sequential applications of POST herbicides improved mid- and late season weed control by controlling later emerging weeds. Dual II Magnum PRE or the addition of Dual II Magnum to EPOST treatments increased late season control of goosegrass, large crabgrass, and Palmer amaranth. A single application of Lightning, which has residual activity, provided greater control of Palmer amaranth, pitted morningglory, sicklepod, and spurred anoda compared to one application of Liberty or Roundup Weathermax. Lightning did not control tropic croton as well as Liberty or Roundup Weathermax. Accent required a LAYBY herbicide for effective control of goosegrass, pitted morningglory, sicklepod, spurred anoda, and tropic croton. A LAYBY application of Evik averaged over PRE and POST treatments controlled the aforementioned weeds >87% for all systems and was greater than systems not receiving a LAYBY. Systems that included POST herbicide treatments had higher yield than systems without POST herbicides. Liberty and Roundup Ultramax systems with equivalent inputs provided equivalent weed control and yield, and these systems also had the broadest weed efficacy. Yield with systems that included LAYBY herbicides were not significantly different than yield in systems without LAYBY herbicides, but they were numerically higher. Choice of herbicide systems should be based on careful consideration of weeds present, crop rotation restrictions, and weed resistance prevention.

POSTEMERGENCE MESOTRIONE COMBINATIONS IN CORN. C.M. Whaley, Virginia Polytechnic Institute and State University, Painter, VA, G.R. Armel, DuPont Crop Protection, Newark, DE, H.P. Wilson, and T.E. Hines, Virginia Polytechnic Institute and State University, Painter, VA.

ABSTRACT

In the past decade, interest has increased in utilizing total postemergence (POST) programs for weed control in field corn. One reason for increased interest is the development of effective POST grass and broadleaf herbicides. Two herbicides available for POST applications include mesotrione and a prepackage mixture of nicosulfuron and rimsulfuron. Mesotrione controls many broadleaf weeds and suppresses large crabgrass and broadleaf signalgrass. The nicosulfuron and rimsulfuron mixture provides control of many grass and a few broadleaf weeds. The weed spectrum of each POST herbicide can be broadened with the addition of atrazine. Research was conducted in 2003 at the Eastern Shore Agricultural Research and Extension Center near Painter, VA to evaluate the effectiveness of total POST weed management programs including combinations of full and reduced rates of mesotrione and nicosulfuron plus rimsulfuron with or without atrazine and to compare these total POST programs to a preemergence (PRE) followed by POST program. The study was a three factor-factorial plus comparison treatments arranged in a randomized complete block design with three replications. All factorial treatments were applied POST. Factors included mesotrione at 0.063 and 0.094 lb ai/A, a prepackage mixture of nicosulfuron plus rimsulfuron at 0, 0.0175, and 0.035 lb ai/A, and atrazine at 0 and 0.5 lb ai/A. Comparison treatments included a POST application of nicosulfuron plus rimsulfuron at 0.035 lb/A and a PRE application of metolachlor at 0.78 lb ai/A plus atrazine at 1.0 lb ai/A followed by (fb) nicosulfuron plus rimsulfuron at 0.035 lb/A POST. Significant rainfall occurred within 16 days following the PRE application. All POST applications were made 4 weeks after planting. At the time of POST applications, heights of common ragweed (*Ambrosia artemisiifolia* L.) and giant foxtail (*Setaria faberi* Herrm.) were less than 3 inches, morningglory species (*Ipomoea* spp.) were less than 4 inches, and large crabgrass (*Digitaria sanguinalis* L.) was less than 1.5 inches. Common ragweed and morningglory control with all total POST combinations that included atrazine was greater than 95% and 88%, respectively. Broadleaf weed control with all total POST combinations was similar to or greater than the PRE fb POST comparison treatment. Giant foxtail control was 99% with all POST treatments including nicosulfuron plus rimsulfuron at either rate. Large crabgrass control ranged from 79 to 90% and was generally higher with treatments that included the full rate of nicosulfuron plus rimsulfuron regardless of mesotrione rate. Metolachlor plus atrazine PRE fb nicosulfuron plus rimsulfuron POST controlled large crabgrass and giant foxtail 95% and 99%, respectively. Corn yields were similar with all total POST treatments that included atrazine and with metolachlor plus atrazine PRE fb nicosulfuron plus rimsulfuron POST.

A NEW MESOTRIONE, S-METOLACHLOR, AND ATRAZINE PREMIX FOR THE CENTRAL AND SOUTHERN CORN BELT. C.F. Grymes, M.D. Johnson, R.A. Pope, and C.A.S. Pearson; Syngenta Crop Protection, Greensboro, NC 27419.

ABSTRACT

A new premixture of mesotrione, *S*-metolachlor, and atrazine was evaluated by Syngenta Crop Protection in 2003 for weed control in corn in the Central and Southern Corn Belts. This premixture is currently coded A14155, and consists of a unique ratio of 1:7.75:7.75 mesotrione:*S*-metolachlor:atrazine, respectively, and a crop safener. A14155 at a planned use rate of 3104 g ai/ha would consist of 188:1457:1459 g/ha mesotrione:s-metolachlor:atrazine g/ha, respectively. The concentration of *S*-metolachlor in 3104 g/ha A14155 would be comparable to the amount in Bicep II MAGNUM® at the labeled medium soil rate of 3240 g/ha. In comparison to Bicep II MAGNUM® at 3240 g/ha applied preemergence, A14155 provided better control of *Panicum texanum, Ipomoea lacunosa, Ipomoea hederacea, Digitaria sanguinalis, Cyperus esculentus, triazine-resistant Chenopodium album, Senna obtusifolia, Brachiaria platyphylla,* and *Ambrosia artemisiifolia* in at least one of 25 trials. Observed control was similar between Bicep II MAGNUM® and A14155 for the remaining 24 weed species evaluated. Crop safety of A14155 was excellent across all trials and similar to that from Bicep II MAGNUM®. Therefore, Syngenta Crop Protection will continue to develop this unique mesotrione, *S*-metolachlor, and atrazine herbicide premixture formulation for corn.

EFFECT OF ADJUVANTS AND APPLICATION TIMING ON THE EFFICACY OF POSTEMERGENCE APPLICATIONS OF NICOSULFURON PLUS RIMSULFURON AND MESOTRIONE MIXTURES IN CORN. S.K. Rick, L.H. Hageman, K.L. Hahn and D.W. Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Field studies were conducted in corn to determine the effect of application timing and the effect of various adjuvant systems on the control of large crabgrass, green foxtail, yellow foxtail, giant foxtail, and various broadleaf weed species with Steadfast (nicosulfuron + rimsulfuron) plus Callisto (mesotrione) and atrazine tank mixtures. Timing of application at two growth stages, within the labeled corn heights, showed little difference in efficacy on grass and most broadleaf weed species or on crop response. In additional trials, at above maximum weed heights, it was found that use of a MSO/OS adjuvant provided the greatest control of grass weeds when used in combination with Steadfast and the tank mix partners. Crop response in these trials was similar across all adjuvant systems with all treatments.

UTILITY OF GLYPHOSATE FOR SICKLEPOD CONTROL IN FIELD CORN. G.K. Breeden and G.N. Rhodes, Jr., University of Tennessee.

ABSTRACT

Sicklepod (*Senna obtusifolia*) is a troublesome weed in Tennessee and many other southern states. Sicklepod is a summer annual that produces an abundance of seed and can spread quickly. Due to this there will often be multiple flushes of sicklepod during a growing season. Several herbicide options are available for effective sicklepod control. However, no herbicide will give season long control with one application. Many programs utilize a preemergence herbicide followed by a postemergence herbicide to aid in the management of this troublesome weed. The development of adapted Roundup Ready Corn hybrids has increased interest in this technology for field corn (*Zea mays*) weed control. Field research was initiated to determine the utility of multiple applications of glyphosate for sicklepod control in Roundup Ready corn.

In 2003, research was conducted at Greenback, TN in conventional tillage. The experiment was replicated 4 times in a randomized complete block design. Experimental units were 10' wide by 30' long. Glyphosate treatments included in this research were 0.75 lbs. a.e./A applied early postemergence (EPOST) followed by (f.b.) 0.75 lbs. a.e./A mid postemergence (MPOST); 0.75 lbs. a.e./A EPOST f.b. 0.75 lbs. a.e./A MPOST f.b. 0.56 lbs. a.e./A late postemergence (LPOST); 0.75 lbs. a.e./A EPOST f.b. 0.56 lbs. a.e./A LPOST; 0.75 lbs. a.e./A EPOST f.b. 0.75 lbs. a.e./A plus 1.5 lbs. a.i./A atrazine MPOST ; and 0.75 lbs. a.e./A EPOST f.b. 0.75 lbs. a.e./A plus 1.5 lbs. a.i./A atrazine MPOST f.b. 0.56 lbs. a.e./A LPOST. Herbicides were applied with a CO_2 pressurized tractor mounted sprayer. Plots were visually rated using a 0-99% scale. The center 2 rows of each plot were harvested for yield.

Good to excellent (86% or greater) control was observed at 5 weeks after planting (WAP) with all treatments with the exception of 0.75 lbs. a.e./A EPOST f.b. 0.75 lbs. a.e./A MPOST of glyphosate. At 11and 17 WAP fair to excellent (79% to 90%) control was observed with all treatments with the exception of 0.75 lbs. a.e./A EPOST f.b. 0.75 lbs. a.e./A MPOST of glyphosate. All treatments increased yield when compared to a weedy check. However, there were no yield differences among herbicide treatments.

LPOST applications improved sicklepod control. The addition of atrazine MPOST tended to increase the length of control. Two or three applications of glyphosate with or without atrazine can be an effective tool for management of sicklepod in field corn.

COMPARISON OF RICE GRAMINICIDES IN LOUISIANA RICE. R.M. Griffin, E.P. Webster, C.T. Leon, W. Zhang, and C.R. Mudge. Louisiana State University AgCenter, Baton Rouge.

ABSTRACT

A study was conducted in 2002 and 2003 at the Rice Research Station located near Crowley, Louisiana to compare current graminicides and application timings used in Louisiana rice production. Soil was a Crowley silt loam (fine, mixed, thermic Typic Albaqualfs) with 1.4% organic matter and pH 5.5. The design was a randomized complete block with four replications. Application timings evaluated were: early postemergence application made to two- to three-leaf rice (EPOST), late postemergence application made to four- to five-leaf rice (LPOST), and postemergence application made to two- to three-tiller rice after permanent flood establishment (POFL). Herbicide treatments were applied using a CO_2-pressurized backpack sprayer calibrated at 140 L/ha at 186 kPa. Herbicide treatments evaluated were: 280 or 314 g ai/ha cyhalofop applied sequentially using the application timings previously mentioned and 66 g ai/ha fenoxaprop formulated with a safener (fenoxaprop/S) followed by fenoxaprop/S plus fenoxaprop totaling 86 g/ha at the application timings previously mentioned. Crop oil concentrate at 2.5% (v/v) was used with cyhalofop. Visual ratings were taken at 16, 49, and 60 d after final postemergence treatment (DAT). In both years, rice was harvested with a small plot combine and rice was adjusted to 12% moisture.

Barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) control was at least 94% with all treatments at 16 DAT except with treatments containing 46 g/ha fenoxaprop/S plus 40 g/ha fenoxaprop. Amazon sprangletop (*Leptochloa panicoides* (Presl) Hitchc.) control was at least 91% except when 280 g/ha cyhalofop EPOST fb 314 g/ha cyhalofop was applied POFL or with treatments containing 46 g/ha fenoxaprop/S plus 40 g/ha fenoxaprop. Broadleaf signalgrass (*Brachiaria platyphylla* (Griseb.) Nash) control was at least 92% with all treatments. Rice injury did not exceed 5%.

At 60 DAT, barnyardgrass control was at least 91% with all treatments except those containing fenoxaprop applied POFL. Amazon sprangletop control was at least 88% 60 DAT with all treatments except those containing fenoxaprop/S plus fenoxaprop applied POFL. Broadleaf signalgrass control was at least 94%. At 60 DAT, little to no injury was observed.

Fenoxaprop/S applied at 66 g/ha EPOST fb 86 g/ha LPOST yielded 7950 kg/ha. Similar treatments had yields 7010 to 7460 and included 314 g/ha cyhalofop EPOST fb 314 g/ha cyhalofop LPOST, 280 g/ha cyhalofop EPOST fb 314 g/ha cyhalofop LPOST, 280 g/ha cyhalofop EPOST fb 280 g/ha cyhalofop POFL, 66 g/ha fenoxaprop/S EPOST fb 66 g/ha fenoxaprop/S LPOST, and 66 g/ha fenoxaprop/S fb 46 g/ha fenoxaprop/S plus 40 g/ha fenoxaprop POFL. All other treatments yielded 6160 to 6980 kg/ha.

There were few differences in grass control comparing the graminicides evaluated applied LPOST or POFL following an EPOST application. These herbicide treatments may offer producers season-long grass control options. The addition of fenoxaprop to fenoxaprop/S to LPOST or POFL applications may not be required if an EPOST fenoxaprop/S application is made. However, if LPOST or POFL treatments are delayed, the use of fenoxaprop may be required.

LONDAX AND PERMIT: POTENTIAL SAFENERS FOR COMMAND IN WATER SEEDED RICE. C.R. Mudge, E.P. Webster, W. Zhang, C.T. Leon, and R.M. Griffin; Louisiana State University AgCenter, Baton Rouge, LA 70803.

ABSTACT

In 2002 and 2003 field studies were conducted at the Rice Research Station, near Crowley, Louisiana, to determine the effects of Command plus Londax or Permit on water-seeded rice. 'Cocodrie' rice was water-seeded at 150 lb/A. Treatments included Command at 17.6 oz/A plus Londax or Permit at 0.25, 0.5, 0.75, and 1.0 oz/A impregnated onto urea (46-0-0) and applied at a rate of 150 lb/A. Treatments were applied at the pegging (PEG) stage of rice. Three comparison treatments were included: 1) Command alone impregnated on urea, 2) Command impregnated on urea followed by a postemergence (POST) application of 1.0 oz/A Londax on three- to four-leaf rice, and 3) Command impregnated on urea followed by 1.0 oz/A Permit POST. POST treatments were applied 14 d after PEG (DAPEG) with a CO_2- pressurized backpack sprayer calibrated to deliver 15 GPA. Data collected included rice bleaching, rice flatsedge control (*Cyperus iria* L.), and rough rice yield adjusted to 12% moisture.

Rice bleaching was 40 to 42% treated with Command at 7 DAPEG. However, Command plus the addition of any rate of Londax or Permit impregnated on urea reduced bleaching to 23 to 30%, indicating a safening effect. At 21 DAPEG, Command plus Londax or Permit at 0.75 oz/A reduced bleaching to 7 and 8%, respectively, compared with 21% bleaching when treated with Command alone. At 14 DAPOST, Command alone controlled rice flatsedge less than 20%. All treatments containing Londax or Permit PEG or POST controlled rice flastsedge 76 to 95%. Treatments containing Command plus Permit PEG controlled rice flatsedge 92 to 95%. Rice yield was 5330 to 6460 lb/A for treatments containing Command impregnated with Londax or Permit in comparison to 5820 lb/A for Londax or Permit POST following Command at PEG.

In 2003, a laboratory study was conducted to determine the effects of Command plus Londax or Permit on chlorophyll content. Three rice cultivars evaluated included 'Bengal' (medium grain), Cocodrie (long grain), and 'Pirogue' (short grain). Plants were grown in a hydroponic solution with equivalent rates of Command at 17.6 oz/A, or with Londax or Permit at 1 oz/A. A nontreated of each cultivar was included for comparison. Fresh leaf and stem samples were ground and chlorophyll was extracted. Chlorophyll A and Chlorophyll B content were measured with a spectrophotometer set at 645 nm and 663 nm, respectively. Chlorophyll content was expressed in µg of chlorophyll/gram of fresh weight.

Differences in chlorophyll A and B were observed between treatments for Cocodrie. The chlorophyll B content in Cocodrie was 59 and 58 µg/g for Command plus Londax and Permit, respectively, compared with 48 µg/g for Command alone. The nontreated chlorophyll content was 88 µg/g. Chlorophyll content of A and B was higher for the nontreated rice cultivars compared with any rice treated with Command or Command plus Londax or Permit.

These results indicate that producers can use Command plus Londax or Permit impregnated on urea fertilizer. These combinations can safen rice from bleaching caused by Command without a reduction in weed control and yield. Such combinations help broaden weed control spectrum and reduce number of applications, variable cost, and off-site Command movement.

A REGIONAL EVALUATION OF THE CLEARFIELD PRODUCTION SYSTEM VERSUS A CONVENTIONAL SYSTEM IN THE PRESENCE OF RED RICE. R.C. Scott, N.D. Pearrow; Cooperative Extension Service, University of Arkansas, Lonoke, AR 72086; E.P. Webster, LSU AgCenter, Louisiana State University, Baton Rouge, LA; J.M. Chandler and G.N. McCauley; Texas A&M University, College Station, TX; M.E. Kurtz, Mississippi State University, Mississippi Agricultural and Forestry Experiment Station, Stoneville, MS 38776; and B. Guice, BASF Corporation, Winnsboro, LA 71295.

ABSTRACT

A regional study was conducted in Arkansas, Louisiana, Texas and Mississippi to compare the economics of the Clearfield rice (*Oryza sativa*) production system to conventional rice in the presence and absence of known densities of red rice. The conventional variety 'Cocodrie' was grown in comparison to the Clearfield variety 'CL161' and the Clearfield hybrid rice 'CLXL8'. A conventional herbicide program of Command followed by Arrosolo plus permit was used if needed to maintain plots weed-free except for red rice. The Newpath weed control program consisted of one 4 oz/acre application of Newpath applied pre-emergence followed by another 4 ounces at the 4-leaf stage tank mixed with Blazer if needed. Red rice densities were established by placing known quantities of red rice seed in packets alone with the rice varieties. Densities evaluated were 0.33, 1 and 2 seed per square foot. The plots were then planted with individual plot planters in areas known to be free of natural populations of red rice. The number of red rice tillers and/or the number of red rice plants was obtained at least once during the growing season. Rice yield and percent red rice in harvested grain was determined. Preliminary results indicate that red rice competes significantly with these newer rice varieties and yield reductions were observed for some varieties at the low red rice density of 0.33 seed per square foot. The hybrid CLXL8 competed at a higher level with red rice than did CL161 or Cocodrie. No CLXL8 yield reductions were observed at the low red rice density at the Mississippi or Arkansas locations. However, all locations reporting found significant levels of red rice in the harvested grain even at the lower red rice density. At the Lonoke location, the high density of red rice resulted in a 62 bushel per acre yield decrease in Cocodrie with 21% red rice found in the harvested sample. This study will be repeated by all states involved in 2004 and a complete economic assessment made upon completion of two full years of research.

SPRANGLETOP AND RED RICE CONTROL PROGRAMS FOR CLEARFIELD RICE.

M.E. Kurtz, Delta Research and Extension Center, Stoneville, MS 38776; and R.C. Scott, University of Arkansas CooperativeExtension Service, Little Rock, AR 72203.

ABSTRACT

Field experiments were initiated on May 05, 2003 at Stuttgart, AR and May 27, 2003 at Stoneville, MS to evaluate sprangletop [*Leptochloa panacoides (Presl.)Hitch.],* LEFPA and red rice (*Oryza sativa* L.) control in Clearfield 161 rice. Clearfield 161 rice is a second generation, non-transgenic rice variety that is tolerant to Newpath (imazethapyr) herbicide. Clearfield 161 was drill seeded at 90 lb/A in both studies. At Stuttgart, LEFPA was over-seeded and ORYSA was naturally infested. At Stoneville, LEFPA was naturally infested and ORYSA was over-seeded. Herbicides were applied with a hand-held boom calibrated to deliver 10 gpa at Stuttgart and 20gpa at Stoneville. Standard rice production practices were used at each location to insure maximum yield potential. Facet (quinclorac) 0.5 lb ai/A was applied preemergence (PRE) at both locations to control non-target annual grass species and Permit (halosulfuron) 1 oz/A was applied preflood (PFLD) at Stuttgart for nutsedge control. Treatments were: Newpath 4 oz/A PRE followed by (fb) Newpath 4 oz at 1-3 leaf rice, Newpath 4 oz at spike fb Newpath 4 oz at 2-3 leaf rice, Prowl (pendimethalin)1 lb/A +Newpath 4 oz/A delayed preemergence (DPRE) fb Newpath 4 oz 1-3L, Prowl 1 lb/A + Newpath 4 oz/A at spike fb Newpath 4 oz/A at 2-3L, Newpath 4 oz/A + Ricestar (fenoxaprop) 17 oz/A at spike fb Newpath 4 oz/A 2-3L, Newpath 4 oz/A at spike fb Newpath 4 oz/a + Ricestar 17 oz/A at 2-3L, Newpath 4 oz/a + Clincher (cyhalofop)15 oz/A at spike fb Newpath 4 oz/A at 2-3L, Newpath 4 oz/A at spike fb Newpath 4 oz/A + Clincher 15 oz/A at 2-3L, Command (clomazone) 0.3 lb/A PRE fb Newpath 4 oz/A at spike fb Newpath 4 oz/A at 2-3L, Command 0.3 lb/A + Newpath 4 oz/A at spike fb Newpath 4 oz/A at 2-3L, and Newpath 4 oz/A + Superwham (propanil)3 lb/A at spike fb Newpath 4 oz/A at 2-3L. All postemergence treatments included AG-98 at 0.25% v/v.

Data were subjected to ANOVA and means were separated using LSD, p=0.05. Interactions occurred and data were analyzed by location. Sprangletop control ranged from 86- 99% in early June to 97-99% in August at Stoneville. The addition of a PRE grass herbicide with Newpath resulted in greater early season grass control. Sprangletop control at Stuttgart (100%) was equal with all treatments. Red rice control at Stuttgart ranged from 93-100% in early August and dropped to 81-91% in late August. However, variation between replications resulted in no significant differences. Red rice control at Stoneville was 99% for all treatments in late August.

IMAZAMOX HERBICIDE IN CLEARFIELD™ RICE. J.B. Guice, L.J. Newsom, and C.D. Youmans; BASF Corporation; P. Bruno; Agricumbia Resources, Inc., M. Chandler; Texas A&M University, C. Guy; G&H Associates, Inc., F. Baldwin, T. Baldwin; Practical Weed Consultants, Inc., B. Graf, Rice Tec, Inc., B. Scott; University of Arkansas, and E. Webster, Louisiana State University.

ABSTRACT

Imazethapyr (Newpath™) provides excellent red rice control in Clearfield™ rice. Due to various reasons, red rice control with imazethapyr may not be one hundred percent, and these "escaped" red rice plants can outcross with Clearfield™ rice. Therefore, studies were initiated to evaluate imazamox (Beyond™) in Clearfield™ rice for control of "escaped" red rice plants, and thus, protect the Clearfield™ technology in rice.

Field studies were conducted to determine the tolerance of Clearfield 161™ and Clearfield XL8™ to imazamox. Imazamox was applied at 0.047 lb ai/A at four different rice growth stages. All tolerance trials were maintained weed-free with conventional herbicides. Trial design was a randomized complete block with four replications. There was no significant difference, in rough rice yield between treatments. Clearfield XL8™ and Clearfield 161™ exhibited good to excellent tolerance at all rice growth stages.

Red rice control with imazamox was evaluated in field trials. Conventional herbicides were utilized to control all weeds except red rice. Imazamox rates were 0.03, 0.04, and 0.047 lb ai/A, applied to red rice in the 1-2 tiller, 3-4 tiller, boot, and flowering growth stages. Averaged over locations, red rice control was 90-96% and 94-97% at the 1-2 tiller and 3-4 tiller growth stages, respectively. Red rice control decreased when imazamox applications were delayed until the boot and flowering growth stages.

IMAZAMOX VERSUS IMAZETHAPYR AND SALVAGE IN IMIDAZOLINONE-RESISTANT RICE. J.A. Kendig, R.M. Cobill, B.A. Hinklin and P.M. Ezell; University of Missouri Delta Center, Portageville.

ABSTRACT

Like all herbicides, imazethapyr (Newpath or Pursuit) occasionally provides inadequate weed control. However, due the possibility of outcrossing of imidazolinone-resistance from Clearfield varieties to red rice (*Oryza sativa*), near-perfect red rice control is desirable. The current registration and labeling for imazethapyr suggests two applications for adequate control, but does not allow additional applications should there be failures. According to BASF, it is likely that imazamox (Beyond or Raptor) could be registered via a Special Local Need (24c) registration for a salvage/clean-up applications.

In previous soybean research, imazethapyr and imazamox had many similarities in weed spectrum and activity, with imazamox having slightly less soil persistence and slightly better grass activity. However, in limited research, imazamox provided excellent red rice and barnyardgrass control in imidazolinone resistant rice, and it is unclear whether imazamox or imazethapyr is the superior product.

An experiment was conducted to compare imazethapyr and imazamox, and to determine what application schemes were needed for salvage/clean-up applications, around the time of permanent flood, when a grower knew that an earlier application had failed.

Treatments were a four by four by two factorial arrangement of four "set up" treatments, four "salvage" treatments, and a comparison of imazethapyr versus imazamox. The four set up treatments were designed to provide various levels of control failures for the salvage treatments. The setup treatment were: preemergence (PRE) only; mid postemergece (MPOST) at 4- to5- leaf rice); PRE, followed by (fb) MPOST; and early postemergence (EPOST) at 1-to 2-leaf rice fb MPOST. The four salvage/cleanup treatments were:1) approximately 3 days preflood (preflood), approximately 7 days postflood (postflood), sequentially preflood fb postflood and a no-salvage control. The imazethapyr vs. imazamox comparison was made with the following two programs: 1) imazethapyr was used for the setup treatments with imazamox used for salvage/cleanup treatments or 2) imazamox used for the setup treatments and imazethapyr for salvage. All treatments were made at a rates of 0.07 and 0.04 kg/ha (4 fl oz/A and 5 fl oz/A respectively) for imazethapyr and imazamox respectively. Postemergence treatments were applied with a label-recommended surfactant and all plots received an application of acifluorfen for control of hemp sesbannia (*Sesbania exaltata*) and other broadleaf weeds.

Standard weed science methods were used. Plots were 2.2 m by 3.7 m, and were drill-planted with CF-161 rice. The experiment was arranged as a randomized complete block with four replications. Treatments were applied with CO_2-pressurized backpack sprayers at 187 l/ha (20 gpa) using flat-fan tips and a spray pressure of approximately 170 kPa (25 psi). The plot area was infested with red rice (Oryza sativa) and barnyardgrass (*Echinochloa crus-galli*) Visual control ratings were collected at the same time as the MPOST and preflood applications as well as late season. A description of the late-season weed control follows.

When no salvage applications were made PRE-only treatments provided less than 25% red rice control, MPOST-only treatments provided 40% or less red rice control, PRE fb MPOST treatments provided 60% control or less and EPOST fb MPOST provided 86 and 71% red rice control. Imazethapyr tended to provide better red rice control than Imazamox in the setup-only programs. However, when a preflood, "salvage" application of imazamox was made, red rice control was 100%, regardless of the setup program and regardless of whether the salvage treatment was a single preflood application or a preflood fb postflood treatment. A salvage application of imazamox provided poor (less than 50%) red rice control when applied following the worst set-up treatment

(imazethapyr, PRE); however, all other salvage treatments of imazamox provided 85 to 100% red rice control. Rice yields closely reflected the weed control that was observed. The highest yield observed from imazethapyr applied EPOST followed by MPOST followed by imazamox preflood followed by imazamox postflood.

All of the setup treatments, including the EPOST-MPOST sequential treatments benefitted from salvage/clean-up treatments. These data suggest that the currently proposed use patterns (imazethapyr for pre-planned EPOST followed by MPOST, and imazamox for salvage-clean up) are appropriate. No detrimental effects were observed on rice, even when imazethapyr and imazamox were both applied twice.

RESPONSE OF CLEARFIELD RICE TO NEWPATH APPLIED DURING THE REPRODUCTIVE PHASE OF GROWTH. R.T. Dunand, R.R. Dilly, E.P. Webster, C.T. Leon, W. Zhang, and C.R. Mudge; Rice Research Station and Department of Agronomy and Environmental Management, LSU Agricultural Center, Crowley and Baton Rouge, LA.

ABSTRACT

In imidiazolinone-tolerant (Clearfield) rice, resistance to imazethapy (Newpath) allows postemergence control of red rice in rice. Cross pollination between Clearfield rice and red rice is possible and will allow transfer of herbicide resistance to red rice. Prevention of red rice seed formation in Clearfield rice is requisite to prevent cross pollination and safeguard the technology. Mid- and late-season applications of Newpath were evaluated to determine the effect on Clearfield rice as part of an overall evaluation of the effectiveness of these applications to prevent pollination between Clearfield rice and red rice.

Clearfield rice (CL161) was drill-seeded on 7-inch rows at 90 lb/A on May 13, 2003, in an area naturally infested with red rice at the Rice Research Station in Crowley. Plot size was 8.75 (15 rows) x 20 ft. Soil type was Crowley silt loam. Agricultural chemicals were applied as recommended for general pest control. Experimental design was a randomized complete block containing seven treatments (timings) and a control with four replications of each. Newpath (BASF Corp., Research Triangle Park, NC) was applied postemergence (3- to 4-leaf stage) on June 9, 2003, and flood establishment was 4 days later. No more than three red rice plants survived in each plot. Midseason treatments of Newpath were applied before heading during the panicle differentiation (PD – 18 July), early boot (EB – 23 July), mid boot (MB – 28 July), and late boot (LB – 1 Aug) stages of growth. Late-season treatments were applied at and following heading during the 50% heading (50Hd – 7 Aug), 100% heading (100Hd – 12 Aug), and milk (MS – 18 Aug) stages of growth. Regardless of timing, Newpath was applied at 4 fl oz/A with a CO_2 driven backpack sprayer using a delivery rate of 15 gal/A.

Crop (CL161) stature and maturity were unaffected by Newpath. Mature plant height averaged 106 cm across all treatments and ranged between 106 and 107 cm (control = 106 cm). Grain moisture (an indicator of crop maturity) averaged 21.3% across all treatments and ranged between 21 and 21.8% (control = 21.7%). Casual observation indicated none of the treatments caused visual injury to the foliage.

Grain production was significantly reduced in CL161 by the mid- and late-season applications of Newpath. On average, treatments with Newpath averaged 7397 lb/A and ranged between 6994 and 7828 lb/A (control = 8090 lb/A). CL161 exhibited a slight sensitivity to Newpath applied at PD (7609 lb/A) and 50Hd (7828 lb/A), an intermediate sensitivity at EB (7393 lb/A), MB (7425 lb/A), and MS (7367 lb/A), and a strong sensitivity at LB (7162 lb/A) and 100Hd (6994 lb/A). The approximate average reductions in yield for the slight, intermediate, and strong sensitivity groups were 300, 600, and 1000 lb/A or 4, 8, and 12%, respectively. Sensitivity increased with crop age with the exception of 50Hd.

Components of yield provided some indication (not significant) of the impact of mid- and late-season applications of Newpath on grain production of CL161. Panicle densities in treatments with Newpath applied at the PD, EB, 50Hd, 100Hd, and MS growth stages averaged 25 panicles/sq ft and ranged between 24 and 26 panicles/sq ft. Panicle densities in treatments with Newpath applied at the MB and LB growth stages were 22 panicles/sq ft for each. Panicle density of the control was 23 panicles/sq ft. In general, seed density was low for Newpath applied at the PD, EB, MB, and MS growth stages and averaged 101 seed/panicle (range = 99 to 103 seed/panicle) compared with the control (107 seed/panicle). Seed density was high for Newpath applied at the LB, 50Hd, and 100Hd growth stages, and averaged 111 seed/panicle (range = 109 to 113 seed/panicle). Individual seed weight (1000-grain weight) was unaffected by Newpath. Individual seed weight averaged 19.6 g across all Newpath treatments and ranged between 19.5 and 19.9 g (control = 19.8 g).

Milling yield was positively affected by Newpath. Total milling yield (amount of grain remaining after hull and bran removal) averaged 65.1% for treatments with Newpath applied at the PD, EB, MB, 50Hd, 100Hd, and MS growth stages (range = 64.5 to 65.9%) compared with 63.8% in the control and 63.7% in the LB treatment. Similarly, whole milling yield (amount milled rice remaining unbroken after milling) was 68.1, 67.0, and 66.7%, respectively.

CL161 exhibited sensitivity to Newpath applied during the pre- and post-heading stages of reproductive growth. Using mid- and late-season applications of Newpath to prevent cross pollination between Clearfield rice and red rice will need to be weighed against the possible associated loss in grain production.

COMPETITIVENESS OF RICE CULTIVARS, WELLS, CL161, AND XL8 AT VARIOUS SEEDING RATES. B.V. Ottis, M.S. Malik, and R.E. Talbert. Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

ABSTRACT

New rice cultivars have been released that have yield potential greater than 200 bu/A. However, in order to achieve high yields it is important to have the proper fertility, seeding rate, and weed control. It is not well understood how these new, high-yielding cultivars respond to varying weed control levels. The most recent research established barnyardgrass threshold levels of 0.5 to 1.0 plants/ft^2 using older cultivars.

Studies were established in 2002 and 2003 at the Rice Research and Extension Center at Stuttgart, AR, to evaluate the innate competitive abilities of three new rice cultivars at reduced seeding rates. Representatives from each of the three classes of long grain rice were selected. 'Wells' represented conventional long grain rice, 'CL161' represented semi-dwarf, imidazolinone-tolerant rice, and 'XL8' represented hybrid, long-grain rice. A randomized complete block design with four replications was used. Treatments were arranged in a factorial arrangement, with factors consisting of three rice cultivars, four plant populations (5, 10, 20, and 40 plant/ft^2) and four levels of weed control (25, 50, 75, and 100%). Planting rates for each cultivar were established based on seed counts of the respective rice cultivars.

Weed control was managed with timely herbicide applications in an effort to achieve the above control levels. Plant populations were verified by stand counts after rice emergence. Harvest index and combine yield from each plot were also collected. Ground cover was also evaluated within 100% control plots to determine canopy closure using a digital camera as another factor of competitive ability. Grain yield was measured and adjusted to 12% moisture prior to analysis. Statistical analysis was done using the PROC REG function in SAS.

Cultivar and seeding rate were not significant factors for rice yield. As barnyardgrass control increased, rice yield increased with all cultivars at all seeding rates. Cultivar was not significant for harvest index, and harvest index increased as rice stand decreased and barnyardgrass control increased. Canopy coverage analysis revealed that XL8 achieves canopy closure one wk prior to CL161 and two wk prior to Wells when averaged across seeding rates.

A NEW HERBICIDE FOR USE IN CLEARFIELD RICE. C.D. Youmans, J.B. Guice, J.M. Chandler, J.A. Kendig, M.E. Kurtz, R.C. Scott, R.E. Strahan, E.P. Webster, and B. Williams; BASF Corp., Dyersburg, TN, BASF Corp., Winnsboro, LA, Texas A&M Univ., College Station, TX, Univ. of Missouri, Portageville, MO, Mississippi St. Univ., Stoneville, MS, Univ. of Arkansas, Lonoke, AR, Louisiana St. Univ., Baton Rouge, LA, Louisiana St. Univ., Baton Rouge, LA, and Louisiana St. Univ., St. Joseph, LA.

ABSTRACT

The primary objective of this trial was to evaluate the performance of BAS 772H herbicide in CLEARFIELD Rice (Oryza sativa). Field trials were conducted in 2003 in Arkansas, Louisiana, Mississippi, Missouri, and Texas, utilizing small plots of approximately 30m^2. BAS 772 is a new herbicide being developed by BASF Corporation for use in CLEARFIELD rice varieties, a type of rice tolerant to imidazolinone herbicides. BAS 772 has two active ingredients, quinclorac and imazethapyr (4.8:1 ratio), and was tested as a 75DF formulation. The proposed recommended use rate of BAS 772 is 7.8 oz formulated product per acre (.3 lb ai. of quinclorac + .063 lb ai/a of imazethapyr). BAS 772 data indicates good to excellent activity on important weeds when applied preemergence (PE) or postemergence (PO) to CLEARFIELD rice, up to the 1-tiller CLEARFIELD rice stage.

Herbicides (and rates) tested included BAS 772 (.36 lb ai/a) and NEWPATH [(imazethapyr) .063 lb ai/a] and any PO timing included 1% crop oil. Timings, including single applications of BAS 772 (PE or PO at 1-leaf) and sequential applications (PE, 1-leaf, 4-leaf, or 1-tiller rice stage) of BAS 772 and NEWPATH were tested.

Red rice (Oryza sativa) were controlled 61 and 73% with BAS 772 applied either PE or PO, respectively. When BAS 772 was applied PE and fb NEWPATH (PO at 4 lf), red rice was controlled 99%. NEWPATH PE fb BAS 772 (PO at 4-leaf) resulted in 97% red rice control. In PO sequential treatments, BAS 772 (PO at 1-leaf) fb NEWPATH (PO at 1-tiller) resulted in 97% red rice control. In PO sequential treatments, NEWPATH (PO at 1-leaf) fb BAS 772 (PO at 1-tiller) resulted in 98% red rice control.

Amazon sprangletop (Leptochloa panicoides) was controlled 94% with NEWPATH (1-leaf) fb BAS 772 (1-tiller). Barnyardgrass (Echinochloa crus-galli) was controlled 96 – 98% or greater with BAS 772 / NEWPATH sequential applications, and the herbicide sequence did not matter. BAS 772 applied PE or PO (1-leaf rice stage) controlled hemp sesbania (Sesbania exaltata) 97 and 99%, respectively in Mississippi and Texas. CLEARFIELD rice was yielded in Arkansas, where yields following BAS 772 alone or in a sequential applications with NEWPATH, were 14,139 kg/ha or greater, with no significant difference in yield. The PO sequential treatments resulted in the greatest numerical yield, 15,342 and 16750 kg/ha.

BAS 772H appears to provide an excellent pre-mix for CLEARFIELD rice.

PENOXSULAM: A NEW HERBICIDE FOR RICE IN THE SOUTHERN U.S. R.B. Lassiter, V.B. Langston, J.S. Richburg, R.K. Mann, D.M. Simpson and T.R. Wright; Dow AgroSciences LLC, Little Rock, AR, The Woodlands, TX, Wayside, MS and Indianapolis, IN.

ABSTRACT

Penoxsulam (DE-638) is a new broad-spectrum triazolopyrimidine sulfonamide herbicide being developed globally for rice weed control. In US field trials from 1998 to 2003, penoxsulam at 20 to 40 g ai ha^{-1} as a postemergence foliar application preflood in dry-seeded rice and as a postemergence foliar application in water-seeded rice provided good to excellent control of all annual and perennial *Echinochloa* species as well as many annual rice weeds including hemp sesbania (*Sesbania exaltata*), northern jointvetch (*Aeschynomene virginica*), dayflower (*Commelina diffusa*), ducksalad (*Heteranthera limosa*), alligatorweed *(Alternanthera philoxeroides*), Texas/Mexicanweed (*Caperonia* spp), smartweed (*Polygonum* spp), annual sedge (*Cyperus* spp), and several other broadleaf weeds. Penoxsulam provided 2 to 4 weeks residual weed control of susceptible weeds in dry-seeded rice. Dry and water-seeded rice demonstrated good to excellent tolerance to penoxsulam when applied from early postemergence to rescue timings. Penoxsulam can be tank mixed with cyhalofop, triclopyr, propanil, clomazone, and pendimethalin to increase the weed control spectrum. Registration is expected in 2005 and will marketed in the southern US under the trade name of Grasp®

® Trademark of Dow AgroSciences LLC.

TEXASWEED (*CAPERONIA PALUSTRUS*) CONTROL IN RICE WITH PENOXSULAM.

R.E. Strahan; Department of Agronomy, LSU Agricultural Center, Baton Rouge, LA 70803.

ABSTRACT

Penoxsulam is a new ALS inhibiting rice herbicide from Dow AgroSciences that will be commercially released in 2005 or 2006. The broadleaf weed control spectrum for this herbicide is currently being investigated in LA rice.

A field study was conducted at Angelina Plantation, Deer Park, LA in 2003 to evaluate the efficacy of penoxsulam and several registered herbicides for texasweed (*Caperonia* palustrus) control in drill seeded CL-161 rice. Penoxsulam was evaluated at 0.036 and 0.045 lb ai/A versus bispyribac-sodium, bensulfuron, triclopyr, carfentrazone and several tankmix combinations of these products. Herbicides were applied to rice at the 3 leaf growth stage and texasweed that ranged in size from cotyledon to 3 inches tall. The weed population was very heavy and averaged 7 plants/ft^2. Study design was a randomized complete block with three replications and 10 total treatments. Visual texasweed control ratings and rice injury were subjected to analysis of variance. Means were separated using Fisher's Protected LSD at the 5% level.

Texasweed control 14 days after treatment (DAT) was similar for penoxsulam at 0.036 and 0.045 lb ai/A (82 and 77%) and bispyribac-sodium, triclopyr, bensulfuron, and bensulfuron + carfentrazone (75 – 83%). By 35 DAT, both rates of penoxsulam, bensulfuron, bensulfuron + carfentrazone, tryclopyr + bispyribac-sodium and triclopyr + propanil provided at least 95% control. However, by 70 DAT, texasweed control for the low and high rates of penoxsulam decreased to 83 and 85%, respectively. Excellent control was observed with bensulfuron (98%) bensulfuron + carfentrazone (97%), triclopyr + bispyribac (98%), and tryclopyr + propanil (95%). Reduced control observed at this late rating period with penoxsulam could be attributed to the producer's difficulty in maintaining a consistent permanent flood in the field and an extremely high population of late emerging texasweed.

Results of this study indicated that penoxsulam can be an effective herbicide for controlling texasweed. However, as with most rice herbicides water management appears to be a very critical component for maintaining seasonlong texasweed control with penoxsulam.

ALLIGATORWEED [*Alternanthera philoxeroides* (Mart.) Griseb.] CONTROL IN RICE WITH DE-638. J.H. O'Barr, G.N. McCauley, J.M. Chandler; Soil & Crop Sciences Department, Texas A&M University, College Station, TX; V.B. Langston, Dow AgroSciences LLC, The Woodlands, TX.

ABSTRACT

Alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb.] control in rice with DE-638. DE-638 (penoxsulam) was evaluated near Eagle Lake and Rock Island, TX for alligatorweed control in rice. Applications were made at two timings; early post emergence (EPOST) at the rice three leaf stage with alligatorweed 3-5 inches tall, and late postemergence (LPOST) when rice was at the five leaf stage and alligator weed 6-8 inches tall. DE-638 was applied at 0.027 lbs active ingredient (ai)/acre (A) alone and in combinations with 2 lbs ai/A Stam and 0.5 pints/A Grandstand EPOST and with 4 lbs ai/A Stam and 0.67 pints/A Grandstand LPOST. A tankmix of Stam/Grandstand without DE-638 was also evaluated at each timing. DE-638 alone provided greater than 80% alligatorweed control. Addition of Grandstand to DE-638 improved alligatorweed control to better than 93%. A tankmix of DE-638 with Stam provided less than 50% control. A tankmix of Stam/Grandstand without DE-638 provided about 20% control. Moisture was critical for good weed control and efficacy increased when soil was moist prior to herbicide application.

EVALUATION OF DE-638 IN DRILL-SEEDED RICE. B.J. Williams, A.B. Burns, and D.B. Copes; Northeast Research Station, St. Joseph, La., Louisiana State University AgCenter, Baton Rouge, La. 70803.

ABSTRACT

The efficacy of DE-638 (penoxsulam) was evaluated in 2003 at the Northeast Research Station near St. Joseph, La. and at Woodsland plantation near Monroe, La. on a Sharkey clay soils. A water- and dry-seeded study was conducted at St. Joseph and an alligatorweed study was conducted at Woodsland plantation on fallow ground. Herbicide treatments were applied, using CO2 pressurized backpack sprayer calibrated to deliver 140 L/ha, to plots measuring 2 by 4.5 meters. Rice "Cocodrie" was drill-seeded at 101 kg/ha on a 19 cm spacing in dry-seeded rice and broadcast at 170 kg/ha in water-seeded rice. After draining the seeding flood, plots were flushed weekly and flooded 4 WAP in the water-seeded rice trial. In the dry-seeded trial, plots were flushed as needed and flooded 5 WAP. The experimental design for the experiments was a randomized complete block. Weed control ratings, rice injury ratings, and rice yield data were subjected to analysis of variance. Means were separated using Fisher's Protected LSD at the 5% level. Penoxsulam at 0.039 and 0.054 kg/ha was as effective as 0.042 kg/ha bensulfuron at controlling ducksalad in water-seeded rice. Ducksalad (*Heteranthera limosa*) was not controlled by 0.026 kg/ha bispyribac or 0.030 kg/ha penoxsulam. Tank mixing 0.03 kg/ha penoxsulam with 0.021 kg/ha carfentrazone or 0.42 kg/ha quinclorac improved ducksalad control from 78 to 82 and 87%, respectively. In water seeded rice, penoxsulam 0.054 kg/ha and bispyribac controlled rice flatsedge (*Cyperus iria*) 87 and 88%, respectively. Lower rates of penoxsulam were not as effective as 0.054 kg/ha. However, tank mixing 0.030 kg/ha penoxsulam with carfentrazone improved flatsedge control from 80 to 88 and 85%. Bensulfuron did not control flatsedge. In dry-seeded rice, a preemergence application of 0.03 kg/ha penoxsulam plus 0.56 kg/ha clomazone controlled barnyardgrass (*Echinochloa crus-galli*) 90%, Amazon sprangletop (*Leptochloa panicoides*) 70%, rice flatsedge 86%, and hemp sesbania (*Sesbania exaltata*) 40% 2 WAF. Clomazone applied alone controlled barnyardgrass 60% and sprangletop 70% and did not control flatsedge or sesbania. Penoxsulam was more effective POST than PRE. At 6 WAF, barnyardgrass, flatsedge, and sesbania control was at least 85% when clomazone was followed by penoxsulam compared to only 60% barnyardgrass, 77% flatsedge, and no sesbania control from clomazone plus penoxsulam applied PRE. Cyhalofop plus penoxsulam applications resulted in good to excellent control of barnyardgrass, sprangletop, flatsedge, and sesbania control. Overall, weed control was best when penoxsulam was tank mixed with the second cyhalofop application. Penoxsulam at 0.035 kg/ha controlled alligatorweed (*Alternathera philoxeroides*) (80%) as well as 0.28 kg/ha triclopyr at 4 WAT, but dropped to less than 70% by 6 WAT. The best alligatorweed control, 90% 4WAT and 85% 6 WAT, was observed from 0.054 kg/ha penoxsulam. Tank mixing low rates of penoxsulam with triclopyr did improve alligatorweed control over that observed with triclopyr alone. Overall, penoxsulam compared very well to standard herbicides and has the potential to control some important broadleaf weed problems in rice. Higher rates need to be evaluated, especially if substantial residual weed control is expected from PRE applications.

BROADLEAF WEED CONTROL WITH CARFENTRAZONE TANK MIXTURES IN RICE.

A.T. Ellis and R.E. Talbert. Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR.

ABSTRACT

An experiment was conducted in 2003 to evaluate the performance of carfentrazone (Aim) tank mixed with various broadleaf herbicides. The experiment was conducted at Rice Research and Extension Center at Stuttgart, Arkansas on a Dewitt silt loam. The experimental design was a randomized complete block design with four replications. 'Francis' was the variety used in the experiment. Broadleaf weed species, hemp sesbania (*Sesbania exalta*), pitted morningglory (*Ipomoea lacunosa*) and northern jointvetch (*Aeschynomene virginica*) were sown in rows perpendicular to the drilled rice.

A blanket application of clomazone (Command) at 0.4 kg ai/ha was applied to the entire study area. Carfentrazone at 0.028 kg /ha + NIS 0.25% V/V was applied alone and with tank mixtures preflood (PREFLD) applications of bentazon + aciflurofen (Storm) at 0.28 kg/ha, triclopyr (Grandstand) at 0.028 kg/ha, bispyribac-sodium (Regiment) at 0.042 kg/ha, propanil (Stam) at 4.45 kg/ha, halosulfuron (Permit) at 0.028 kg/ha. Carfentrazone was also in a tank mixture at 0.028 kg/ha + NIS 0.25% V/V with 2,4-D amine (Savage) at 0.28 kg/ha applied postflood (POSTFLD).

Greater than 98% control of hemp sesbania was achieved with all treatments except for carfentrazone + triclopyr (28%) and carfentrazone + bispyribac-sodium (46%). Pitted morningglory was controlled at 100% with all treatments. Northern jointvetch control was >80% with carfentrazone + 2,4-D amine, carfentrazone + halosulfuron and carfentrazone + bispyribac-sodium with Carfentrazone (22%), acifluorfen + bentazon (26%), triclopyr (32%), propanil (68%). No significant crop injury was observed.

REGIMENT EFFECT ON RICE GROWTH AND YIELD. J.D. Scasta, J.H. O'Barr, G.N. McCauley, G.L. Steele, J.M. Chandler; Texas Agricultural Experiment Station, Texas A&M University, College Station, TX 77843.

ABSTRACT

Field research was conducted in 2003 to evaluate the effects of Regiment (bispyribac-sodium) on rice growth and yield. Experiments were conducted at the Texas Agricultural Experiment Station Research and Extension Centers near Beaumont and Eagle Lake, TX. Each experiment was conducted as a randomized complete block and treatments were replicated four times. Treatments of Regiment were applied early postemergence (EPOST), preflood (PREFL) and postflood (POSFL) alone; EPOST followed by (fb) PREFL or POSFL; and PREFL fb POSFL. Regiment rates were 22.2, 28, and 33.6 g ai/ha for all EPOST, PREFL, and POSFL applications, respectively. Rice was visually evaluated for stunting, and plant samples were measured biweekly for root and shoot length and dry weight. Yield was determined by mechanically harvesting the center 4 rows of each 6-row plot.

All Regiment combinations, except for the POSFL treatment, injured rice 10 to 15% at 14 days after treatment (DAT) of PREFL at Beaumont. By 34 DAT rice had recovered from injury, with the exception of Regiment POSFL (10%). At 5 DAT in Eagle Lake, only treatments that included a PREFL application caused injury (26-30%). By 42 DAT rice injury had diminished to 5% or less. Root length decreased proportionally with increasing total amount of Regiment applied in Beaumont at 14 DAT preflood. By 42 DAT root stunting had diminished and did not differ between treatments. Root weight at Beaumont, 14 DAT, was significantly reduced by EPOST and EPOST fb PREFL applications. Root weight with the EPOST treatment remained significantly lower at 42 DAT but root weight with the EPOST fb PREFL treatment had recovered. At 14 DAT in Eagle Lake only the single PREFL application significantly reduced root weight. At 42 DAT there was no significant differences among root weights, regardless of rate or timing of applications.

Shoot length at Beaumont 14 DAT did not differ from the control, with the exception of Regiment EPOST fb PREFL. There were no differences in shoot length at 42 DAT. Regiment applied EPOST and EPOST fb PREFL reduced shoot weight at 14 DAT, but shoot weight had recovered by 42 DAT. There were no differences in shoot weight detected in Eagle Lake, at either evaluation date. Rice yield at Beaumont did not significantly differ among Regiment treatments, and all herbicide treatments yielded higher than the weedy check. Rice yields with Regiment at Eagle Lake were not different from the weed-free check. The only yield reduction with Regiment treatments occurred with Regiment PREFL (7280 kg/ha) compared to Regiment EPOST (8198 kg/ha).

In conclusion, Regiment application, especially at the PREFL timing injured rice up to 30%. Root injury, expressed as root length and weight, increased with Regiment rate. Regiment treatments had little effect on shoot length and weight. Rice injury had diminished by harvest, and, in general, rice injury did not translate into yield reduction.

BISPYRIBAC WEED CONTROL PROGRAMS IN DRILL SEEDED RICE. R.M. Cobill, J.A. Kendig, B.A. Hinklin and P.M. Ezell. University of Missouri-Delta Center, Portageville, MO 63873.

ABSTRACT

Field studies were conducted in 2002 and 2003 at the University of Missouri-Delta Center Lee Farm near Portageville, MO on a Portageville Clay soil. Control of barnyardgrass [*Echinochloa crus-galli* (L.) Beauv] and Amazon sprangletop [*Leptichloa panicoides* (Presl.) Hitchc] were evaluated 2 and 4 weeks after the preflood treatment application.

This study focused on sequential and tank mix weed control programs with bispyribac. Sequential treatments were a preemergence (PRE), delayed preemergence (DPRE), or early postemergence (EPOST) herbicide followed by a preflood application of bispyribac. Tank mix programs were based on early postemergence (2-3 grass leaf stage) treatments of bispyribac tank mixed with various residual herbicides. Early treatments included 0.5 lb ai/A clomazone PRE, 1.0 lb ai/A pendimethalin DPRE, 4 lb ai/A thiobencarb DPRE, 3 lb ai/A propanil EPOST, 4.5 lb ai/A propanil+molinate (Arrosolo) EPOST , 0.25 lb ai/A cyhalofop EPOST , 0.063 lb ai/A fenoxoprop (Ricestar) + 0.013 lb ai/A fenoxoprop (Whip) EPOST, and 0.02 lb ai/A bispyribac-sodium. The Ricestar + Whip treatment is equivalent to 14 fluid ounces of the 2003 formulation of Ricestar and 4 fluid ounces of Whip. Treatments also included a no early post followed-by (fb) bispyribac PREFLD control. Tank mix applications included bispyribac alone, bispyribac + clomazone, bispyribac + pendimethalin, bispyribac + thiobencarb, and bispyribac + quinclorac. All tank-mix applications were applied EPOST.

Barnyardgrass control 2 weeks after preflood treatments ranged from 23 to 91%. Control with the EPOST followed by bispyribac treatments was 78 to 91%, and was better than most bispyribac tank-mix applications except pendimethalin + bispyribac, which provided 84% barnyardgrass control. By 4 weeks after preflood applications, barnyardgrass control ranged from 22 to 96%. The best control was achieved with the sequential treatments, where control ranged from 82 to 95%. Control from the tank-mix of pendimethalin + bispyribac EPOST, 82%, was comparable to the its DPRE followed by PREFLD equivalent. Amazon sprangletop control 2 weeks after the preflood treatment ranged from 79 to 95% where control with pendimethalin DPRE fb bispyribac PREFLD (95%) was greater than with bispyribac alone EPOST (79%). By 4 weeks after preflood treatment, Amazon sprangletop control ranged from 33 to 97%. Control with pendimethalin DPRE fb bispyribac PREFLD (97%) and pendimethalin + bispyribac EPOST (94%) were comparable. Amazon sprangletop control with thiobencarb DPRE fb bispyribac PREFLD (94%) was better than the tank-mix with bispyribac (59%). Control with the pendimethalin fb bispyribac (97%), pendimethalin + bispyribac (89%), and thiobencarb EPOST fb bispyribac PREFLD (94%) were better than clomazone + bispyribac (63%), thiobencarb + bispyribac (59%), bispyribac fb bispyribac (59%), and quinclorac + bispyribac (34%).

This data indicates that barnyardgrass control with bispyribac is best achieved with a sequential program where bispyribac is applied preflood following the use of an earlier treatment with another herbicide. Early post tank mixtures of bispyribac with residual herbicides generally resulted in reduced weed control. Control with sequential applications ranged from 82 to 95% versus less than 80% with the tank-mix applications, with the exception of pendimethalin + bispyribac (84%) four weeks after bispyribac PREFLD application. The best Amazon sprangletop treatments included command PRE, DPRE applications of pendimethalin or thiobencarb, EPOST applications of propanil + molinate or propanil fb bispyribac and pendimethalin + bispyribac, where control ranged from 80 to 97%. These treatments provided better control than that achieved by thiobencarb + bispyribac (59%), bispyribac fb bispyribac (59%) and quinclorac + bispyribac (34%).

RICE VARIETAL RESPONSE TO DRIFT RATES OF GLYPHOSATE. M.B. Kelley, K.L. Smith and R.C. Scott; University of Arkansas, Southeast Research and Extension Center, Monticello, AR and Cooperative Extension Service, Lonoke, AR.

ABSTRACT

Past research has shown that the Cocodrie rice variety has low tolerance for high drift rates of glyphosate when sprayed at either the 3 to 4-leaf, preflood or postflood stages. When applied at the 0.1x rate, glyphosate significantly reduced both heading and yield. Variety tolerance screens conducted in 1995 (Yan) examined tolerance of 25 germplasm varieties and 6 commercial varieties to 0.5x, 1.0x, 1.5x and 2.0x rates of glyphosate. Great variability in crop response existed among varieties and across locations. This variability suggests the need for further exploration for tolerance to lower rates more common with herbicide off-target movement. A study was conducted in Rohwer, AR in 2003 on sharkey clay soil in a standard small plot design to examine rice varietal response to drift rates of glyphosate. Drew, Lagrue, Cocodrie, CL-161, XL-8, Wells, Bengal, Katy, Areant, and Francis rice varieties were grown in 4.5 ft x 20 ft plots and treated at various growth stages with 0.008 and 0.08 lb ae/a glyphosate (Roundup Weathermax) to simulate 0.01x and 0.1x use rates. Glyphosate was applied at the 3 to 4-leaf, 1 week postflood, and preboot growth stages. CL-161, XL-8 and Katy varieties showed the greatest visual injury at 20% when sprayed with 0.1x rate of glyphosate at the 3 to 4-leaf stage. Bengal and Areant showed 10% and 15% visual injury respectively at the same rate and timing, and Drew was not affected at this growth stage. At the 0.01x rate of glyphosate at the 3 to 4-leaf stage, the greatest visual injury was exhibited by XL-8, Bengal and Katy showing 20-25% visual injury. CL-161 expressed 17% visual injury. At the 1 week postflood application of 0.1x rate of glyphosate, Bengal had 12% visual injury and XL-8 had no visual injury. All other varieties showed 20% and greater injury. No significant visual injury was seen at the 0.01x rate. No yield reductions resulted from either rate of glyphosate at the 3 to 4-leaf or post-flood growth stages. At the preboot timing, CL-161, Cocodrie, and Bengal had 17-25% injury at the 0.1x rate. At the 0.01x treatment, Bengal showed 21% injury. Yields were not reduced at the 3 to 4-leaf stage or the 1 week postflood stage at either rate of glyphosate. When applied at the preboot stage, the 0.01x rate caused reductions in yield of Cocodrie, CL-161, Bengal, Areant, and Francis varieties. The crop response to glyphosate between varieties changed with growth stage applications. The 0.1x rate significantly reduced yields for all varieties. Varietal response in percent yield reductions from lowest to highest were: XL-8, Wells, Areant, Cocodrie, Francis, CL-161, Bengal, Lagrue, Drew and Katy.

SUPREND (PROMETRYN + TRIFLOXYSULFURON) WEED CONTROL PROGRAMS IN COTTON. J.A. Kendig, R.M. Cobill, B.A. Hinklin, and P.M. Ezell; University of Missouri Delta Center, Portageville.

ABSTRACT

Suprend is a soon-to-be registered, postemergence-directed herbicide based on prometryn (Caparol) and trifloxysulfuron (Envoke). Caparol can be slightly weak for control of morningglory (*Ipomoea* spp.), nutsedge (Cyperus spp.) and sicklepod (*Senna obtusifolia*), which are weeds controlled strongly with Envoke. Conversely, Caparol provides generally good Palmer amaranth (*Amaranthus palmeri*) control, which can be a weakness with Envoke. Postemergence directed herbicides all require the establishment of a good weed-to-cotton height differential where directed sprays will cover the majority of weed foliage, with relatively little contact with cotton foliage. When there is an adequate cotton:weed height differential, most directed herbicides will provide excellent weed control. When height differentials are not adequate, post directed herbicides generally fail, regardless of the product.

Because Suprend is based largely on Caparol, experiments were conducted to compare these herbicides in several equivalent weed control programs. Treatments were a factorial arrangement of two preemergence (PRE) treatments; three early POST, over-the-top treatments (EPOST) and Caparol versus Suprend, post directed (DIR). Preemergence treatments were no herbicide or Prowl (pendimethalin) at 1 lb ai/A. Postemergence over-the-top treatments were Touchdown IQ (diammonium glyphosate with surfactant) at 0.75 lb ae/A, Touchdown plus + Dual II Magnum (s-metolachlor) at 0.96 lb ai/A and Touchdown plus Staple (pyrithiobac) at 0.031 lb ai/A. Suprend and Caparol were applied in tank mixture with 2 lb ai/A of MSMA in surfactant-containing formulation. No surfactant was added to the EPOST treatments.

The experiment was conducted using standard weed science methodology. 'Suregrow 501BR' cotton was planted in 30" rows and Prowl treatments were applied on June 15, 2003. After unusually cool and wet weather, plots were treated with Gramoxone (paraquat) and cotton was replanted on May 27. Early postemergence treatments were applied June 24, and directed treatments were applied July 11. Treatments were applied to 3 rows (in 4-row plots with a running check) using CO2-pressurized sprayers. Hand-held equipment was used for PRE and EPOST treatments and a tractor mounted-directed sprayer was used for DIR treatments. All treatments were broacast.

There were no differences in late season control between Suprend and Caparol for control of goosegrass (*Eleusine indica*) and Palmer amaranth. Ivyleaf and entireleaf morningglory *(Ipomoea hederacea*) control was 5% better with Suprend versus Caparol. Early season control (before directed applications) of Palmer amaranth and Ivyleaf and Entireleaf morningglory were not affected by the Prowl treatment. However, Touchdown plus Dual Magnum provided the best Palmer amaranth and goosegrass control, while Touchdown plus Staple provided the best morningglory control.

Sicklepod, and nutsedge were not present in these tests; however, glyphosate typically provides excellent sicklepod control alone and MSMA provides good nutsedge control. Differences between Caparol and Suprend may be minor, especially when there is a good cotton:weed height differential.

EVALUATION OF TRIFLOXYSULFURON AND PROMETRYN AS A POST-DIRECTED WEED CONTROL PROGRAM IN COTTON SYSTEMS. M.T. Kirkpatrick, D.B. Reynolds, L.T. Barber, J.J. Walton, and J.C. Sanders Mississippi State University Mississippi State, MS 39762.

ABSTRACT

Trifloxysulfuron and prometryn are broad spectrum herbicides for postemergence weed control in cotton. These two herbicides will be marketed as a premix under the trade name Suprend. A three year study was designed to address weed control efficacy of Suprend following Touchdown (glyphosate) or Touchdown plus Dual (metolachlor) applied early postemergence over-the-top, in a weed management program. The test was designed as a randomized complete block design with four replications, and conducted at the Black Belt Branch Experiment Station in Brooksville, MS in 2002 and 2003, and at the Mississippi State Plant Science Research Center in Starkville, MS in 2003. Touchdown (0.75 lbs ae/A) or Touchdown plus Dual (0.95 lbs ai/A) were sprayed as a postemergence over-the-top treatment when cotton was three inches tall. Suprend was applied either post-directed at 6- to 10-inch cotton or layby following the topical application of Touchdown or Touchdown plus Dual. Suprend rates of 0.6, 0.8, 1.0, 1.2 lb ai/A were used at each of the application times. Weed control ratings were taken 7, 14, and 21 days after each application.

Results of these studies indicate no differences in pitted morningglory (*Ipomea lacunosa*), palmleaf morningglory (*Ipomea wrightii*), and entireleaf morningglory (*Ipomea hederacea* var. *integruiscula*) control between Touchdown alone followed by Suprend and Touchdown + Dual followed by Suprend, when applied as a post-directed application or layby. Both chemical combinations resulted in good weed control regardless of Suprend rate and a high weed mortality was observed on each weed species at the post-directed application timing. Furthermore, all treatment combinations that included Suprend resulted in greater control than Touchdown applied alone or in combination with Dual. Large crabgrass control increased when Touchdown was applied in combination with Dual (78%) compared to Touchdown alone (45%). The results further indicated that application timing of Suprend effected pitted and entireleaf morningglory efficacy, with a post-directed application of Suprend greatly increasing weed control (80%) of these species over a layby application (68%). A post-directed application of Suprend also resulted in increased seed cotton yield compared to a layby application. However, if Suprend was not applied following Touchdown or Touchdown + Dual, seed cotton yield was decreased, further indicating that a followup application is needed to provide weed control season-long. Based on this research, Suprend provided effective control of larger weed species; however, if applications were not made early, decreased cotton yields resulting from increased weed competition may occur.

WEED CONTROL AND COTTON (*GOSSYPIUM HIRSUTUM*) RESPONSE TO COMBINATIONS OF GLYPHOSATE AND TRIFLOXYSULFURON. A.J. Price, C.H. Koger, and K.N. Reddy, USDA-ARS National Soil Dynamics Laboratory, Auburn, and USDA-ARS Southern Weed Science Research Unit, Stoneville.

ABSTRACT

Greenhouse and field studies were conducted to evaluate potential interactions between glyphosate and trifloxysulfuron on barnyardgrass, browntop millet, hemp sesbania, johnsongrass, pitted morningglory, prickly sida, sicklepod, and velvetleaf control as well as cotton injury and yield. In the greenhouse, glyphosate was tested at 420 and 840 g ae/ha and trifloxysulfuron at 2.5 and 5 g ai/ha on two- and four-leaf plants. Combinations of both herbicides were also evaluated at both rates and plant growth stages. Glyphosate at 840 g/ha controlled all weed species 62 to 99% and better than 5 g/ha trifloxysulfuron. Mixtures of glyphosate plus trifloxysulfuron improved LPOST control of pitted morningglory and hemp sesbania 18 to 22% when compared to glyphosate alone. In field studies conducted at two locations, glyphosate (840 g/ha) and trifloxysulfuron (5 g/ha) were applied alone and in combination to two- to three-leaf and five- to six-leaf weeds. Glyphosate controlled barnyardgrass, johnsongrass, prickly sida, and sicklepod 88 to 100% and trifloxysulfuron controlled these same species 10 to 81%. Greenhouse results were confirmed by field studies, where the addition of trifloxysulfuron to glyphosate improved control of pitted morningglory and hemp sesbania 23 and 57% compared with glyphosate alone. Combinations of glyphosate (840 g/ha) and trifloxysulfuron (5 g/ha) were applied over-the-top and postemergence-directed to three-, six-, and nine-leaf cotton in field studies at two locations. Cotton injury at 2 WAT was less than 13% for all herbicide treatments and less than 5% by 3 WAT. Number of open and unopened bolls and number of nodes per plant was not different across all treatments. Seed cotton yield ranged from 1429 to 1658 kg/ha, and only the sequential over-the-top applications of trifloxysulfuron reduced cotton yield compared to weed-free check. Mixing trifloxysulfuron with glyphosate has potential to improve control of pitted morningglory and hemp sesbania compared to glyphosate alone with little to no reduction in cotton yield.

ENVOKE™, WEED CONTROL FOR THE FUTURE. J.C. Holloway*, S.M. Schraer, C.A.S. Pearson, C. Foresman, and H.S. McLean, Syngenta Crop Protection, Greensboro, NC.

ABSTRACT

ENVOKE™ herbicide (CGA-362622) is being developed for post-emergent and post directed weed control in cotton. Federal registration was granted October 1, 2003. Envoke will be registered for use in the Southeast and Mid-south regions of the US, as well as Eastern Texas. Subsequent registrations in CA, AZ, and NM are planned. The proposed ISO common name is trifloxysulfuron-sodium. Envoke is formulated as a 75% water dispersible granule, and will be packaged in a three-ounce container. Envoke can be utilized in conventional, Roundup Ready® and BXN® cotton production systems. The signal word for Envoke will be Caution

Proposed Envoke rates for post-emergence over-the-top (POT) application, starting at a minimum of 5 true leaves in picker-type cotton varieties, are 0.10-0.15 oz per acre. Proposed rates for post-emergence directed (PD) application are 0.10-0.25 oz per acre. A non-ionic surfactant (NIS) should be included at 0.25% v/v to all POT applications and NIS or COC may be used when applications are made PD.

Crop response when observed was transient and had no impact on cotton yield. Envoke applied over the top of cotton can cause chlorosis and shortening of the internodes. By 21 days after application, crop response was <5% for Envoke 0.1-0.25 oz/A.

Envoke dissolves quickly under normal agitation in the spray tank and the solution is stable for a period of time. It is recommended that no more spray be mixed than what can be sprayed during one day. Translocation studies indicate Envoke applied to cotton will remains in the treated leaf. Weeds such as morningglory and nutsedge readily translocate Envoke throughout the plant providing control of target weeds.

At recommended use rates Envoke will provide systemic control of many of the more troublesome weeds in cotton, including, but not limited to, pitted and entireleaf morningglories (*Ipomoea lacunosa* and *I. hederacea*), sicklepod (*Senna obtusifolia*), common cocklebur (*Xanthium strumarium*), and hemp sesbania (*Sesbania exaltata*) and Nutsedge (*Cyperus esculentus* and *C. rotundus*), control may require sequential applications.

Envoke's spectrum of activity on difficult to control weeds will complement current cotton herbicide systems. In Roundup Ready® cotton, a typical program may include Sequence® (a mixture of Touchdown and Dual Magnum) applied E-POT followed by Envoke POT followed by a PD application of Suprend™ (a mixture of trifloxysulfuron and prometryn with registration also expected in January 2004). In conventional cotton, a program starting with a pre-plant incorporated or preemergence herbicide followed by Envoke POT followed by a PD application of Suprend will provide excellent control of troublesome weeds.

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*Important Notice: SEQUENCE and SUPREND herbicides are not currently registered for sale or use in the United States and they therefore are not being offered for sale. This abstract does not constitute an offer for sale. SEQUENCE and SUPREND herbicides will not be available for sale until EPA has approved registration and all necessary state authorizations have been granted.

SUPREND™ COTTON HERBICIDE FOR COTTON. S.M. Schraer, J.C. Holloway, Jr., H.S. McLean, C.A.S. Pearson, and C. Foresman. Syngenta Crop Protection, Greensboro, NC.

ABSTRACT

Suprend™ is a new post-directed herbicide pre-mix for use in Cotton developed by Syngenta Crop Protection, and its application for registration is currently pending with US EPA. Suprend™ is a pre mix of trifloxysulfuron sodium (the active ingredient in Envoke™) and prometryn (the active ingredient in Caparol™), formulated as an 80 WG in a 1:112 ratio. Suprend™ contains two herbicide modes of action that aid weed control as well as provides sound glyphosate resistance management. Suprend™ also provides excellent residual weed control in cotton. Suprend™ is compatible with conventional, Roundup Ready® and BXN® cotton production systems.

Economically important weeds controlled by Suprend™ in cotton include but are not limited to: coffee senna (*Cassia occidentalis)*, hemp sesbania (*Sesbania exaltata)*, sicklepod (*Senna obtusifolia)*, common cocklebur (*Xanthium strumarium)*, pitted morningglory (*Ipomoea lacunosa)*, ivyleaf morningglory (*Ipomoea hederacea)*, entireleaf morningglory (*Ipomoea hederacea var. integriuscula)*, redroot pigweed *(Amaranthus retroflexus)*, smooth pigweed (*Amaranthus hybridus),* and suppression of seedling johnsongrass (*Sorghum halepense)*, yellow nutsedge (*Cyperus esculentus)*, and purple nutsedge (*Cyperus rotundus)*.

Suprend™ can be used in all picker cotton varieties across a large section of the southern cotton growing areas, including the Southeast, Mid-South as well as portions of Texas. Applications should be post directed beginning in cotton as small as 8 inches in height up through the lay-by timing. Use rates will be 1 to 1.5 pounds of formulated product per acre. Do not apply more than 2.7 pounds of formulated product per year nor do not apply 60 days before harvest. Suprend™ is expected to be available for the 2004 cotton use season.

Tank mix options include several commonly used herbicides in cotton such as MSMA, Touchdown®, Dual Magnum®, Aim™, diuron, linuron, Cobra®, Caparol®, and Buctril®. Do not tank mix Suprend™ with malathion, profenofos (Curacron®) or emamectin-benzoate containing insecticides (Denim®), acephate, Bidrin®, Capture®, Karate® or unacceptable cotton injury can occur.

Rotation restrictions include: 3 months: wheat, transplanted tomato, 7 months: cotton, corn, sorghum, peanut, rice, soybean, transplanted tobacco, 12 months bell pepper, Irish potato, radish, parsley, 18 months: all other crops.

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SEQUENCE, A NEW POSTEMERGENCE HERBICIDE FOR COTTON. D. Porterfield, H. McLean, and C. Foresman; Syngenta Crop Protection, Greensboro, NC 27419.

ABSTRACT

Sequence is a new broad-spectrum herbicide that provides postemergence burndown weed control with residual activity in RR cotton. The active ingredients in Sequence are the K^+ salt of glyphosate plus S-metolachlor. Sequence is formulated as a 630 g per liter soluble liquid. Each liter of Sequence contains 270 g acid equivalent of glyphosate acid and 360 g ai S-metolachlor. Use rates range from 2.9 to 4.1 liters of product per hectare. Sequence at 2.9 l/ha delivers 1934 g acid equivalent of glyphosate acid and 2579 g active ingredient S-metolachlor.

Sequence may be applied post over the top of 3 inch RR cotton up to 5 leaf cotton with the fifth leaf the size of a quarter. Applications beyond the fifth leaf up to 12 inch cotton must applied with a post-direct hooded sprayer.

Small plot replicated trials were conducted during 2002 and 2003. Results showed that Sequence applied at 2.9 to 4.1 liters of product per hectare gave 88 to 93% control of common lambsquarters (*Chenopodium album*) and 83 to 87% control of annual grasses at 38 days after application compared to 71% control with Roundup Weathermax at 1.6 liters of product per hectare. Sequence applied post over the top of 4 leaf cotton and followed with Suprend herbicide early post-direct gave greater than 95% control of Palmer amaranth (*Amaranthus palmeri*), sicklepod (*Senna obtusifolia*), barnyardgrass (*Echinochloa crus-galli*), pitted morningglory (*Ipomoea lacunosa*), and hemp sesbania (*sesbania exaltata*). Sequence applied post over the top of 4 leaf cotton and followed with Envoke herbicide post over the top of 14 inch cotton gave 96% control of redroot pigweed (*Amaranthus retroflexus*), 99% control of sicklepod (*Senna obtusifolia*), 94% control of crabgrass (Digitaria sanguinalis), and 95% control of pitted morningglory (*Ipomoea lacunosa*).

UTILITY OF CARFENTRAZONE AND PYRAFLUFEN AS HARVEST-AIDS FOR CORN AND COTTON. J.C. Sanders, D.B. Reynolds, M.T. Kirkpatrick, and J.J. Walton; Mississippi State University, Mississippi State, MS.

ABSTRACT

Chemical harvest-aids are used to desiccate weeds, such as morningglories, that can interfere with the harvest of cotton and corn. Harvest-aid applications in cotton are utilized to achieve boll opening, leaf defoliation, regrowth inhibition, and weed desiccation in order to properly prepare cotton for harvest. Aim (carfentrazone) and ET (pyraflufen) are two recently labeled chemical harvest-aids for use in cotton and corn, that prepare the crops for harvest and desiccate many problematic weeds. These two harvest-aids have a PPO (protoporphyrinogen oxidase) inhibiting mode-of-action and are very active on morningglories.

Field experiments were conducted to evaluate the efficacy of carfentrazone and pyraflufen on cotton as harvest-aids in 2001 and 2002 at the Plant Science Research Center near Starkville, MS and in 2003 at the Black Belt Branch Experiment Station near Brooksville, MS. Treatments were arranged in a randomized complete block design with four replications on plots that were 40 ft long by 26 ft wide. Carfentrazone was applied at the 0.016 and 0.025 lb ai/A, while pyraflufen was applied at the 0.0025 and 0.0033 lb ai/A. Cotton was evaluated for visual percent leaf defoliation, visual percent leaf desiccation, and percent boll opening 3, 7, and 14 DAT (days after treatment) in addition to yield. To evaluate the efficacy of carfentrazone and pyraflufen on pitted morningglory (*Ipomoea lacunosa* L.), another field experiment was initiated at the Plant Science Research Center near Starkville, MS in 2003. Efficacy was evaluated through visual estimates of percent leaf defoliation, leaf desiccation, and stem desiccation 3, 7, and 14 DAT. An untreated control was included in both the cotton and weed efficacy experiments.

The performance of carfentrazone and pyraflufen were similar in harvest-aid efficacy on cotton. The two harvest-aids had at least 48% leaf desiccation 3 DAT. Leaf defoliation was found to be no less than 76% at 7 DAT and 87% at 14 DAT for both carfentrazone and pyraflufen. At least 75% boll opening was achieved 7 DAT and 82% regrowth inhibition achieved 14 DAT for both harvest-aids. Morningglory desiccation results were also similar among both products with at least 62% leaf desiccation 3 DAT, and 81% leaf defoliation and 84% stem desiccation 7 DAT. With carfentrazone and pyraflufen both capable of properly preparing cotton for harvest and desiccating problematic weeds, producers have two effective chemical harvest-aids available to achieve all desired aspects of a harvest-aid application in both corn and cotton.

EVALUATION OF TRIFLOXYSULFURON-SODIUM AND HALOSULFURON-METHYL IN DARK TOBACCO (*Nicotiana tabacum* L.). W.A. Bailey, R.A. Hill, and T.W. Lax, University of Kentucky Research and Education Center, Princeton, KY 42445.

ABSTRACT

Herbicide options for weed control in dark tobacco are limited to sulfentrazone, clomazone, pendimethalin, napropamide, pebulate, and sethoxydim. Pre-transplant combinations of sulfentrazone and clomazone are the most popular herbicide systems in dark tobacco production. However, inadequate control of certain weed species has been observed with this system when dry conditions or heavy rainfall occur following application. Currently, no herbicides are registered for postemergence control of broadleaf weeds or nutsedge that may escape sulfentrazone plus clomazone applications. Experiments were conducted in 2003 at the University of Kentucky Research and Education Center in Princeton, KY and at the Murray State University Research Farm in Murray, KY to evaluate crop tolerance and weed control from the sulfonylurea herbicides trifloxysulfuron-sodium and halosulfuron-methyl. Each herbicide was applied postemergence over-the-top (POT) or postemergence-directed (PD) at two application rates. POT applications were made 1 month after transplanting and PD applications were made 2 months after transplanting. Application rates were 0.0036 and 0.0053 kg ai/ha for trifloxysulfuron and 0.036 and 0.053 kg ai/ha for halosulfuron. Either herbicide applied POT caused crop injury and plant height reductions of approximately 30% at 1 wk after treatment (WAT). However, tobacco appeared to recover by 2 to 3 WAT. Crop tolerance from PD applications was much more acceptable. Late-season weed control was also more effective with PD applications, most likely due to late weed emergence that occurred between the time of POT and PD applications. Yellow nutsedge (*Cyperus esculentus* L.) was controlled 59 to 85% with POT applications and 65 to 94% with PD applications. Morningglory species (*Ipomoea* sp.) were controlled 63 to 71% with POT applications and 70 to 93% with PD applications. Total dark tobacco yield ranged from 357 to 420 kg/ha at Princeton with the only significant yield reduction coming from trifloxysulfuron applied at 0.0036 kg/ha POT. Total dark tobacco yield at Murray ranged from 576 to 633 kg/ha with no significant yield differences in any treatment.

APPLICATION TIMING FOR BROADLEAF WEED CONTROL IN CONVENTIONAL TILLED WHEAT. J.R. Martin and D.L. Call; Department of Agronomy, University of Kentucky, Princeton.

ABSTRACT

There is an increasing interest in applying herbicides in the fall rather than delaying treatments until the spring for controlling broadleaf weeds in wheat. This approach is beneficial for achieving optimum yields in no tillage wheat and for obtaining effective control of certain species such as cornflower. However, it is unclear if fall applications provide an advantage over spring applications for managing such weeds as common chickweed (*Stellaria media*) and henbit (*Lamium amplexicaule*) in wheat planted in a conventional tilled seedbed.

The objective of this research was to evaluate the influence of fall and spring applications of Harmony Extra 75 DF (thifensulfuron 50% + tribenuron 25%) and Sencor 75 DF (metribuzin) on common chickweed and henbit control and yield of wheat planted in a conventional tilled seedbed.

All studies were conducted in areas where the previous rotational crop was field corn. Plot areas were prepared after corn harvest with multiple passes of a field disk or by a combination of chisel plowing and disking. Pioneer 2552 wheat was planted in early to mid October at Calloway County, Warren County, and the University of Kentucky Research and Education Center (UKREC) in Caldwell County in 2001, and at Warren County and UKREC in 2002. Fall treatments were applied in mid to late November and included Harmony Extra at 0.3 oz/A or 0.5 oz of product/A plus nonionic surfactant at 0.25% v/v and Sencor at 2, or 4 oz of product/A. Spring treatments were applied in late March to early April and included Harmony Extra at 0.5 oz/A plus nonionic surfactant at 0.25% v/v and Sencor at 4 or 6 oz/A. Visual ratings for broadleaf weed control were made in late April to early May. Wheat was harvested with a small plot combine in mid to late June.

In most instances Harmony Extra and Sencor provided at least 93% control of henbit and common chickweed in wheat, regardless of timing of application and herbicide rate. Although the spring application of Harmony Extra at 0.5 oz/A provided 93% control of common chickweed at the UKREC site during the 2001-2002 season, this level of control was significantly less compared with 100% control achieved with the same rate of Harmony Extra applied in the fall. Common chickweed control in this study with fall- applied Sencor at 2 oz/A was slightly less compared with fall- or spring- applied Sencor at 4 oz/A rate. At the Warren County site in the 2001-2002 season, the use of Sencor in the fall at the low rate of 2 oz/A, resulted in 86% control of henbit compared with 100% control with Sencor applied in the fall at the 4 oz/A rate. Delaying Sencor until the spring in this study resulted in 96 and 100% control of henbit, for the 4 and 6 oz/A rate, respectively.

Although all herbicide treatments provided at least 86% control of common chickweed and henbit in all five studies, they did not increase wheat yield when compared with the non treated check in four of the five studies. Apparently the infestation levels of broadleaf weeds observed in these four studies were low and non competitive to the wheat stands. However, yield differences were observed in the UKREC study during the 2002-2003 season. The fact this study had a dense stand of common chickweed may be a reason why all herbicide treatments yielded better then the non treated check. The wheat yields in the UKREC study in the 2002-2003 season tended to be low for the spring treatments compared with the fall treatments, especially for Harmony Extra at 0.5 oz/A and Sencor at 6 oz/A.

The fact that herbicide treatments provided at least 86% control of common chickweed and henbit by mid spring, but did not increase wheat yield in four of the studies, indicates that in many cases competition from these weeds is not a limiting factor in wheat planted after corn in a conventional tilled seedbed. However, there are instances where Harmony Extra or Sencor is needed for controlling such species as common chickweed and henbit. Controlling these weeds in the fall rather than delaying treatments until the spring may occasionally provide a yield benefit.

ADJUVANT SYSTEMS TO OPTIMIZE PERFORMANCE OF IMAZAMOX IN CLEARFIELD™ WINTER WHEAT. M.C. Boyles, T.F. Peeper, Department of Plant and Soil Science, Oklahoma State University, Stillwater, Okla. 74078, C. Youmans, BASF Corp. RTP, NC. 27709.

ABSTRACT

Rye (*Secale cereale* L.) appears to have been cultivated for more than 2,000 years. It was widely distributed during the medieval period, particularly in Europe. Rye was brought to the western hemisphere by the English and Dutch who settled in the northeastern United States. Rye is an annual or winter annual grass that reproduces by seed. Rye in the United States is used mainly for a feed grain and as a cover crop to protect soil from erosion. In winter wheat, rye causes serious problems because it emerges as volunteer rye freely and the grain shatters readily. The shattered rye grain produces volunteer plants that thrive under adverse conditions and typically matures and shatters before wheat harvest. Rye is very difficult to control in winter wheat and its presence in wheat grain will result in dockage, grade reduction due to foreign materials and a decrease of wheat quality. A current control method is applying imazamox herbicide post emerge in CLEARFIELD™ winter wheat.

The objective of this research was to evaluate different rates of liquid fertilizer (UAN 28-0-0) with labeled rates of imazamox applied both in the fall and spring to determine if overall rye efficacy in wheat could be improved. Four field studies were conducted between the years 2000 to 2003. Two were conducted during the 2000-2001 wheat season, one study during the 2001-2002 season and one study during the 2002-2003 season. Non-ionic surfactant at 0.25% v/v was applied with all treatments. Only minor wheat injury that was quickly outgrown was noted at each timing on all studies. Wheat injury was minor leaf burn with UAN and temporary stunting and chlorosis with imazamox.

In the fall and spring of 2000-2001 imazamox was applied at 4 oz product per acre with 1.25, 50, 75 and 100% v/v UAN. In the fall the wheat was 3 leaf to four tillers and the rye was 2 leaf to four tillers. The spring application was on wheat 2 to 9 tiller and rye at 1 to 8 tillers. Results from fall applications (two locations) at harvest (150 DAT) showed that imazamox at 4 oz per acre with 1.25, 50, 75 and 100% v/v UAN provided 68%, 79, 78 and 63% rye control, respectively. Results from spring applications (two locations) at harvest (60 DAT) showed that imazamox at 4 oz per acre with 1.25, 50, 75 and 100% v/v UAN provided 50%, 73, 78 and 79% rye control, respectively. Wheat yields after cleaning at the only location harvested showed the check with 35 bushels. Fall applications of imazamox at 4 oz per acre with 1.25, 50, 75 and 100% v/v UAN provided 85, 84, 87 and 85 bushels per acre, respectively. Spring applications of imazamox at 4 oz per acre with 1.25, 50, 75 and 100% v/v UAN provided 81, 83, 91 and 89 bushels per acre, respectively. Rye seed per 10 grams harvested sample from fall applications showed the check with 241 seeds. Fall applications of imazamox at 4 oz per acre with 1.25, 50, 75 and 100% v/v UAN resulted in 36, 8, 11 and 20 rye seeds per 10 gram sample, respectively. Spring applications of imazamox at 4 oz per acre with 1.25, 50, 75 and 100% v/v UAN resulted in 37, 21, 9 and 7 rye seeds per 10 gram sample, respectively.

In the fall and spring of 2001-2002 and 2002-2003 imazamox was applied at 4 oz product per acre with 1.0, 5, 10, 25 and 50% v/v UAN. In the fall the wheat was three to four tiller and the rye was 2 to 6 tillers. The spring application was on wheat of 7 to 12 tiller and rye at 5 to 9 tillers. Results from fall applications (two locations) at harvest (137 & 192 DAT) showed that imazamox at 4 oz per acre with 1.0, 5, 10, 25 and 50% v/v UAN provided 49, 67, 75, 79 and 84% rye control, respectively. Results from spring applications (two locations) at harvest (56 & 63 DAT) showed that imazamox at 4 oz per acre with 1.0, 5, 10, 25 and 50% v/v UAN provided 56, 74, 75, 80, 83% rye control, respectively. All treatments with 5 to 50% UAN v/v applied in the fall or spring provided significantly better rye control than the 1.0% rate of UAN.

Research will continue to confirm results at rates of 5 to 10% v/v UAN. Studies will also be conducted to evaluate rates at 2.5 and 5% v/v UAN on improving control of feral rye and other key grass species in winter wheat.

DOWNY BROME (*BROMUS TECTORUM*) AND CHEAT (*BROMUS SECALINUS*) CONTROL IN WINTER WHEAT WITH OLYMPUS HERBICIDE. W.R. Perkins, J. Cagle, A. Wyman, S.S. Hand; Bayer CropScience RTP, NC.

ABSTRACT

Olympus Herbicide is a new postemergence herbicide being developed by Bayer CropScience for weed control in winter wheat. Olympus Herbicide is comprised of the active ingredient propoxycarbazone-sodium. This herbicide acts as an inhibitor of acetolactate synthase (ALS) and is a member of the sulfonylaminocarbonyl triazolinone class of chemistry. Propoxycarbazone-sodium will control many important grass weeds in winter wheat and is highly active on downy brome, cheat, Japanese brome, and soft chess as well as a multitude of broadleaf weeds such as wild mustard and tumble mustard. Olympus Herbicide exhibits excellent winter wheat tolerance at 30 to 45 g ai /ha.

In field experiments in North America, propoxycarbazone-sodium controlled downy brome cheat, Japanese brome, soft chess, wild canarygrass, and windgrass as well as wild mustard, Tansy mustard, and blue mustard. Olympus Herbicide is applied to grass weeds up to 2-tillers in size and broadleaf weeds up to 1-2 leaf in size. Applications of Olympus Herbicide must include a tankmix partner of a non-ionic surfactant at a rate of 0.25-0.5% v/v.

Olympus Herbicide has a very favorable ecological, ecotoxicological and environmental profile with low acute mammalian toxicity and no genotoxic, mutagenic or oncogenic properties noted. Microbial degradation is the primary degradation pathway of propoxycarbazone-sodium in the environment. Propoxycarbazone-sodium offers a flexible recropping profile to succeeding crops. Excellent control of ACC-ase resistant wild oat (*Avena fatua* L.) biotypes have been attained with Olympus Herbicide in field trials.

The low use-rate, excellent weed control and crop safety combined with very favorable toxicological, ecotoxicological and environmental properties will make this product a valuable new tool for winter wheat farmers.

ANNUAL RYEGRASS (*LOLIUM MULTIFLORUM* L.) CONTROL IN WINTER WHEAT WITH OSPREY HERBICIDE. K. Vodrazka, J.M. Rosemond, J.W. Sanderson, S.B. Garris, A. Hopkins, and S.S. Hand. Bayer CropScience, RTP, NC.

ABSTRACT

Osprey Herbicide is a new postemergence herbicide being developed by Bayer CropScience for weed control in winter wheat. Osprey Herbicide is comprised of the active ingredient mesosulfuron-methyl. This herbicide acts as an inhibitor of acetolactate synthase (ALS). Mesosulfuron-methyl will control many important grass weeds in winter wheat and is highly active on wild oat and Italian/annual ryegrass as well as some broadleaf weeds such as wild mustard. Osprey Herbicide exhibits excellent winter wheat tolerance at 10 to 15 g ai /ha.

In field experiments in North America, mesosulfuron-methyl controlled Italian/annual ryegrass, annual bluegrass, wild oat, and canarygrass as well as wild mustard, Tansy mustard and blue mustard. Osprey Herbicide is applied to grass weeds up to 2-tiller in size and 1-2 leaf mustards. Applications of Osprey Herbicide must include a tankmix partner of a high-quality MSO with 10% emulsifier or greater at 1.5 pt/a. In certain circumstances where Osprey Herbicide is tankmixed with a herbicide that prohibits the addition of a MSO, a NIS plus ammonium nitrogen fertilizer may be used instead.

Osprey Herbicide has a very favorable ecological, ecotoxicological and environmental profile with low acute mammalian toxicity and no genotoxic, mutagenic or oncogenic properties noted. Microbial degradation is the primary degradation pathway of mesosulfuron-methyl in the environment. Mesosulfuron-methyl is rapidly degraded and unlikely to pose any risk to succeeding crops. Excellent control of ACC-ase resistant wild oat (*Avena fatua* L.) biotypes have been attained with Osprey Herbicide in field trials. Osprey Herbicide also controls diclofop-resistant Italian/annual ryegrass (*Lolium multiflorum* L.).

The low use-rate, excellent weed control and crop safety combined with very favorable toxicological, ecotoxicological and environmental properties will make this product a valuable new tool for winter wheat farmers.

SECTION II. WEED MANAGEMENT IN TURF CROPS

BROADLEAF WEED CONTROL WITH SULFONYLUREA HERBICIDES IN BERMUDAGRASS TURF. A.G. Estes and L.B. McCarty; Department of Horticulture, Clemson University, Clemson, SC 29634-0319.

ABSTRACT

Broadleaf weeds make for an unsightly appearance in highly maintained turf areas as they are prolific seed producers and are widely distributed. The purpose of this research was to investigate the efficacy of various sulfonylurea herbicides for broadleaf weed control.

In the spring of 2003 two studies were conducted at Clemson University, investigating broadleaf weed control with sulfonylurea herbicides. Plot size for each treatment measured 2.0 m by 3.0 m, replicated three times. Treatments were applied using a CO_2 backpack sprayer calibrated at 20 GPA, at 30 p.s.i., with 8003 flat fan spray tips. Treatments for study 1 included: TranXit (25DG) at 0.03 lb ai/A; Manor (60DF) at 0.04 lb ai/A; Revolver (0.19SC) at 0.03 lb ai/A; Monument (75WG) at 0.03 lb ai/A; Katana (25DG) at 0.05 lb ai/A; Battalion (75DG) at 0.02 lb ai/A; Speed Zone (2.2L) at 1.1 lb ai/A; and Trimec Classic (3.32L) at 1.66 lb ai/A. Treatments for study 2 included: Katana (25DG) at 0.02 lb ai/A; Katana at 0.04 lb ai/A; Katana at 0.05 lb ai/A; Katana + MSMA (6SC) at 0.05 lb ai/A + 2.0 lb ai/A; Katana + 2,4-D (4L) at 0.05 lb ai/A + 1.0 lb ai/A; Speed Zone (2.2L) at 1.1 lb ai/A; and Trimec Classic (3.32L) at 1.66 lb ai/A. Initial applications for both studies were made on March 27, 2003. All treatments containing a sulfonylurea herbicide received Induce (non-ionic surfactant) at 0.25% V/V.

Visual broadleaf weed control ratings were taken 23 and 47 DAT. Ratings for broadleaf weed control were based on a scale of 0-100% with 0% representing no control and 100% representing complete control. Broadleaf weeds rated in study 1 include: Carolina Geranium (*Geranium carolinianum*), Dandelion (*Taraxacum officinale*), Field Madder (*Sherardia arvensis*), Curly Dock (*Rumex crispus*), Ground Ivy (*Glechoma hederacea*), Dichondra (*Dichondra carolinensis*), White Clover (*Trifolium repens*), Little Barley (*Hordeum pusillum*), Tall Fescue (*Festuca arundinacia*). Broadleaf weeds rated in study 2 include: Large Hop Clover (*Trifolium campestre),* Field Madder *(Sherardia arvensis)*, Yellow Woodsorrel (*Oxalis stricta)*, Dandelion (*Taraxacum officinale)* Common Chickweed (*Stellaria media*), and Rattail Fescue (*Festuca myuros*).

By 47 DAT of study 1, >80% control of broadleaf weed species was achieved by: Dandelion and White Clover – all treatments; Carolina Geranium – TranXit, Manor, Revolver, Speed Zone, and Trimec Classic; Curly Dock – Speed Zone; Field Madder – TranXit and Katana; Ground Ivy – TranXit, Manor, Revolver, Monument, Katana, Speed Zone, and Trimec Classic; Dichondra – TranXit, Manor, Revolver, Monument, Katana, Speed Zone; Tall Fescue - TranXit, Revolver and Katana; and, Little Barley – TranXit, Revolver, Monument Katana, and Battalion. In study 2, >80% broadleaf weed control was achieved as by: Large Hop Clover, Field Madder, Common Chickweed – all treatments; Yellow Woodsorrel – Katana at 0.05 lb ai/A and Katana plus 2,4-D; Common Dandelion – Speed Zone; and, Rattail Fescue – all treatments containing Katana. Future research at Clemson University will be to continue to screening new and experimental sulfonylurea herbicides for broadleaf weed control.

EFFICACY OF ALS-INHIBITING HERBICIDES APPLIED TO SELECTED WINTER WEEDS IN COMMON BERMUDAGRASS TURF. D.W. Wells, J.M. Taylor, J.D. Byrd Jr., and R.S. Wright; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Experiments were conducted to evaluate selected ALS-inhibiting herbicides for winter weed control efficacy and injury to common bermudagrass turf. The following herbicides were evaluated: Monument (trifloxysulfuron) 75WG at 0.28 and 0.56 oz/A; Revolver (foramsulfuron) 0.19L at 13.0 and 26.0 oz/A; Battalion (sulfosulfuron) 75DF at 1.3 and 2.6 oz/A; Image (imazaquin) 70DF at 0.375 and 0.5 lb/A; Corsair (chlorsulfuron) 75DF at 1.5 and 3.0 oz/A; Tranxit (rimsulfuron) 25DF at 1.0 and 2.0 oz/A; Manor (metsulfuron) 60DF at 0.5 and 1.0 oz/A; Manage (halosulfuron) 75DF at 0.66 and 1.33 oz/A; Katana (flazasulfuron) 25DG at 1.5 and 3.0 oz/A; Kerb (pronamide) 50WP at 0.75 lb/A; and Trimec Classic (2,4-D, MCPP, dicamba) 2.72EC at 3.0 pts/A. Targeted weed species were annual bluegrass (*Poa annua*), lawnburweed (*Soliva pterosperma*), henbit (*Lamium amplecicaule*) and wild garlic (*Allium vineale*). Evaluations were made at 14, 27, and 42 days after herbicides application. None of the herbicide treatments provided 80% or better control of annual bluegrass at 14 days. At 27 days, 80% control or greater was achieved with 0.28 oz/A Monument, 26 oz/A Revolver, or 1.0 and 2.0 oz/A of Tranxit. At 42 days both rates of Monument, Revolver, Image, Tranxit, or Katana and the highest rate of Battalion provided 80% or greater control. As with the annual bluegrass no treatment provided 80% control of lawnburweed within the first 14 days. However, only Revolver, Manage, Kerb and the lowest rate of Monument did not provide 80% control by 27 days. Only Kerb provided less than acceptable control of lawnburweed at 42 days. Trimec Classic was not included as a treatment in the annual bluegrass or lawnburweed plots. Monument, Manor, Katana at both rates and Tranxit at the high rate gave greater than 80% control of henbit at all evaluation dates. Battalion and Manage provided little activity on henbit and provided unacceptable control at all rating dates. No treatment provided better than 45% control of wild garlic at 14 days. Only Monument at 0.28 oz/A provided 80% control at 27 days and only Revolver (70%) provided less than 78% control at 42 days. Kerb was not included as a treatment in the henbit and wild garlic plots. Bermudagrass turf injury was minimal, with only Battalion and Image having any statistical differences from the untreated control plots.

WARM-SEASON TURFGRASS TOLERANCE AND WEED CONTROL WITH ALS-INHIBITING HERBICIDES. B.J. Brecke, J.B. Unruh, A.J. Powell and S.D. Davis; West Florida Research and Education Center, University of Florida, Jay; University of Kentucky, Department of Agronomy, Lexington; Bayer Environmental Sciences, Gulf Breeze, FL.

ABSTRACT

Nine acetolactate synthase (ALS) inhibiting herbicides were evaluated for weed control and tolerance in warm-season turfgrass species. Herbicides were applied postemergence once at the maximum use rate (determined either by the herbicide label or the maximum rate proposed by the manufacturer) or twice the maximum use rate. Bermudagrass was not injured by bispyribac, chlorsulfuron, flazasulfuron, foramsulfuron, halosulfuron, metsulfuron, rimsulfuron, sulfosulfuron or trifloxysulfuron. Zoysiagrass was injured less than 10% by any of these herbicides and quickly recovered from any injury observed. Centipedegrass and St. Augustinegrass tolerated only sulfosulfuron and halosulfuron while seashore paspalum tolerated these two herbicides in addition to metsulfuron and chlorsulfuron. Purple nutsedge was controlled 85 to 95% by trifloxysulfuron, flazasulfuron, sulfosulfuron and halosulfuron. Only metsulfuron and chlorsulfuron failed to control cocks-comb kyllinga. Trifloxysulfuron, foramsulfuron and rimsulfuron controlled dollarweed (pennywort) 75 to 80% while the other ALS-inhibitor herbicides failed to provide acceptable control of this species. Only foramsulfuron controlled goosegrass and only metsulfuron and trifloxysulfuron provided acceptable control of bahiagrass. Weed control may be improved by sequential applications of these herbicides.

NON-TARGET MOVEMENT OF ACETOLACTATE SYNTHASE INHIBITING HERBICIDES APPLIED TO TURF. J.B. Unruh, B.J. Brecke, C.M. White, J.L. White, and S.D. Davis; University of Florida, West Florida REC, Jay, FL 32565 and Bayer Environmental Sciences, Gulf Breeze, FL 32561.

ABSTRACT

A number of new acetolactate synthase (ALS) inhibiting herbicides are being launched into the turf market and several others are soon to follow. As the use of these products has increased, turf managers have raised concerns about their non-target movement from treated areas onto desirable turf. This is especially important when these herbicides are sprayed near warm-season turf that has been overseeded with cool-season grasses.

The objectives of our research and demonstration trials were to evaluate the effect of irrigation on down-slope movement of selected ALS herbicides and to assess the impact of ALS herbicide movement via foot traffic. Two replicated trials along with several demonstration trials were conducted during 2003 at the University of Florida's West Florida Research and Education Center near Jay and Indian Bayou Golf and Country Club in Destin, FL. Plots were treated with a CO_2 pressurized back pack sprayer fitted with 11002 nozzles calibrated to deliver 190 L ha.

In the slope movement studies, rimsulfuron, trifloxysulfuron, foramsulfuron, and pronamide were applied to perennial ryegrass (*Lolium perenne*) overseeded bermudagrass (*Cynodon dactylon* X *C. transvaalensis*). Irrigation was withheld for 24 hours or applied either immediately following herbicide application or one hour after herbicide application. Down-slope injury was measured. At the WFREC, no treatment differences were noted when irrigation was withheld for one hour. When irrigation was withheld for 24 hours, all three herbicides moved an equal distance. When irrigation was applied immediately following herbicide application, trifloxysulfuron moved considerably farther than foramsulfuron and pronamide. Results at Indian Bayou Golf and Country Club were less conclusive.

In the movement via foot traffic demonstrations, plots were sprayed with the various herbicides and then either walked through and into untreated *Poa trivialis* immediately following treatment, two hours after treatment, or the following morning while heavy dew was present. Foramsulfuron, rimsulfuron, and pronamide at 1X rates did not move with foot traffic immediately after spraying, however, trifloxysulfuron, flazasulfuron, and sulfosulfuron did. None of the products tested at 1X rates moved with foot traffic once the herbicides had dried or in heavy dew the morning following herbicide application. Foramsulfuron moved immediately after treatments at 2X rates, but required 3X rates to move after drying and the following day on foliage wet with dew. At 2X rates, trifloxysulfuron, flazasulfuron, rimsulfuron, pronamide, and sulfosulfuron moved via foot traffic even after the materials were allowed to dry and the following day on foliage wet with dew.

***VIOLA* SPECIES CONTROL USING SULFONYLUREA HERBICIDES.** L.S. Warren, Jr. and F.H. Yelverton; Department of Crop Science, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Trials were conducted in 2003 comparing sulfonylurea herbicides against broad-spectrum broadleaf herbicide industry standards for field pansy and wild violet control in bermudagrass turf. Field pansy treatments included flazasulfuron, rimsulfuron (TranXit GTA) and trifloxysulfuron (Monument) applied at 2.25, 1 and 0.47 ounces of product per acre (oz/A), respectively, and foramsulfuron (Revolver) applied at 1.09 pints per acre (pt/A). These treatments received a nonionic surfactant at 0.25% v/v. Comparison treatments included carfentrazone + 2,4-D + mecoprop + dicamba (Speed Zone), mcpa + triclopyr + dicamba (Cool Power), triclopyr + clopyralid (Confront) and 2,4-D + mecoprop + dicamba (Trimec Classic) applied at 3.5, 3, 1 and 3.25 pt/A, respectively. Wild violet treatments included the above-mentioned sulfonylurea herbicides in addition to metsulfuron (Manor) and sulfosulfuron applied at 0.75 and 1.5 oz/A, respectively. These treatments also received a nonionic surfactant at 0.25% v/v. Comparison treatments included Confront applied at 1 and 2 pt/A, Trimec Classic applied at 3.5 pt/A and 2,4-D + clopyralid + dicamba (Millennium Ultra) applied at 2.5 pt/A.

The field pansy trial was initiated March 24. Plants averaged 3 inches in height and were flowering with a density of 3 per ft2. Percent control ratings were recorded at 9, 18, 28, 35 and 46 days after treatment (DAT). The wild violet trial was initiated June 2 with plants only 1 to 2 inches in height. The test area had recently been mowed (scalped) as this site was a low maintenance area. Wild violet plants averaged 4 per ft2. Percent control ratings were recorded at 15, 28, 50 and 64 DAT.

Excellent field pansy control (>90%) was achieved with Speed Zone 18 DAT. At this time, Confront was providing 62% control, which was greater than control provided by Revolver or TranXit, 23 and 28%, respectively. By 35 DAT, all treatments provided >95% control except Trimec Classic (45%). Wild violets were controlled at least 86% with Manor, sulfosulfuron, flazasulfuron and 2 pt/A Confront 15 DAT. All sulfonylurea herbicides tested provided greater control than 1 pt/A Confront, Millennium Ultra and Trimec Classic at this time. At 50 DAT, Manor, sulfosulfuron, flazasulfuron and Monument provided at least 85% wild violet control. 2 pt/A Confront control dropped to 43%. Revolver and TranXit GTA at 50 and 64 DAT provided similar control as that of 1 and 2 pt/A Confront, Millennium Ultra and Trimec Classic (<50% 50 DAT, <30% 64 DAT). By 64 DAT, Manor, sulfosulfuron and flazasulfuron provided at least 74% wild violet control, with Manor providing total (100%) control. Monument at 64 DAT provided 61% control, which was greater that control with Trimec Classic (24%).

These data suggest that excellent field pansy control (>95%) can be achieved with sulfonylurea herbicides as well as Confront, Cool Power and Speed Zone. Trimec Classic does not provide acceptable control. Good to excellent season-long wild violet control (74 to 100%) may be achieved with single applications of Manor, sulfosulfuron and flazasulfuron. Single applications of Confront, Millennium Ultra, Trimec Classic, Revolver and TranXit GTA provided <45% control.

POSTEMERGENCE CONTROL OF PARSLEY-PIERT (*Aphanes arvensis)* **AND WILD GARLIC** (*Allium vineale*) **IN DORMANT BERMUDAGRASS** (*Cynodon dactylon*)**.** T.G. Willis, L.B. McCarty, and A.G. Estes. Clemson University, Department of Horticulture, Clemson, SC. 29634-0375.

ABSTRACT

Parsley-piert is a freely-branched, low-growing winter annual which reproduces via seed and contains inconspicuous flowers in the leaf axils. Wild Garlic is a cool-season perennial with slender, hollow cylindrical leaves, and underground bulbs that contain membrane bound bulblets. Wild Garlic reproduces via seeds, aerial bulbils, and underground bulblets. The objective of this research was to evaluate the postemergence control of Parsley-piert and Wild Garlic in dormant bermudagrass with various herbicides.

Treatments for the Parsley-piert study were applied on January 14, 2003 to a dormant common bermudagrass rough on a golf course in Pendleton, SC. The Wild Garlic study was performed on a dormant bermudagrass rough in Anderson, SC. The herbicide treatments for the Wild Garlic study were applied on November 13, 2002 with sequential applications made on February 12, 2003. Treatments applied to both studies included: Confront 3L (clopyralid + triclopyr) at 0.75 lbs ai/A, Lontrel T&O 3L (clopyralid) at 0.375 lbs ai/A, 2,4-D Amine 4L at 1 lb ai/A, Trimec Classic 3.32L (2,4-D + MCPP + dicamba) at 1.36 lbs ai/A, Speed Zone 2.2L (carfentrazone + 2,4-D + MCPP + dicamba) at 1.1 lbs ai/A, Turflon Ester 4.0 EC (triclopyr) at 1 lb ai/A, Manor 60DG (metsulfuron) at 0.01875 lbs ai/A, Image 70DG (imazaquin) at 0.38 lbs ai/A, and Monument 75WG (trifloxysulfuron) at 0.03 lbs ai/A. Revolver 2.34SC (foramsulfuron) was applied to the Parsley-piert study only at 0.3108 lbs ai/A.

Parsley-piert and Wild Garlic control was visually rated bi-weekly on a 0-100% scale with 0% = no control, and 100% = complete control. Control < 70% was considered unacceptable.

Parsley-piert control >90% was provided by Confront, Trimec Classic, Speed Zone, Manor, and Monument. Parsley-piert control >80% was provided by 2,4-D and Image. Parsley-piert control >70% was provided by Lontrel.

Following one application, Speed Zone, Manor, and Monument provided >90% Wild Garlic control. Speed Zone was the quickest to reach >90% control (4 weeks). Following two applications, Image provided >90% Wild Garlic control. Wild Garlic control >80% was provided by Trimec Classic after a single application.

In conclusion, Parsley-piert and Wild Garlic control was provided by several of the herbicide treatments. However, it is necessary to monitor the long-term effectiveness of these treatments and continue to evaluate the control of Parsley-piert and Wild Garlic by adjusting the herbicide combinations, herbicide rates, and application timings.

POSTEMERGENCE PROSTRATE KNOTWEED (*Polygonum arenastrum*) PROSTRATE SPURGE (*Euphorbia maculata*) AND PATH RUSH (*Juncus tenuis*) CONTROL. P.J. Brown, L.B. McCarty, and A.G. Estes. Clemson University, Department of Horticulture, Clemson, SC. 29634-0375.

ABSTRACT

Prostrate Spurge (*Euphorbia maculata*), Path Rush (*Juncus tenuis*) and Prostrate Knotweed (*Polygonum arenastrum*) are common weeds found in turfgrasses. All three of these weeds make for an unsightly appearance in turfgrass. The object of this study was to evaluate the efficacy of various commercial and experimental herbicides for Prostrate Spurge, Path Rush and Prostrate Knotweed control.

In the summer of 2003 three studies were conducted at Clemson University. Study 1 investigated the control of Prostrate Spurge, study 2 investigated the control of Path Rush and Study 3 investigated the control of Prostrate Knotweed. The treatments for study 1 included Manor (metsulfuron) 60 DF at 0.019 lb ai/A and two experimental formulas designated as S-10439 0.023 G at 0.019 lb ai/A and S-10926 0.03 G at 0.019 lb ai/A. The treatments for study 2 included Monument (trifloxysulfuron) 75 WG at 0.03 lb ai/A, Manage 75 WG at 0.06 lb ai/A, Image 70 DG at 0.5 lb ai/A, Basagran 4.0 L at 2.0 lb ai/A, MSMA 6.6 L at 2.0 lb ai/A and Image 70 DG + MSMA 6.6 L at 0.38 and 1.0 lb ai/A. The treatments for study 3 included Corsair (chlorsulfuron) 75 DF at 0.14 lb ai/A + 2,4-D Amine 4.0 L at 1.0 lb ai/A, Turflon Ester (triclopyr) 4.0 L at 1.0 lb ai/A + 2,4-D Amine 4.0 L at 1.0 lb ai/A, 2,4-D Amine 4.0 L at 1.0 lb ai/A, Vista (fluroxypyr) 1.5 EC at 0.375 lb ai/A, Trimec Classic (2,4-D, MCPP, Dicamba) 3.32 EC at 1.66 lb ai/A, Speedzone (carfentrazone, 2,4-D, MCPP, Dicamba) 2.2 L at 1.1 lb ai/A and Manor (metsulfuron) 60 DF at 0.02 lb ai/A.

All of the studies were designed as randomized complete block arrangements. The blocks were each replicated a total of three times. The treatments were applied using a CO_2 backpack spray boom calibrated at 187 L/ha (20 gal/A). Treatments for study one were applied on July 22, 2003. Treatments for study two were applied on July 23, 2003. Treatments for study three were applied on June 10, 2003 with sequential applications on June 17 and July 23, 2003. The studies subjectively determined the control of the weeds on a percentage scale with 100% designated as complete control and 90% being considered acceptable control.

By 64 DAT of study 1, Manor provided 100% control of the Prostrate Spurge while S-10439 and S-10926 provided unacceptable control. By 74 DAT of study 2, none of the treatments were providing acceptable control of the Path Rush, greatest control (36%) was obtained using Basagran. By 72 DAT of study 3, all treatments were providing 100% control of the Prostrate Knotweed.

Future research in this area include adjusting the rates, timing, and tank mixes of the herbicides especially for path rush.

SOIL VS. FOLIAR EXPOSURE OF HERBICIDES TO PERENNIAL SEDGES AND IMPLICATIONS FOR CONTROL IN TURFGRASS SYSTEMS. J.S. McElroy, F.H. Yelverton, T.W. Gannon, and J.W. Wilcut, Crop Science Department, NC State University, Raleigh, NC 27695.

ABSTRACT

Recent problems have been observed with respect to movement of sulfonylurea herbicides on to non-target species, namely intolerant cool-season grasses. Herbicide movement has been through tracking by machinery or foot traffic, or lateral movement through mass water flow. To mitigate such problems, some sulfonylurea herbicides have been labeled with recommendation to provide light, frequent irrigation to move the herbicides off the leaf surface and into the soil. Such a tactic will increase rhizome and root exposure to the herbicide, thus increasing the potential for uptake from the soil. While uptake of sulfonylurea herbicides is largely foliar, research has pointed out the potential benefits of uptake from the soil. Research was conducted to evaluate variation in efficacy when halosulfuron and trifloxysulfuron are applied to the foliage and/or soil. Two separate studies were conducted; the first utilized purple nutsedge (*Cyperus rotundus*) and yellow nutsedge (*Cyperus esculentus*), the second green kyllinga (*Kyllinga brevifolia)* and false-green kyllinga (*Kyllinga gracillima*). Both studies included trifloxysulfuron at 10 g ai/A plus 0.25% v/v NIS, while the *Kyllinga* spp. study evaluated halosulfuron at 27 g ai/A plus 0.25% v/v NIS as well. Nutsedge species were propagated from tubers and *Kyllinga* spp. from rhizomes. Propagation parts were planted at a 2cm depth in 400 mL pots. Soil medium was a 1:1 v/v mixture of Norfolk loamy fine sand and sand. Plants were irrigated and fertilized as needed and allowed to mature for 6 wks before experiment initiation. Herbicide treatments were applied in one of three placement levels: soil + foliar-, soil-, and foliar-applied. Soil + foliar-applied treatments were made using moving-belt sprayer calculated to deliver 20 GPA. Foliar-applied treatments were made in the same fashion, but a layer of activated charcoal was applied to the soil surface before application, and removed after the herbicide had dried on the leaf surface. Soil-applied treatments were made by calculating the amount of herbicide that would contact the pot surface in a soil + foliar-applied treatment, that amount was diluted in 10 mL of water, containing the correct surfactant amount and syringe-applied to the pot soil surface. All plants were clipped at the soil surface 30 d after treatment (DAT). Regrowth was evaluated after 60 DAT, with measurements of shoot number and weight, and root weight taken. Measurements were transformed to a percent decrease/increase relative to the non-treated before analysis. Data were subjected to ANOVA ($P = 0.05$) and means separated by Fisher's LSD.

No difference in yellow and purple nutsedge were observed, therefore data were pooled over nutsedge species. Soil- and soil + foliar-applied trifloxysulfuron reduced yellow and purple nutsedge shoot weight (100 and 85%, respectively) greater than the foliar applied (54%) 60 DAT. Similar differences in yellow and purple nutsedge root weight reduction were observed; however while soil-applied trifloxysulfuron reduced shoot number greater than foliar-applied, soil + foliar-applied reduced shoot number an intermediate amount. Differences were observed in green and false-green kyllinga, and halosulfuron and trifloxysulfuron. Soil + foliar-applied halosulfuron and trifloxysulfuron reduced green kyllinga shoot number (63 and 100%, respectively) greater than foliar- and soil-applied (both $\leq$40%). All treatments decreased false-green kyllinga shoot number similarly ($\geq$84%). Similar patterns among placement levels were seen for halosulfuron and trifloxysulfuron reduction of green and false-green kyllinga shoot and root weight. These data indicate that herbicide exposure to the soil is necessary to maximize control of yellow and purple nutsedge, and green kyllinga by halosulfuron and trifloxysulfuron.

PURPLE NUTSEDGE (*CYPERUS ROTUNDUS* L.) CONTROL FROM SULFOSULFURON APPLICATIONS TO TURFGRASS. P.A. Baumann, F.T. Moore, and M.E. Matocha, Texas Cooperative Extension, College Station, TX.

ABSTRACT

A field study was conducted in 2003 to evaluate the efficacy of sulfosulfuron for controlling purple nutsedge (*Cyperus rotundus*) in a mixed stand of Tifway 419 bermudagrass (*Cynodon dactylon x C. transvaalensis*) and common bermudagrass (*Cynodon dactylon*). The experimental site was located at Pebble Creek Country Club, near College Station, Texas. The soil type was a Lufkin fine sandy loam containing less than 1% organic matter. All treatments were applied with a CO_2 backpack sprayer calibrated to deliver 20 GPA. Treatments were replicated four times and arranged in a RCB design. Initial applications made on June 16, 2003, included sulfosulfuron at 0.66, 0.75, 1.0,1.33,1.5 and 2.0 oz./acre of herbicide product formulated as a 75% active WG. Manage (halosulfuron) was included as a standard, applied at 1.33 oz./acre. Sequential applications were made on August 27, 2003. These included sulfosulfuron applied at 0.66 and 1.33 oz./acre sequentially to the initial 0.66 and 1.33 oz./acre treatments, respectively. A sequential treatment of Manage was also applied at 1.33 oz./acre over an initial rate of 1.33 oz./acre.

When evaluated 35 DAT, all treatments provided in excess of 95% purple nutsedge control. When evaluated 64 DAT, only the sulfosulfuron treatments equal to or above 1.33 oz./acre exceeded 88% control. At 104 DAT, only sulfosulfuron rates of 1.0 oz./acre and Manage at 1.33 oz./acre provided control ranging from 80-85%. When the sequential applications were evaluated 32 DAT, control ranged from 91-99 %. The mixed stand of turfgrass was adversely affected only by rates of sulfosulfuron equal to or greater than 1.33 oz./acre. Visual growth inhibition ranged from 18-25%, when evaluated 14 DAT. By 35 DAT, this inhibition decreased to less than 14 %. Both sequential applications of sulfosulfuron and the sequential Manage treatment caused growth inhibition ranging from 15-18%.

PRE AND POSTEMERGENCE GOOSEGRASS (*ELEUSINE INDICA*) AND SMOOTH CRABGRASS (*DIGITARIA ISCHAEMUM*) CONTROL IN BERMUDAGRASS TURF. R.K. McCauley, L.B. McCarty, and A.G. Estes. Clemson University, Department of Horticulture, Clemson, SC. 29634-0375.

ABSTRACT

Goosegrass (*Eleusine indica*) and Smooth crabgrass (*Digitaria ischaemum*) are summer annuals distributed throughout the southern United States. Their contrasting textures and unsightly seed heads make them nuisances in turfgrass. The purpose of this research was to investigate the efficacy of various preemergence and postemergence herbicides for Smooth Crabgrass and Goosegrass control.

During the spring and summer of 2003 two studies were conducted. Study one, Preemergent control of Goosegrass and Crabgrass, was conducted in Batesburg, SC, and study two, Postemergent control of Goosegrass was conducted in Anderson, SC. The treatments for study one included Pendulum 3.3EC at 2.0 lbs ai/A, Pendulum 3.3EC at 1.5 lbs ai/A, Pendulum 3.8 CS at 3.0 lbs ai/A, Pendulum 3.8 CS at 2.0 lbs ai/A, 1.5 lbs ai/A, Barricade 65 WG at 0.75 lbs ai/A, Barricade 65 WG at 0.38 lbs ai/A, Dimension 40 WP at 0.5 lb ai/A, Dimension 40 WP at 0.38 lbs ai/A, Ronstar 2G at 3.0 lbs ai/A, Ronstar 2G at 2.0 lbs ai/A, Ronstar 2G at 1.0 lb ai/A, Surflan 4 AS at 3.0 lbs ai/A, Surflan 4 AS at 1.5 lbs ai/A, and Scott Goose & Crab 6.56G at 115 lbs/A. Treatments for study two included Revolver 0.19 SC at 28.0 fl oz/A, Monument 75 WG at 0.03 lbs ai/A, Flazasulfuron 25 DG at 3.0 oz product/A, Illoxan 3.0 EC at 1.0 lb ai/A, and MSMA 6.6 + Sencor 75 DF at 2.0 lbs ai/A and 0.25 lb ai/A, respectively. Initial applications for study one occurred on March 9, 2003 with a follow up treatment on May 1, 2003. Initial applications for study 2 occurred on July 7, 2003, with a sequential application on July 24, 2003. All treatments in study two received Lesco NIS (non ionic surfactant) at 0.25% V/V.

All of the studies were designed as randomized complete block arrangements with 3 replications each. The treatments were applied using a CO_2 backpack sprayer calibrated at 20 GPA, at 31p.s.i., with 8003 flat fan spray tips. For study one, visual Crabgrass and Goosegrass control ratings were recorded 110,144, and 164 DAT. During study two, visual Goosegrass control ratings were recorded 8, 17, 25, 31, and 45 DAT. Ratings for Crabgrass and Goosegrass control in both studies were based on a scale of 0-100% with 0% representing no control and 100% representing complete control. Acceptable control was deemed >90%.

For study 1 Pendulum 3.3EC and 3.8CS (2.0 fb 2.0), Pendulum 3.3EC and 3.8CS (1.5 fb 1.5), Barricade 65WG (0.38 fb 0.38), Dimension 40WP (0.5) (0.5 fb 0.5) (0.38 fb 0.38) provided excellent (>90%) crabgrass control 164 DAT. For study one Pendulum 3.3EC and 3.8CS (2.0 fb 2.0) and Dimension 40WP (0.5 fb 0.5) provided excellent (>90%) goosegrass control 164 DAT. For study 2, MSMA + Sencor, Illoxan, and Revolver provided excellent (>90%) control 45 DAT. Monument and Katana had <10% control of goosegrass throughout study.

No Bermudagrass injury was observed with any of the treatments. Future research at Clemson University will be to continue to conduct pre and early postemergence grassy weed control studies.

SELECTIVE REMOVAL OF TORPEDOGRASS (*PANICUM REPENS*) IN CENTIPEDEGRASS (*EREMOCHLOA OPHIUROIDES*). R.E. Strahan; Department of Agronomy, LSU Agricultural Center, Baton Rouge, LA 70803.

ABSTRACT

Torpedograss is a troublesome weed of turfgrasses throughout the Southern United States. The weed invades golf courses and home lawns throughout south Louisiana and severely infests centipedegrass in the New Orleans area. There are currently no cultural practices or registered herbicides that will selectively remove torpedograss in centipedegrass.

Previous research indicates that clethodim is an effective herbicide for removing creeping perennial grasses, such as common bermudagrass (*Cynodon dactylon*) in centipedegrass. However, information concerning the effectiveness of clethodim for torpedograss control is not available. The objective of this research was to evaluate clethodim for torpedograss control in centipedegrass.

Field studies were conducted in La Place and Slidell, LA and greenhouse studies were conducted in Baton Rouge, LA to evaluate the use clethodim for torpedograss control in centipedegrass. In field studies, single or sequential applications of clethodim at 0.60 kg ha^{-1} and sequential applications at 0.30 kg ha^{-1} were more effective than sethoxydim applications. Torpedograss control with clethodim, however, did not exceed 79%. Torpedograss control with sethoxydim was no greater than 55%. Although still commercially acceptable (< 30% injury), clethodim caused some moderate centipedegrass injury.

In greenhouse studies, the effectiveness of several spray adjuvants were evaluated for use in increasing the efficacy of clethodim. Regardless of adjuvant, clethodim at 0.60 kg ha^{-1} controlled torpedograss better than clethodim at 0.30 kg ha^{-1} (62 vs 44%). Results of these studies indicated that the herbicide rate is a more critical factor than the adjuvant used.

CHEMICAL OPTIONS FOR SELECTIVE CONTROL OR SUPPRESSION OF BERMUDAGRASS IN CREEPING BENTGRASS, KENTUCKY BLUEGRASS, AND PERENNIAL RYEGRASS. S.D. Askew, J.B. Beam, and W.L. Barker; Department of Plant Pathology, Physiology, and Weed Science; and E.H. Ervin, Department of Crop Soil & Environmental Sciences, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061.

ABSTRACT

In the turfgrass transition zone, bermudagrass [*Cynodon dactylon* (L.) Pers.] is often grown in close proximity to cool-season grasses like creeping bentgrass (*Agrostis stolonifera* L.), Kentucky bluegrass (*Poa pratensis* L.), and perennial ryegrass (*Lolium perenne* L.). Inevitably, bermudagrass often becomes an invasive weed in neighboring cool-season grasses. Lack of selective herbicides makes it difficult to suppress (prevent spread without discoloration) or control bermudagrass in infested cool-season grasses. Field studies were conducted in Blacksburg, VA to evaluate several herbicides and plant growth regulators for selective bermudagrass control or suppression in creeping bentgrass, Kentucky bluegrass, and perennial ryegrass. Strips of common bermudagrass 'Vamont' sod were established in perennial ryegrass and 'Kelly' Kentucky bluegrass. In contrast, creeping bentgrass 'Penncross' sod strips were established into plots of 'Tifway' hybrid bermudagrass. In all cases, chemical treatments were evaluated for affects on bermudagrass encroachment into the cool-season grass and visual quality of desirable turfgrass. The objectives were to determine methods to selectively control bermudagrass with minimal injury to cool-season grass or to limit bermudagrass encroachment into cool-season grasses without decreasing visual quality of either species. Plots were 2 m by 2 m with a 0.3 m wide by 2 m long strip of sod established in the center. Treatments were initiated May 16, 2003 and applied every three weeks until August 29, 2003 for a total of six treatments. Bermudagrass was green and growing at first treatment. Mowing heights were 1.6, 2.5, and 1.6 cm for creeping bentgrass, Kentucky bluegrass, and perennial ryegrass, respectively. Treatments were applied at 280 L/ha and included the following: ethofumesate at 1.68 kg ai/ha, flurprimidol at 0.84 kg ai/ha, ethofumesate + flurprimidol, siduron at 13.44 kg ai/ha, fenoxaprop at 0.04, 0.06, and 0.08 kg ai/ha, fluazifop at 0.04, 0.07, and 0.1 kg ai/ha, mesotrione at 0.28 kg ai/ha, isoxaflutole at 0.28 kg ai/ha, triclopyr at 1.1 kg ai/ha, fenoxaprop at 0.06 kg/ha + ethofumesate, and fenoxaprop at 0.06 kg/ha + flurprimidol. The entire experimental area was treated with propaconizol at 0.5 kg ai/ha. Mesotrione and isoxaflutole were not included in the creeping bentgrass study. In perennial ryegrass, the two higher rates of fenoxaprop, fenoxaprop + triclopyr, fenoxaprop + ethofumesate, isoxaflutole and all rates of fluazifop controlled bermudagrass greater than 90% 18 weeks after initial treatment (WAIT). The two higher rates of fluazifop caused unacceptable injury to perennial ryegrass. In Kentucky bluegrass, the two higher rates of fenoxaprop, fenoxaprop + triclopyr, all rates of fluazifop, and isoxaflutole controlled bermudagrass greater than 90% at 18 WAIT. Ethofumesate + flurprimidol and the two higher rates of fluazifop caused unacceptable injury to Kentucky bluegrass. In creeping bentgrass, only ethofumesate + flurprimidol selectively controlled bermudagrass 68%. Other treatments either did not control bermudagrass or were too injurious to creeping bentgrass. Siduron did not control bermudagrass, but decreased lateral growth without causing discoloration of bermudagrass or creeping bentgrass.

SELECTIVE DALLISGRASS (*Paspalum dilatatum*) CONTROL IN BERMUDAGRASS TURF. L.R. Hubbard, A.G. Estes and L.B. McCarty. Clemson University, Department of Horticulture, Clemson, SC 29634-0319.

ABSTRACT

Dallisgrass (*Paspalum dilatatum*) is a clumping perennial grass weed common in turf areas. Dallisgrass produces unsightly seedheads in the summer and disrupts the uniformity of the turf. The purpose of this research was to investigate the efficacy of various postemergence herbicides for possible dallisgrass control.

In summer of 2003, two studies were conducted at Clemson University investigating postemergence Dallisgrass control. Treatments were applied with a CO_2 backpack sprayer calibrated at 20 GPA, at 30 PSI, using 8003 flat fan spray tips. Plot size measured 1.5 m by 1.5 m (study 1) and 2 m by 3 m (study 2), replicated three times. Treatments for Study 1 included: Katana (25 DG) at 0.09 lb ai/A (0 fb 21 DAI); Katana + MSMA (6.6 SC) at 0.09 lb ai/A + 2.0 lb ai/A (0 fb 21 DAI); MSMA at 2.0 lb ai/A (0 fb 7 DAI); MSMA + Sencor (75 DF) at 2.0 lb ai/A + 0.25 lb ai/A (0 fb 7 DAI); Revolver (0.19 SC) at 0.04 lb ai/A (0 fb 21 DAI); Revolver + MSMA at 0.04 lb ai/A + 2.0 lb ai/A (0 fb 21 DAI); and, Revolver at 0.04 lb ai/A (0 DAI) fb MSMA 2.0 lb ai/A (7 DAI). Initial applications for Study 1 were made on June 11, 2003.

Treatments for Study 2 included: MSMA at 2.0 lb ai/A (0 fb 7 fb 14 DAI); MSMA + Sencor at 2.0 lb ai/A + 0.25 lb ai/A (0 fb 7 fb 14 DAI); Plateau (2.0 L) at 0.09 lb ai/A (0 fb 30 DAI); Plateau + MSMA at 0.09 lb ai/A + 2.0 lb ai/A (0 fb 30 DAI); Monument (75 WG) 0.03 lb ai/A (0 fb 14 fb 30 DAI); Monument + MSMA at 0.03 lb ai/A + 2.0 lb ai/A (0 fb 14 fb 30 DAI); Katana at 0.09 lb ai/A (0 fb 14 fb 30 DAI); Katana + MSMA at 0.09 lb ai/A + 2.0 lb ai/A (0 fb 14 fb 30 DAI). Initial applications for Study 2 were made on July 23, 2003. All treatments received non-ionic surfactant (Lesco) at 0.25 % V/V.

Visual ratings for Study 1 were taken 8 DAI, 14 DAI, 21 DAI, 28 DAI, 35 DAI, 42 DAI, 49 DAI, 58 DAI, and 63 DAI. Visual ratings for Study 2 were taken 8 DAI, 16 DAI, 21 DAI, 28 DAI, 42 DAI, 49 DAI and 57 DAI. Ratings for Dallisgrass control were based on a scale of 0-100%, with 0% representing no control and 100% representing complete control. Ratings for Bermudagrass injury were based on a scale of 0-100%, with 0% representing no damage and 100% representing dead turf.

All treatments in Study 1 containing MSMA provided excellent (>90%) Dallisgrass control at 49 DAI, except Katana + MSMA (applied initially + 21 DAI). Revolver + MSMA applied initially + 21 DAI provided excellent control at 49 DAI. However, Revolver applied initially, followed by MSMA at 7 DAI provided only minimal control early (45 % at 21 DAI) and very poor long-term control (8% at 49 DAI). All treatments in Study 2 resulted in excellent (>90%) Dallisgrass control 49 DAI. Bermudagrass injury was acceptable (<30%) with all treatments during entire study, except for Plateau & Plateau + MSMA, which had recovered by 5 WAT. Katana efficacy greatly improved with the addition of a third treatment.

Future research will continue screening new and experimental herbicides, applied with and without MSMA, for Dallisgrass activity. Research will continue to evaluate additional combinations and timings in combination with mowing heights and frequencies.

EFFECT OF MOWING HEIGHT ON GROWTH AND REPRODUCTIVE CAPABILITIES OF DALLISGRASS AND BAHIAGRASS. G.M. Henry and F.H. Yelverton, Crop Science Department, North Carolina State University, Raleigh, NC 27695-7620.

ABSTRACT

In North Carolina, *Paspalum dilatatum* (dallisgrass) and *Paspalum notatum* (bahiagrass), are two of the most prevalent and difficult to control weed species in turfgrass. They are both rhizomatous, perennial grass weeds that readily invade golf course fairways and roughs. Over time, individual plants slowly increase in diameter due to the spread of aggressive underground rhizomes. Currently, few post-emergent herbicide options exist for the effective, economical control of these weeds. Chemical treatment and frequent mowing practices common to high maintenance turfgrass environments does not dramatically reduce the spread of these weeds.

Plugs of individual dallisgrass and bahiagrass plants were collected in Raleigh, NC, in 2003, using a cup-cutter. Plugs were immediately transplanted into bare ground at the Sandhills Research Station in Jackson Springs, NC, on May 29, 2003. Treatments consisted of two mowing regimes: 1.3 and 7.6 cm mowed three times per week. Mowing heights were selected to simulate typical turfgrass maintenance practices conducted on golf course fairways and roughs. A non-mowed check was included for comparison. Plots were arranged in a split-plot experimental design with four replications. Each plot contained six individual plants.

Plants were gradually reduced to their respective mowing heights over a two-week period immediately before initiation of the study, which was approximately three weeks after transplanting. Initial plant diameters were measured at the start of the study and were determined monthly afterward. Plants were excavated on November 15, 2003 and rhizome fresh weights were determined for each plant. Plant diameters and rhizome fresh weights of excavated plants were subjected to ANOVA and separated using Fisher's protected LSD at the 0.05 significance level.

The non-mowed dallisgrass check measured 41 cm and had a rhizome weight of 82 g. Dallisgrass spread was reduced 27% for the 1.3 cm mowed treatment and 30% for the 7.6 cm mowed treatment, respectively. Dallisgrass rhizome production was reduced 57% for the 1.3 cm mowed treatment and 48% for the 7.6 cm mowed treatment, respectively. The non-mowed bahiagrass check measured 70.5 cm and had a rhizome weight of 297 g. Bahiagrass spread was reduced 48% for the 1.3 cm mowed treatment and 24% for the 7.6 cm mowed treatment, respectively. Bahiagrass rhizome production was reduced 83% for the 1.3 cm mowed treatment and 63% for the 7.6 cm mowed treatment, respectively. Dallisgrass spread and rhizome production was reduced when compared to the non-mowed check. However, the amount of reductions did not differ between mowing treatments. Bahiagrass plants that were mowed at the 1.3 cm height had both spread and rhizome production reductions that were less than plants mowed at 7.6 cm. Therefore, areas that are maintained at a rough height may be more conducive to bahiagrass infestation than areas maintained at a fairway height.

POSTEMERGENCE CRABGRASS CONTROL IN KENTUCKY BLUEGRASS. J.B. Beam, W.L. Barker, and S.D. Askew; Department of Plant Pathology, Physiology, and Weed Science, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061.

ABSTRACT

Crabgrass (*Digitaria* sp.) is an annual concern for most turfgrass professionals. One preemergence herbicide application does not effectively control crabgrass during a spring of above average rainfall. Fenoxaprop, MSMA, fluazifop, and quinclorac are registered for postemergence crabgrass control in most turf species, but effective control and turfgrass injury are dependant on environmental conditions and crabgrass size. Mesotrione and isoxaflutole are experimental herbicides that are safe on most turfgrass species and may control crabgrass. Imazapic, although not labeled for use in Kentucky bluegrass (*Poa pratensis* L.) lawns, controls crabgrass and could be safely used on Kentucky bluegrass at appropriate rates. An experiment was conducted in 2003 at the Turfgrass Research Center in Blacksburg, VA to determine Kentucky bluegrass and crabgrass response to dithiopyr, fenoxaprop, MSMA, fluazifop, quinclorac, imazapic, mesotrione, and isoxaflutole. The experiment was conducted as a randomized complete block with treatments replicated three times. Herbicides included dithiopyr at 0.56 kg ai/ha, fenoxaprop at 0.1 and 0.5 fb 0.5 kg ai/ha, MSMA at 1.96 fb 1.96 kg ai/ha, fluazifop at 0.09 kg ai/ha, quinclorac at 0.63 fb 0.63 kg ai/ha with crop oil concentrate (COC) at 1% v/v and 0.84 kg ai/ha with COC and at 0.84 kg ai/ha without surfactant, imazapic at 0.05 kg ai/ha and 0.02 fb 0.02 kg ai/ha, mesotrione at 0.44 kg ai/ha, and isoxaflutole at 0.28 kg ai/ha. A non-ionic surfactant at 0.25% v/v was included with fluazifop, mesotrione, and isoxaflutole treatments. Weeds consisted of mostly smooth crabgrass (*Digitaria ischaemun* Schreb. *ex* Muhl.) at the one- to three-tiller growth stage when treatments were first applied. Sequential applications were made two weeks after initial. Crabgrass control and Kentucky bluegrass injury were visually estimated at 2, 4, and 8 weeks after treatment (WAT). Fenoxaprop at 0.1 and 0.05 kg ai/ha applied twice, MSMA at 1.96 kg ai/ha applied twice, isoxaflutole at 0.28 kg ai/ha, and quinclorac at 0.63 kg ai/ha applied twice controlled crabgrass greater than 90% 8 WAT. Quinclorac at 0.84 kg ai/ha, mesotrione at 0.44 kg ai/ha, and imazapic at 0.02 kg ai/ha applied twice controlled crabgrass between 80 and 90% 8 WAT. Quinclorac at 0.84 kg ai/ha without surfactant, fluazifop at 0.09 kg ai/ha, dithiopyr at 0.56 kg ai/ha, and imazapic at 0.05 kg ai/ha controlled crabgrass less than 70% 8 WAT. Imazapic at 0.02 kg/ha applied twice injured Kentucky bluegrass 85% while all other herbicides injured Kentucky bluegrass less than 25% 8 WAT. Results suggest fenoxaprop, MSMA, quinclorac, mesotrione, and isoxaflutole are effective for postemergence crabgrass control.

DIFLUFENZOPYR ADMIXTURES; DO THEY HAVE A ROLE IN VIRGINIA BUTTONWEED CONTROL IN WARM SEASON TURF? G. Wehtje and R.H. Walker, Department of Agronomy and Soils, Auburn University, AL 36849.

ABSTRACT

Virginia buttonweed control in warm-season turfgrass species requires high rates and/or repeated applications of herbicides with auxin-type mode of action. These treatments often lead to unacceptable turfgrass injury. Diflufenzopyr functions as a synergist with auxin-type herbicides, including pyridine herbicides such as fluroxypyr. Field and laboratory research were conducted to determine whether Virginia buttonweed control could be improved with admixtures of fluroxypyr and diflufenzopyr without unacceptable turfgrass injury. Treatments consisted of fluroxypyr applied alone at 140 and 280 g ae/ha, diflufenzopyr alone at 70 and 140 g/ha, and all possible 2-way admixtures. Treatments were applied to a hybrid bluegrass 'Thermal blue' infested with Virginia buttonweed. Sod of centipedgrass 'common', hybrid bermudagrass 'Tifway', hybrid zoysiagrass 'Emerald' and St. Augustinegrass 'Raleigh', which had been previously established in pots, were treated simultaneously and returned to a greenhouse. Experimental objectives were met by the admixture of fluroxypyr plus diflufenzopyr at 280 and 70 g/ha, respectively. This treatment provided nearly 40% more Virginia buttonweed control relative to the same rate of fluroxypyr alone. Turfgrass injury was species dependent, and was either equivalent to, or less than that obtained with fluroxypyr alone. Radiotracer studies established that, depending upon the turfgrass species, fluroxypyr absorption was either not influenced, or reduced by the addition of diflufenzopyr. Neither root nor foliar absorption of fluroxypyr by Virginia buttonweed was influenced by diflufenzopyr. Translocation of foliar-absorbed fluroxypyr was reduced, but translocation of root-absorbed fluroxypyr was increased by diflufenzopyr. The diflufenzopyr-induced synergism may indicate that a significant portion of the applied fluroxypyr is absorbed by roots and/or other sub-soil tissues.

VIRGINIA BUTTONWEED CONTROL WITH ALS-INHIBITING HERBICIDES APPLIED ALONE AND WITH TRIMEC CLASSIC. D.W. Wells, J.M. Taylor, J.D. Byrd Jr., and K.C. Hutto; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Virginia buttonweed (*Diodia virginiana*) is considered by many Southern U.S. turf managers as the number one weed pest of managed turf, especially in residential lawns within the Gulf Coast states. This spreading perennial broadleaf reproduces by seed, roots and stem fragments making it very prolific and difficult to control.

The objectives of this experiment were: 1) to evaluate the efficacy of ALS-inhibiting herbicides on Virginia buttonweed when applied alone or tank-mixed with 2 pt/A Trimec Classic (2,4-D, MCPP, dicamba) 2.72 EC; 2) compare these treatments to a recommended standard of 3 pt/A Trimec Classic followed by a sequential application approximately 30 days later; and 3) determine turf tolerance to these herbicide treatments.

Herbicides applied alone and in combination with Trimec Classic at 2pt/A included the following: Monument (trifloxysulfuron) 75WG at 0.56 oz/A; Revolver (foramsulfuron) 0.19L at 26.0 oz/A; Battalion (sulfosulfuron) 75DF at 2.6 oz/A; Image (imazaquin) 70DF at 0.71 lb/A; Corsair (chlorsulfuron) 75DF at 3.0 oz/A; Tranxit (rimsulfuron) 25DF at 2.0 oz/A; Manor (metsulfuron) 60DF at 1.0 oz/A; Manage (halosulfuron) 75DF at 1.33 oz/A; Katana (flazasulfuron) 25DG at 3.0 oz/A. Trimec Classic at 2.0 pt/A; Trimec Classic at 3.0 pt/A followed with a sequential application of 3.0 pt/A; and an untreated control were also included as comparison treatments. A non-ionic surfactant was added at 0.25% v/v to all treatments except the Revolver and Trimec Classic alone treatments.

Evaluations were made at 7, 16, 22, 30, 57 and 92 days after the initial herbicides application (DAT) which was applied July 16, 2003. Statistical differences (LSD) were determined at p=0.05. At 7 DAT, no treatment provided greater than 43% control, however, there was an additive effect with the tank-mix combinations. At 16 DAT only the Manor plus Trimec Classic treatment reached 80% control, but was not statistically different from any other tank-mix combination or Trimec Classic alone. No other treatments applied alone provided greater than 58% control at 16 DAT. By DAT, rating, all tank-mix treatments, except Manage plus Trimec Classic (73%), provided 80% or greater control as did the Trimec Classic alone at 3.0 pts/A. At 30 DAT Corsair (95%) was the only single product alone treatment providing greater than 80% control. Tank-mix treatments above 80% control at 30 DAT included Monument (88%), Battallion (93%), Image (80%), Corsair (98%), Manor (93%), and Katana (85%). By the 57 DAT rating, Virginia buttonweed recovery and regrowth begin to separate treatment effects with Corsair (80%) and Trimec Classic 3 pts/A (95%) being the only single product treatments with greater than 53% control. Tank-mix treatments still above 80% control included Monument (85%) Battalion (85%), Corsair (93%), Manor (88%), and Katana (80%) with only Manage (55%) being statistically different from any of the tank-mix treatments. At 92 DAT the only treatment not containing Trimec Classic that gave greater than 43% control was Corsair which was still providing 83% control. All tank-mix combinations other than Manage (60%) were still providing from 73-95% control at 92 DAT compared to the Trimec Classic 3 pts/A plus 3 pts/A sequential which provided 95% control of Virginia buttonweed. Turf tolerance was never an issue with any treatments. The highest injury rating to the 'Tifway' bermudagrass was only 16% at the 7 DAT rating. By the 16 DAT rating and beyond, injury ratings for all treatments were 0%.

VIRGINIA BUTTONWEED CONTROL IN BERMUDAGRASS WITH CARFENTRAZONE AND SULFONYLUREA HERBICIDES. T.W. Gannon and F.H. Yelverton; Department of Crop Science, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Virginia buttonweed (*Diodia virginiana*) is a mat-forming perennial broadleaf weed which favors moist or wet sites in turfgrass environments and typically requires repeat applications for acceptable control. In the 2000 SWSS Weed Survey, Virginia buttonweed was ranked as one of the top five most troublesome weeds in turfgrass environments in ten of thirteen participating states. The objectives of this research were to evaluate select newly registered sulfonylurea herbicides and carfentrazone for Virginia buttonweed control in bermudagrass turf.

Two trials were initiated during the summer of 2003. Each study was conducted in a common bermudagrass rough maintained at two inches. Trial one was located at Reedy Creek Golf Course in Raleigh, NC and was initiated on June 10 while trial two was initiated on July 22 and was located at Echo Farms Golf Course in Wilmington, NC. Sulfonylurea herbicides evaluated in trial one included: a single application or two applications of flazasulfuron applied at 1.5, 2.3, or 3 oz/a, Monument (trifloxysulfuron) at 0.56, Revolver (foramsulfuron) at 26 fl oz, or TranXit GTA (rimsulfuron) at 1 oz. Standard treatments included in trial one were: Confront (triclopyr + clopyralid) at 1 pt/a, Millenium Ultra (2,4-D + clopyralid + dicamba) at 2.5 pt, Speed Zone (carfentrazone + 2,4-D + MCPP + dicamba) at 4 pt, or Trimec Classic (2,4-D + MCPP + dicamba) at 3.5 pt. In trial two, Trimec Classic at 3.5 pt/a, Horsepower (MCPA + triclopyr + dicamba) at 2 pt, Chaser 2 amine (2,4-D + triclopyr) at 2.5 pt, or Millenium Ultra at 2 pt were evaluated alone or tank-mixed with 1.3 oz/a QuickSilver (carfentrazone). Standard treatments included in trial two included: QuickSilver at 1.3 oz/a, Confront at 1 pt, or Monument at 0.56 oz.

Trial one and two utilized 30 or 50 ft^2 plots, respectively, while each contained four replicates and were broadcast treated at 33 gallons per acre. Each trial was evaluated visually on a 0 - 100% scale where 0 = no injury and 100 = complete control. Data were subject to ANOVA and means were separated according to Fisher's Protected LSD (P=0.05).

In trial one, no sulfonylurea herbicide provided acceptable Virginia buttonweed control at 12 WAIT. However, Confront or Speed Zone provided good control at 4 WAT and remained at 78 & 73%, respectively, through 12 WAT. Further, Millenium Ultra provided excellent control (96%) through 12 WAT. In trial two, at 7 DAT, Virginia buttonweed injury was increased when QuickSilver was tank-mixed with Trimec Classic, Horsepower, Chaser 2, or Millenium Ultra, compared to the products applied alone. However, at 65 DAT, QuickSilver only enhanced Virginia buttonweed control when tank-mixed with Horsepower. Millenium Ultra provided similar control (70%) regardless of whether QuickSilver was tank-mixed or applied alone. QuickSilver applied alone provided injury through 14 DAT but at 65 DAT, provided no control. In each of the trials, bermudagrass injury was not objectionable from any treatments.

PREEMERGENCE ANNUAL BLUEGRASS (*Poa annua*) CONTROL IN OVERSEEDED AND NONOVERSEEDED TURFGRASS. F.W. Totten, L.B. McCarty, and A.G. Estes. Department of Horticulture, Clemson University, Clemson, SC 29634-0375.

ABSTRACT

Annual bluegrass (*Poa annua*) is an annual grass weed common in various turfgrass situations. Annual bluegrass has an off-yellow color that can disrupt uniformity, produce noxious seedheads, and germinate throughout winter. More importantly, this species has broad genetic diversity which has led to an increase in resistant populations. The purpose of this research is to screen various products for annual bluegrass control in non-overseeded and overseeded bermudagrass.

Two studies were conducted at Clemson University to investigate the efficacy of various herbicides on annual bluegrass control in non-overseeded and overseeded bermudagrass, and evaluate any effects the products may have on bermudagrass green-up. Study one was conducted on non-overseeded, dormant common bermudagrass at the Clemson University band field. Study two was conducted on overseeded Tifway bermudagrass at Boscobel Golf Course, Pendleton, SC. Plot sizes for each treatment were 2.0 m by 2.0 m, and replicated three times. Treatments were applied using a CO_2 backpack sprayer calibrated at 20 GPA, at 30 PSI, with 8003 flat fan spray tips. Treatments for study one included: Barricade, Dimension, Pendimethalin, Surflan, Bensulide, Simazine, Ronstar, Balan, Regal Star, Kerb, and Plateau. Treatments for study two included: Dimension, Barricade, Kerb, Ronstar, TranXit, Prograss, and Bensulide.

Ratings for annual bluegrass control were based on a scale of 0-100%, with 0% representing no control and 100% representing complete control. Any rating recorded below 90% was deemed unacceptable. Green-up ratings of common bermudagrass were based on a scale of 0-100% with 0% representing no green-up and 100% representing complete green-up.

On the final rating date (April 28, 2003) for study one, Barricade (65 WG) at 0.75 lb ai/a (August-2002), Barricade at 0.75 lb ai/a (August-2002) fb Barricade at 0.38 lb ai/a (January-2003), Surflan (4 AS) at 3.0 lbs ai/a (August-2002), Surflan at 3.0 lbs ai/a (August-2002) fb Surflan at 1.5 lbs ai/a (January-2003), Simazine (4 L) at 2.0 lbs ai/a (August-2002) fb 1.0 lb ai/a (January-2003), Ronstar (2 G) at 2.0 lbs ai/a (August-2002), Ronstar at 2.0 lbs ai/a (August-2002) fb 1.0 lb ai/a (January-2003), Regal Star (1.2 G) at 3.0 lbs ai/a (August-2002), Regal Star at 3.0 lbs ai/a (August-2002) fb 1.5 lbs ai/a (January-2003), Kerb (50 WP) at 2.0 lbs ai/a (November-2002), and Plateau (2L) at 0.1 lb ai/a (November-2002 fb January-2003 fb February 2003) treatments provided >90% control. Pendimethalin (60 WG) at 3.0 lbs ai/a (August-2002) fb 1.5 lbs ai/a (January-2003) and Balan (1.5 EC) at 3.0 lbs ai/a (August-2002) fb 1.5 lbs ai/a (January-2003) treatments provided 70-80% control. Also, a delay in common bermudagrass green-up (12%) was observed with Plateau treatment.

On the final rating date (April 21, 2003) for study two, Barricade (65 WG) at 0.5 lb ai/a (60 DBO) fb 0.5 lb ai/a (January-2003) and Prograss (1.5 EC) at 1.0 lb ai/a (45 DAO) fb 1.0 lb ai/a (December-2002) treatments provided >90% control. Dimension (40 WP) at 0.5 lb ai/a (45 DBO) fb 0.5 lb ai/a (January-2003), Dimension at 0.5 lb ai/a (45 DBO) fb Prograss (1.5 EC) at 1.0 lb ai/a (December-2002), Barricade at 0.5 lb ai/a (60 DBO) fb Prograss at 1.0 lb ai/a (December-2002), Kerb (50 WP) at 2.0 lbs ai/a (45 DBO) fb Prograss at 1.0 lb ai/a (December-2002), and Ronstar (2G) at 2.0 lbs ai/a (45 DBO) fb Prograss at 1.0 lb ai/a (December-2002) provided 80-90% control. Kerb at 2.0 lbs ai/a (45 DBO), Ronstar at 2.0 lbs ai/a (45 DBO), TranXit (25 DF) at 0.03 lb ai/a (14 DBO), and TranXit at 0.03 lb ai/a (14 DBO) fb Prograss 1.0 lb ai/a (December-2002) treatments provided 70-80% control.

Future research should screen new products for annual bluegrass control in various turfgrass situations. Furthermore, different combinations of treatments and sequential treatments, and altering the timing of application should be evaluated.

VELOCITY (BISPYRIBAC-SODIUM) FOR SELECTIVE POSTEMERGENCE *POA ANNUA* CONTROL IN COOL-SEASON TURF. L.B. McCarty and A.G. Estes, Department of Horticulture, Clemson University, Clemson, SC 29634-0375.

ABSTRACT

Bispyribac-sodium (Velocity 80S) recently received a 24c label for selective, late-season annual bluegrass (*Poa annua* L.) control in bermudagrass overseeded with perennial ryegrass in several southern USA states. Its mode of action is an inhibitor of acetolactate synthase (ALS) enzyme necessary for formation of the branch chain amino acids, valine, leucine and isoleucine. Bispyribac-sodium was initially used for grass (especially *Echinochloa* spp.), sedge and broadleaf weed control in rice.

Several experiments were conducted in 2003 all arranged as randomized complete blocks with three replications to evaluate its efficacy on *Poa annua* control and turf safety. Treatments were applied in February, March and/or April at 1.3 to 2.6 oz product per acre to a naturally infested annual bluegrass 'Tifway' bermudagrass golf course fairways overseeded with 250 to 300 lbs per acre perennial ryegrass. Plot size were 6 sq.m. with treatments applied using a CO_2- powered backpack sprayer calibrated at 20 GPA (187 l/ha) and plots mowed at 1.3 cm (0.5 inch) three times weekly. Data analyzed included visual weed control percentages and turf injury from 0 to 100 where 30% was maximum acceptable. Data was analyzed using ANOVA with means separated with LSD (0.05).

Postemergence *Poa annua* control with mid-February applications in South Carolina in 2003 at either the 1.3 or 2.6 oz/acre were ineffective (<10% control) over four different experiments when final control ratings were made in late-April. Mid-March application at either rate was highly effective (≥95%) in control. Early-April applications (April 4th) also provided excellent (≥93%) control at the 2.6 oz/a rate. Repeat monthly applications were also made but control was unacceptable unless March and/or April applications were included. In comparison, ethofumesate (Prograss 1L) applied at 1 gallon per acre in February, March or February+March provided no annual bluegrass control.

Perennial ryegrass turf phytotoxicity was minimum (≤15%) with all application rates and timings. Highest (15%) phytotoxicity resulted with 2.6 oz/acre applied in February plus March. A single application of 5.2 oz per acre in mid-March caused temporary ryegrass phytotoxicity (~30%) for approximately 3 weeks. This would simulate an overlap application scenario. No damage or delay in bermudagrass green-up was noted for any treatment in any study.

An additional study was performed on 'Penncross' creeping bentgrass (*Agrostis palustris*) golf course fairway to determine its tolerance to bispyribac-sodium. April and May applications at 1.3 or 2.6 oz per acre caused only minor (<10%) turf phytotoxicity. One interesting side-note was the lack of dollar spot disease (*Sclerotinia homoeocarpa*) occurrence in bispyribac-sodium treated plots. Early April or May treatments at 1.3 or 2.6 oz/acre had <15% dollarspot occurrence through July 7, 2003 while untreated, paclobutrazol (Trimmit), trinexapac-ethyl (Primo MAXX) or ethephon (Proxy) treated plots had between 25 and 70% occurrence during the same time frame.

Overall, mid-March or early-April bispyribac-sodium applications at 1.3 or 2.6 oz/a provided excellent control of annual bluegrass in overseeded ryegrass. February applications in 2003 in SC provided unacceptable control. Additional research should be performed on reducing ryegrass phytotoxicity with iron and/or nitrogen timing and rate applications and to substantiate *Poa annua* control with bispyribac-sodium throughout a wider geographical region.

EFFICACY OF BISPYRIBAC-SODIUM ON ANNUAL BLUEGRASS CONTROL IN BERMUDAGRASS OVERSEEDED WITH PERENNIAL RYEGRASS. T.R. Murphy and J.A. Ferrell, The University of Georgia, Griffin, GA.

ABSTRACT

Postemergence control of annual bluegrass (*Poa annua* L.) is difficult to achieve in bermudagrass that has been overseeded with perennial ryegrass. Studies were conducted at Griffin, Georgia to determine if bispyribac-sodium (Velocity) would selectively control annual bluegrass in overseeded bermudagrass. 'Tifway' bermudagrass was seeded with perennial ryegrass at 10.0 lbs./1,000 sq. ft. the last week of September in 2001 and 2002. Clipping height was 0.625 inches and the site was irrigated as needed.

In Study 1, bispyribac-sodium was applied at 0.7, 1.4 and 2.8 oz. product/acre at either 4 or 18 weeks after seeding (WAS). Applied at 4 WAS to 3-leaf ryegrass, bispyribac-sodium injury across the rates evaluated ranged from 8 to 33% at 40 days after treatment (DAT). By 48 DAT, injury was < 6% for this same rate range. When bispyribac-sodium applications were delayed until 18 WAS (perennial ryegrass growth stage was 3- to 4-tiller), bispyribac injury was < 15% for all rates at 35 DAT. When applied 4 WAS, annual bluegrass control at 7 months after treatment was 83% for bispyribac-sodium at 2.8 oz. product/acre. Control was unacceptable (<70%) at lower rates. If applied 18 WAS, bispyribac-sodium control of annual bluegrass at 5 weeks after treatment (WAT) was >95% for all rates. By 8 WAT annual bluegrass control was <50% for all bispyribac sodium rates, except the 2.8 oz. product/acre which provided 86% control.

In Study 2, bispyribac-sodium was applied at either 1.3 or 2.6 oz. product/acre at annual bluegrass seedhead emergence on February 18, 2003. Repeat applications were made at 21 or 35 DAT, or at 21 fb 14 days after the initial application. There was no difference in perennial ryegrass injury between bispyribac-sodium rates until 8 weeks after the initial application (WAI). Injury peaked at 30% 4 WAI, and by 8 WAI bispyribac-sodium at 2.6 oz. product/acre applied three times injured perennial ryegrass 13%. Only 5% perennial ryegrass injury was observed 8 WAI with three applications of bispyribac-sodium at 1.3 oz. product/acre. Three applications of bispyribac-sodium generally provided better annual bluegrass control than two applications. Control was >75% for bispyribac-sodium applied 3 times at either 1.3 or 2.6 oz. product/acre at 11 WAI.

In Study 3, bispyribac-sodium was applied at 1.3 oz. product/acre with and without adjuvant on February 18 fb March 3, 2003, or on March 3 fb March 21, 2003. Adjuvants and rates evaluated were a nonionic surfactant (Chem-Nut 80/20) at 0.25% v/v, an organosilicone surfactant (Kinetic) at 0.25% v/v and methylated seed oil (Destiny) at 1.0% v/v. All adjuvants increased bispyribac-sodium injury to perennial ryegrass at either 2 or 4 WAI. Of these adjuvants methylated seed oil tended to increase injury the most. By 6 WAI, perennial ryegrass injury from bispyribac-sodium applied with or without adjuvant was < 5%. When bispyribac-sodium was applied on February 18 fb March 3, all adjuvants increased annual bluegrass control approximately 20% 8 WAI. However, if bispyribac-sodium applications were delayed until March 3 fb March 21, adjuvants did not increase control at the 6 WAI evaluation.

POSTEMERGENCE CONTROL OF *POA ANNUA* IN DORMANT BERMUDAGRASS (*CYNODON DACTYLON*). B.J. Tucker*, L.B. McCarty, C.J. Cox, and A.E. Estes. Clemson University, Department of Horticulture, Clemson, SC. 29634-0375.

ABSTRACT

Annual Bluegrass (*Poa annua*) is a persistent bunch type winter annual weed found throughout the southern United States, and also voraciously produces seedheads. The abundance of seedheads and pale green color disrupt uniformity, and make *Poa annua* particularly unsightly in dormant Bermudagrass (*Cynodon dactylon*). The objectives of this study were to evaluate *Poa annua* control with postemergence herbicide applications, and observe any differences in herbicide efficacy when applied in December or February.

Two studies were performed during the winter of 2002-2003. Each study was performed on a common bermudagrass rough on a golf course in Pendleton, SC. Treatment applications for study one were made on December 17, 2002, and applications for study two were made on February 5, 2003. Treatments applied to studies one and two included: Atrazine 4.0 L at 2.24 kg ai/ha, Princep 4.0 L (simazine) at 2.24 kg ai/ha, Reward 2.0 EC (diquat) 0.56 kg ai/ha, Roundup Pro 4.0 L (glyphosate) 0.56 kg ai/ ha, QuickPro 66 DG (glyphosate + diquat) at 1.12 kg ai/ha, Finale 1.0 SC (glufosinate) at 1.68 kg ai/ha, Roundup Pro 4.0 L + Envoy 0.94 EC (glyphosate + clethodim) at 0.56 and 0.28 kg ai/ha, Finale 1.0 SC + Envoy 0.94 EC (glufosinate + clethodim) at 1.68 kg and 0.28 kg ai/ha. Finale 1.0 SC + Roundup Pro 4.0 L (glufosinate + glyphosate) at 1.68 kg ai/ha and 0.56 kg ai/ha, Kerb 50 WP (pronamide) at 1.68 kg ai/ha, Image 70 DG (imazaquin) at 0.56 kg ai/ha, Manor 60 DF (metsulfuron) 0.03 kg ai/ha, TranXit 25 DF (rimsulfuron) at 0.04 kg ai/ha, Battallion 75 DG (sulfosulfuron) at 0.02 kg ai/ha, Katana 25 DG (flazasulfuron) at 0.05 kg ai/ha, Revolver 2.34 SC (foramsulfuron) at 0.35 kg ai/ha, and Monument 75 WG (trifloxysulfuron) at 0.03 kg ai/ha. Velocity 80 WP (bispyribac sodium) at 0.15 kg ai/ha was applied to study 2 only.

Poa annua control was rated weekly. Control was rated visually on a 0-100% scale with 0% = worst and 100% = best. Control >90% was considered acceptable.

Following December application, Finale provided excellent control (>90%) control from 3 weeks after treatment (WAT) to the final rating date (15 WAT). Finale + Envoy, Finale + Roundup Pro, and Roundup Pro + Envoy provided >90% *Poa annua* control from 5 WAT to 15 WAT. Quick Pro provided >90% control from 7 WAT to 15 WAT. Kerb, TranXit, Flazasulfuron, Revolver, and Monument provided >90% control at 15 WAT.

Following February application, Finale + Envoy, Kerb, TranXit, and Monument were the only treatments providing excellent *Poa annua* control (>90%) at 12 WAT. Finale provided >90% control from 4 WAT to 8 WAT, and Roundup Pro and Diquat provided >90% control from 6 WAT to 8 WAT.

In conclusion, Finale + Envoy, Kerb, TranXit, and Monument provided >90% control by the final rating date of both studies. Finale, QuickPro, Finale + Roundup Pro, and Roundup Pro + Envoy exhibited excellent control when applied in December, but control was short-lived when applied in February. Future research will include continued evaluation of adjusted rates, timings, and tank mixes of non-selective herbicides, as well as, the continued evaluation of sulfonylureas for *Poa annua* control.

ANNUAL BLUEGRASS CONTROL WITH BISPYRIBAC-SODIUM ON BENTGRASS PUTTING GREEENS. T.C. Teuton, J.C. Sorochan, C.L. Main, and T.C. Mueller. Department of Plant Sciences, University of Tennessee, Knoxville, TN 37996.

ABSTRACT

Annual bluegrass (*Poa annua* L.) has long been one of the toughest weeds to control in bentgrass (*Agrostis palustris* Huds.) and ryegrass (*Lolium perenne* L.). Bispyribac-sodium is an acetolacatate sythesis (ALS) inhibitor which stops the production of branch chain amino acids. Like all of the ALS inhibitors, bispyribac-sodium has selective weed control. An experiment was conducted at Three Ridges Golf Course in Knoxville, TN in the March of 2003 to evaluate of bispyribac-sodium for control of annual bluegrass in a bentgrass putting green maintained at 3 mm. Treatments included bispyribac-sodium 80 WP at 20 g ai/A monthly for 3 months, 5 g ai/A weekly for 3 months, 10 g ai/A weekly for 2 and 3 months, and 5 and 10 g ai/A every other week for 3 months. Treatments were evaluated weekly for annual bluegrass control and bentgrass injury on a scale of 0-100, 0 being no control or injury and 100 being complete annual bluegrass control or bentgrass death. Treatments were also evaluated for overall turfgrass quality (playability) on a scale of 0-9, 0 being dead turf and 9 being ideal turf.

Annual bluegrass control 30 days after initial application (DAA) was unacceptable (< 85%) for all treatments with weekly applications at 10 g ai/A showing the best results at 68% and 71%, respectively. Annual bluegrass control increased with both weekly 10 g ai/A treatments. Treatments of 10 g ai/A weekly for 2 or 3 months were the best treatments with ≥ 98% control for the duration of the study. By 86 DAA control increased for the 5 g ai/A weekly applications to 94%. By 105 DAA the weekly treatment of 5 and 10 g ai/A were the only treatment to provide acceptable annual bluegrass control (≥ 86%).

Bentgrass injury 30 DAA for the 5 g ai/A weekly treatment at 15%, both 10 g ai/A weekly treatments at 50% and 46%, and 10 g ai/A every other week at 10%, respectively. Injury > 10% is considered excessive for putting greens. However, at 57 DAA only the 10 g ai/A weekly at eight applications remained above the 10% injury level. Bentgrass injury at the 86 and 105 DAA were minimal.

Putting green quality 30 DAA was below the minimum 6.5 for the weekly applications of bispyribac-sodium at 10 g ai/A. By 57 DAA all weekly applications of bispyribac-sodium were at or below the minimum 6.5 and remained below that level for the duration of the trial. Initial research has shown bispyribac-sodium may give golf course superintendents a new weapon in their arsenal against annual bluegrass. However, bentgrass injury at putting green height and overall drop in putting quality are of concern. Future research is planned to evaluate multiple rates, timings, and surfactants to decrease bispyribac-sodium injury on bentgrass putting greens.

VELOCITY FOR *POA ANNUA* CONTROL IN PERENNIAL RYEGRASS. J.L. Belcher, R.H. Walker and M. Cooper; Agronomy and Soils, Auburn University, Auburn, AL 36849.

ABSTRACT

Choices for postemergence control of annual bluegrass (*Poa annua* var. *annua*; POANN) in overseeded bermudagrass (*Cynodon dactylon*) are limited. Concerns associated with products currently available for this purpose include injury to the ryegrass (*Lolium perenne*; LOLPE) and/or bermudagrass as well as delays in spring greenup. Velocity (bispyribac sodium) is under development by Valent Corporation for selective postemergence control of annual bluegrass from perennial ryegrass. A study was initiated to evaluate Velocity for postemergence control of annual bluegrass in overseeded bermudagrass.

Research was conducted fall 2002-spring 2003 at Auburn Turfgrass Research Unit with the following variables: bispyribac rates of 0.066, 0.132 and 0.264 lb ai/A; applications were single, double or triple. Single applications were applied 2/11 or 3/25; double was applied 2/11 + 3/7 or 2/11 + 3/25; triple was 2/11 + 3/7 + 3/25. Fairway Master perennial ryegrass was seeded at 300 lb/A into a Tifway bermudagrass sod managed as a golf course fairway. The bermudagrass turf was scalp mowed and perennial ryegrass was broadcast seeded on 10-23-02. The area has a natural infestation of POANN that can be characterized as high density and excellent uniformity. Perennial ryegrass and POANN were always at mowed canopy height of 0.75 inch when Velocity was applied. POANN was in very early flower, mid-flower and full flower at time of the three respective application dates in the non-treated plots. All herbicide applications were applied in a volume of 30 gallons/A and no adjuvant was included. Data collection included visual evaluations over time of POANN control and LOLPE injury. Tifway bermudagrass was evaluated on 5/7/03 to determine if Velocity affected spring transition. Velocity injury to LOLPE was generally <30% (slight) with 0.066 and 0.132 lb/A rates with occasional injury to 40% (moderate) with the 0.264 lb/A rate. Injury was generally 20% or less in 3 weeks after bispyribac application. It was difficult to visually separate ryegrass chlorosis from POANN chlorosis. Commercially acceptable control of POANN was obtained with the triple application of 0.066 lb/A rate (21-day interval) and the double application of 0.132 lb/A rate (42-day interval). POANN seed heads were reduced to 10% or less with a single early application. However, if not retreated, regrowth occured. Percent green Tifway bermudagrass increased with later applications of bispyribac and when triple applications were made. Observations of the plots on 1/16/04 (non-overseeded) showed significant residual control (reduced infestations) of POANN with all treatments that received a triple application and with double applications that totaled at least 0.198 lb/A of Velocity.

BERMUDAGRASS AND ZOYSIAGRASS TOLERANCE AND WEED CONTROL FROM TRANSITION-ASSISTING HERBICIDES APPLIED AT EARLY GREENUP. W.L. Barker, J.B. Beam, and S.D. Askew; Department of Plant Pathology, Physiology, and Weed Science, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061.

ABSTRACT

Bermudagrass [*Cynodon dactylon* (L.) Pers.] is commonly overseeded in the commonwealth of Virginia while zoysiagrass (*Zoysia japonica* L.) typically is not. Each of these warm season grasses becomes infested with winter weeds regardless of overseeding. Herbicides are often used to control winter weeds or aid in transitioning overseeded turf back to a warm-season monoculture. Practitioners are often concerned about the affects herbicides may have on post-dormant warm-season grasses in early spring. The purpose of these studies was to determine bermudagrass and zoysiagrass tolerance and weed control from several herbicides that are commonly used for spring transition. Six trials were conducted at three Virginia locations, Turfgrass Research Center, Blacksburg; Independence Golf Club, Manikin-Sabot; and Goodyear Golf Club, Danville. Trials were conducted as randomized complete block designs with three replications of each treatment. Herbicides were applied mid-spring and included foramsulfuron at 5 g ai/ha, rimsulfuron at 70 g ai/ha, trifloxysulfuron at 3 g ai/ha, metsulfuron at 7 g ai/ha, chlorsulfuron at 34 g ai/ha, pronamide at 276 g ai/ha, imazaquin at 80 g ai/ha, and flazasulfuron at 70 g ai/ha. Turf coverage, turf injury and weed control were rated at two-week intervals. Imazaquin injured bermudagrass more than 30% at 3 weeks after treatment (WAT). Foramsulfuron, trifloxysulfuron, metsulfuron, chlorsulfuron, and pronamide all had significantly more bermudagrass coverage than the nontreated control at 3 WAT. Foramsulfuron, rimsulfuron, and trifloxysulfuron all had significantly more bermudagrass coverage than the nontreated control at 8 WAT. At 3 WAT, metsulfuron injured zoysiagrass over 30% and foramsulfuron, rimsulfuron, trifloxysulfuron, chlorsulfuron, pronamide, imazaquin, and flazasulfuron all had greater than 80% zoysiagrass coverage. Metsulfuron had less zoysiagrass coverage than the nontreated control 3 WAT. At 8 WAT, zoysiagrass coverage was 100% when treated with rimsulfuron, trifloxysulfuron, flazasulfuron, or pronamide. Rimsulfuron, pronamide and trifloxysulfuron controlled annual bluegrass (*Poa annua* L.) greater than 75% 6 WAT. Pronamide controlled corn speedwell (*Veronica arvensis* L.) greater than 75% 6 WAT. Trifloxysulfuron, metsulfuron, chlorsulfuron, pronamide, imazaquin, and flazasulfuron controlled mouseear chickweed (*Cerastium vulgatum* L.) greater than 75% 6 WAT. Pronamide and trifloxysulfuron controlled Parsley-piert (*Alchemilla arvensis* (L.) Scop.) greater than 75% 6 WAT. Metsulfuron, chlorsulfuron, and flazasulfuron controlled knawel (*Scleranthus annuus* L.) greater than 75% 6 WAT. Bermudagrass coverage typically increased due to weed control following treatment of foramsulfuron, rimsulfuron, or trifloxysulfuron. Zoysiagrass coverage also improved with the control of winter weeds by foramsulfuron, pronamide, flazasulfuron, rimsulfuron, and trifloxysulfuron. Imazaquin delayed bermudagrass greenup and metsulfuron, injured zoysiagrass initially. In these studies, the benefits of weed control tended to outweigh any slight delay in greenup or turfgrass injury associated with using transition-assisting herbicides in early spring.

HERBICIDE TOLERANCE OF SEEDLING BERMUDAGRASS AND ZOYSIAGRASS. J.W. Boyd, M.D. Richardson and J.W. McCalla. University of Arkansas.

ABSTRACT

'Zenith' zoysiagrass and 'Riviera' bermudagrass were seeded at 1.0 lb PLS/1,000 sq ft on July 1, 2003 at the University of Arkansas Research Station in Fayetteville, AR. The site had been fumigated with methyl bromide. Herbicide treatments were applied at 2 weeks after emergence. Carrier volume was 50 gpa. Turfgrass cover was measured using digital image analysis.

Herbicide treatments applied to zoysiagrass and bermudagrass in a tank mix with MSMA at 2.0 lb/ai/a were flazasulfuron (0.046 lb/ai/a), foramsulfuron (0.026 lb/ai/a), trifloxysulfuron (0.026 lb/ia/a), clopyralid (0.38 lb/ai/a), triclopyr + clopyralid (0.28 + 0.094 lb/ai/a) and 2,4-D + dicamba + mecoprop (0.87 + 0.23 + 0.09 lb/ai/a). Quinclorac was applied alone at 0.5 and 0.75 lb/ai/a to bermudagrass and zoysiagrass. Treatments unique to zoysiagrass were fenoxaprop + clopyralid + triclopyr (0.125 + 0.094 + 0.28 lb/ai/a) and metsulfuron + MSMA (0.015 + 2 lb/ai/a). Treatments applied to bermudagrass only included metribuzin + MSMA (0.38 lb + 2.0 lb/ai/a) and metsulfuron + MSMA (0.028 + 2.0 lb/ai/a).

At 7 DAT (days after treatment), percent bermudagrass groundcover for metribuzin + MSMA, triclopyr + clopyralid + MSMA and 2,4-D + dicamba + mecoprop + MSMA was 24, 64 and 79%, respectively compared to 95% for the untreated control. At 21 DAT, seedling bermudagrass cover was greater than 97% for all herbicide treatments except metribuzin + MSMA. Percent cover for the metribuzin + MSMA treatment was 89% compared to 99% for the untreated control.

At 21 DAT, seedling zoysiagrass cover was greater than 90% for all herbicide treatments except fenoxaprop + clopyralid + triclopyr and metsulfuron + MSMA. Percent cover for fenoxaprop + clopyralid + triclopyr, flazasulfuron + MSMA and metsulfuron + MSMA was 45, 61 and 82%, respectively, compared to 98% for the control.

A second 'Riviera' bermudagrass trial was located on a non-fumigataed site at a sod farm near Little Rock, AR. It was seeded at 1.0 lb PLS/1,000 sq ft on June 24, 2003. Herbicide treatments were applied at 2 weeks after emergence. Herbicide injury and weed control were rated on a 0 to 100 scale with 0 being no injury or weed control and 100 being dead turf or dead weeds. Carrier volume was 30 gpa. Metribuzin + MSMA produced 87% injury at 7 DAT. However, injury from this treatment dropped to 27% at 21 DAT. Injury from 2,4-D + dicamba + mecoprop + MSMA was 30% at 7 DAT, but declined to 7% at 21 DAT.

Weeds at the Little Rock site included large crabgrass (*Digitaria sanguinalis),* purslane *(Portulaca oleracea)*, tighthead sprangletop (*Leptochloa fasicularis*), rice flatsedge (*Cyperus iria*), barnyardgrass (*Echinochloa crus-galli*), broadleaf signalgrass (*Urochloa platyphylla*), and tufted lovegrass (*Eragrostis pectinacea*). Treatments containing MSMA provided 95 to 100% control of all weeds except tufted lovegrass. Quinclorac alone at 0.5 and 0.75 lb/ai/a gave 100% control of barnyardgrass, 80% control of broadleaf signalgrass and 50% control of large crabgrass, but failed to provide control of sprangletop, purslane and rice flatsedge.

TURFGRASS TOLERANCE AND WEED CONTROL WITH CARFENTRAZONE. J.M. Taylor, J.D. Byrd Jr., and K.C. Hutto; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Experiments were performed to evaluate carfentrazone for weed control and turfgrass tolerance. Carfentrazone, a contact herbicide that disrupts cell membranes, was applied alone (Quicksilver), tank-mixed with translocated herbicides, or applied in a pre-packaged formulation of carfentrazone + 2,4-D, MCPP, and dicamba (Speed Zone). In the first experiment, Quicksilver 2 EW was applied at 2.33, 4.66, or 9.32 fl oz/A to common bermudagrass, 'Tifway' bermudagrass, common centipedegrass, and 'Raleigh' St. Augustinegrass. All rates were higher than the maximum labeled rate of 2.1 fl oz/A. No unacceptable injury was observed on any of the warm-season turfgrasses evaluated. Quicksilver injured common bermudagrass 8-15% at 7 days after treatment (DAT) while injury of 8-15% was only observed at 3 DAT on 'Tifway' bermudagrass. Injury to centipedgrass was only observed with the highest rate of Quicksilver. Three to 5% injury was observed at 3, 7, and 30 DAT. Injury to St. Augustinegrass from 4.66 fl oz/A was only observed at 3 DAT. Injury to St. Augustinegrass from 9.32 fl oz/A was 8, 5, 5, 5, 10, and 15% at 3, 7, 14, 30, and 45 DAT, respectively. All treatments were applied on September 30, 2002 and evaluations were discontinued on November 14, 2002 due to frost. Quicksilver was also evaluated for Virginia buttonweed control. The objective of this experiment was to evaluate the effects of Quicksilver for Virginia buttonweed control and turf injury on ALS-inhibiting herbicides and Trimec Classic, all of which are mobile herbicides. Quicksilver alone did provide some burndown of Virginia buttonweed. The highest control (65%) from 1.3 fl oz/A Quicksilver was at 16 DAT; control decreased at the later rating dates. The data from the first two evaluations at 7 DAT indicate that Quicksilver did provide a faster burndown of Virginia buttonweed when added to several treatments compared to those treatments applied alone. Control with 1.3 fl oz/A Quicksilver + 2.0 pt/A Trimec Classic was 58% at 7 DAT compared to 23% with Trimec Classic alone. With 1.3 fl oz/A Quicksilver + 0.5 lb ai/A Image at 7 DAT, control was 43% compared to 23% with Image alone at the same rating date. At the later rating dates Quicksilver generally did not have an effect on control with the other herbicides except with Image and Monument. Virginia buttonweed control with Quicksilver + Image or Quicksilver + 0.56 oz/A Monument was 68 to 85% at 57 and 92 DAT compared to 40 to 63% with Image or Monument alone, respectively. The only injury to bermudagrass from any treatment was at 7 DAT and was no more than 10%. In a third experiment, Speed Zone 2.2 L which contains 0.05, 1.53, 0.48, and 0.14 lb ae/gal carfentrazone, 2,4-D, MCPP, and dicamba, respectively, was compared to Trimec Classic 2.72 L which contains 1.98, 0.53, and 0.21 lb ae/gal 2,4-D, MCPP, and dicamba, respectively. Comparing these two products at 3 pt/A, Speed Zone controlled white clover better than Trimec Classic at 7, 15, and 21 DAT. Control with Speed Zone was 35, 80, and 88%, respectively at these dates compared to 13, 60, and 65%, respectively, with Trimec Classic. Buckhorn plantain control was also better with Speed Zone at the same dates compared to Trimec Classic. Control of buckhorn plantain was 40, 80, and 85%, respectively, with Speed Zone at those dates compared to 20, 60, and 65%, respectively with Trimec Classic at the same dates. Control of dandelion by the two products did not differ. Control evaluated from 29 through 85 DAT was the same for all three weeds evaluated.

WEED CONTROL DURING BERMUDAGRASS SEEDLING ESTABLISHMENT. S.D. Askew, J.B. Beam, and W.L. Barker; Department of Plant Pathology, Physiology, and Weed Science, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061.

ABSTRACT

The recent release of high quality seeded bermudagrass cultivars such as 'Princess', 'Riviera', and 'Yukon' have increased demand for bermudagrass seed. Since the most widely used chemicals available for weed control during bermudagrass sprigging can't be used at seeding, research is needed to evaluate selective herbicides for weed control during bermudagrass establishment from seed. Greenhouse and field studies were conducted at Blacksburg, VA to evaluate several herbicides for bermudagrass tolerance at seeding (PRE) and 3 weeks after seedling emergence (POST). In field evaluations, best tolerance and cover of Riviera and Yukon bermudagrass was achieved with quinclorac applied PRE at 0.63 kg ai/ha followed by quinclorac at 0.42 kg ai/ha POST or MSMA at 1.9 kg ai/ha four weeks after emergence followed by MSMA + 2,4-D + dicamba + MCPP eight weeks after emergence. The following chemicals did not significantly injure seeded bermudagrass when applied PRE: foramsulfuron, rimsulfuron, sulfosulfuron, and quinclorac at less than 0.9 kg ai/ha. The following chemicals were too injurious when applied at bermudagrass seeding: bispyribac, atrazine, mesotrione, ethofumesate, nicosulfuron, primisulfuron, cyanazine, diclosulam, flumetsulam, imazapic, sulfentrazone, siduron, quinclorac at greater than 0.9 kg ai/ha, metsulfuron, chlorsulfuron, pronamide, flazasulfuron, imazaquin, and flumioxazin. The following chemicals did not significantly injure bermudagrass when applied 3 weeks after emergence in the greenhouse: dicamba, 2,4-D, diclosulam, flumetsulam, MSMA, foramsulfuron, rimsulfuron, trifloxysulfuron, metsulfuron, chlorsulfuron, sulfosulfuron, halosulfuron, bromoxynil, bentazon, sulfentrazone, bispyribac, quinclorac, dithiopyr, pendimethalin, and prodiamine. The following chemicals were too injurious to warrant use early POST: atrazine, 2,4-D + dicamba + MCPP, triclopyr, triclopyr + clopyralid, and fenoxaprop. These preliminary studies indicate that weed control in seeded bermudagrass should be attempted using herbicides applied early POST rather than PRE. Future studies will evaluate specific programs for weed control.

FLAZASULFURON – USE ON WARM SEASON TURF. M.D. Grove and C. Honda, ISK Biosciences and Ishihara Sangyo Kaisha, Houston, TX and Osaka, Japan.

ABSTRACT

Flazasulfuron is a new sulfonylurea herbicide being developed for use on warm season turf. The product exhibits good human and environmental safety. It is effective at a rate range of 0.5 to 1.5 oz/A for use as a transition aid in removal of cool season grasses overseeded to warm season turf. It is highly effective for control of clumpy perennial ryegrass and tall fescue. It is also quite effective for early season crabgrass control. Flazasulfuron controls a wide range of grass, sedge and broadleaf weeds present in commercially managed warm season turf.

FLUROXYPYR FOR WEED MANAGEMENT IN WARM SEASON TURFGRASS. C.M. White, B.J. Brecke, J.B. Unruh, and D.W. Lickfeldt; West Florida Research and Education Center, University of Florida, Jay; Dow AgroSciences LLC, Fayetteville, GA.

ABSTRACT

Fluroxypyr, a broadleaf auxin-type herbicide, was evaluated for weed control effectiveness and turfgrass tolerance. Studies were conducted at the University of Florida West Florida Research and Education center during 2000-2003. Visual control ratings used a 0% to 100% scale, 0%= no control, and 100%= complete control, 70% control was considered minimally acceptable. Turfgrass injury was rated on a 0% to 100% scale, 0%= no visible injury or discoloration and 100%= brown or dead turfgrass, 30% was considered the maximum allowable injury. 'Tifway' and 'TifSport' bermudagrass (*Cynodon dactylon* X *C. transvaalensis*), and 'Raleigh' and 'Palmetto' St. Augustinegrass (*Stenotaphrum secundatum*) in some instances exhibited 10 to 20% injury soon after application. However, both turfgrass species rapidly recovered from any early damage and showed no reduction in quality by four weeks after treatment. Fluroxypyr applied alone at 0.06 to 0.25 lb a.i./A provided inconsistent control of dollarweed (*Hydrocotyle* sp.). Mixing with clopyralid, MCPP, 2,4-D or metsulfuron improved dollarweed control to at least 85%. Fluroxypyr at 0.28 lb/A provided 90% Virginia buttonweed (*Diodia virginiana*) control when applied alone. Early control (14 days after application) at lower rates of fluroxypyr was improved with the addition of MCPP but by 40 days after treatment, there was no advantage to having MCPP in the mixture. Sequential applications of fluroxypyr improved late-season control of Virginian buttonweed and spotted spurge (*Euphorbia maculata*) over single applications. Control improved to 85% or greater with the sequential treatment compare to less than 70% control with the single application. Fluroxypyr appears to offer control of broadleaf weed species in bermudagrass and St. Augustinegrass with minimal turfgrass injury

MONUMENT™ 75 WG: A NEW HERBICIDE FOR WEED CONTROL IN WARM-SEASON GRASSES. D.K. Mosdell, R.J. Keese, L.D. Houseworth and D. Ross; Syngenta Professional Products, Greensboro, NC.

ABSTRACT

Monument™ 75 WG (trifloxysulfuron-sodium) is a new broad-spectrum herbicide in the chemical family of sulfonylureas developed for post-emergence weed control in warm season turfgrasses. Monument received federal registration in September 2003 for use on bermudagrass (*Cynodon dactylon*) and zoysiagrass (*Zoysia sp*.). Rates up to 40g ai/A of Monument were found to be safe on several cultivars of bermudagrass and zoysiagrass turf. St. Augustinegrass (*Stenotaphrum secundatum*) was sensitive to Monument at rates above 10 g ai/A, particularly if a repeat application was made 4 to 6 weeks after the initial application. Control of yellow nutsedge (*Cyperus esculentus*), green kyllinga (*Cyperus brevifolius*), purple nutsedge (*Cyperus rotundus*), and several dicot weed species including Virginia buttonweed (*Diotia virginiana*) were greater than 80% in replicated trials at 7 to 12.5 g ai/A. In general, a repeat application 4 to 6 weeks after initial treatment was required for control of sedges and Virginia buttonweed. In non-overseeded bermudagrass, Monument provided acceptable control (>80%) of winter annuals such as *Poa annua* and common chickweed (*Stellaria media*) at rates of 7 to 12.5 g ai/A. Perennial ryegrass (*Lolium perenne*) and *Poa trivialis* were effectively removed from bermudagrass turf to enhance spring transition at Monument rates of 2 to 6.5 g ai/A.

EFFICACY OF FLAZASULFURON FOR WEED CONTROL IN BERMUDAGRASS. J.B. Beam, W.L. Barker, and S.D. Askew; Department of Plant Pathology, Physiology, and Weed Science, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061; M.D. Grove and J. Wolf; ISK Biosciences Corporation, Houston, TX 77015.

ABSTRACT

Flazasulfuron inhibits acetolactate synthase (ALS) and is under evaluation for a US turfgrass registration by ISK Biosciences. Previous research indicates flazasulfuron does not injure established bermudagrass (*Cynodon dactylon* (L.) Pers.) turf, but efficacy on many turfgrass weeds is unclear. Several studies were conducted in 2002 and 2003 at numerous locations throughout Virginia to determine flazasulfuron efficacy for weed control in bermudagrass turf. Species evaluated included: perennial ryegrass (*Lolium perenne* L.), smooth crabgrass (*Digitaria* ishaemum Schreb. *ex* Muhl.), yellow rocket (*Barbarea vulgaris* R.BR.), prostrate knotweed (*Polygonum aviculare* L.), tall fescue (*Festuca arundinacea* Schreb.), buckhorn plantain (*Plantago lanceolata* L.), common lespedeza (*Lespedeza striata* (Thunb.) H. & A.), creeping bentgrass (*Agrostis stolonifera* L.), and bermudagrass. Flazasulfuron was applied at rates between 8 and 105 g ai/ha and a nonionic surfactant at 0.25% v/v was added on all postemergence applications. Flazasulfuron postemergence in all experiments did not injure bermudagrass more than 20% at any rating period. Flazasulfuron applied preemergence at 34 g ai/ha injured seeded bermudagrass varieties 'Yukon' and 'Riviera' 90%. Flazasulfuron did not injure these seeded bermudagrass varieties when applied three weeks after emergence. Flazasulfuron applied at 9 g ai/ha or higher controlled perennial ryegrass and tall fescue 8 WAT. Flazasulfuron at 70 g ai/ha controlled two-tiller crabgrass 93% 4 WAT and 70% 12 WAT. Flazasulfuron at rates between 13 and 105 g ai/ha injured creeping bentgrass 50% at one location 1 WAT and 30 % at a second location; creeping bentgrass recovered 5 WAT except when rates higher than 53 g ai/ha were applied. Flazasulfuron at 39 and 53 g ai/ha controlled yellow rocket and prostrate knotweed 90% 8 WAT. In a second experiment, prostrate knotweed was controlled 60%. Flazasulfuron at rates between 26 and 53 g ai/ha did not control common lespedeza or buckhorn plantain 12 WAT. Results indicate flazasulfuron can safely be used on emerged bermudagrass and controls or suppresses several broadleaf and grass weeds.

THE USE OF SALTWATER AS AN HERBICIDE ON SEASHORE PASPALUM. N.B. Pool, B.J. Brecke, J.B. Unruh, G.E. MacDonald, L. Trenholm, and A. Bennett. University of Florida, Gainesville, FL.

ABSTRACT

Seashore paspalum (Paspalum vaginatum) is a perennial warm season turfgrass native to the tropical and subtropical regions of North and South America. It has been around for thousands of years, but has only been used commercially for the past decade. The plant spreads by rhizomes and stolons that root at the nodes to form a deep fibrous root system. The texture is slightly coarser than bermudagrass unless mowed at less than an inch. Seashore paspalum thrives in moist soils and has a high tolerance to salinity.

Experiments were conducted under greenhouse condition at the University of Florida, Milton Campus during the summer of 2003. In the first study, eight weeds were tested for salinity tolerance: torpedograss, dollarweed, Virginia buttonweed, large crabgrass, common bermudagrass, purple nutsedge, goosegrass, and Florida pusley. The weeds were transplanted into six-inch pots and placed in the greenhouse. Each weed species was treated with five saltwater treatments which were as follows: 34,000 ppm (1x), 25,500 ppm (3/4x), 17,000 ppm (1/2x), 8,500 ppm (1/4x), and untreated (0x). In the second study, Seashore paspalum plugs were transplanted into six-inch pots, and watered with five saltwater treatments (same concentrations as for the weed tolerance study). Eighteen different herbicides were then applied to each saltwater treatment.

Visual ratings and dry weights were collected for the weeds. Weeds that showed injury levels of greater than 70% were: Purple nutsedge and bermudagrass (1x), crabgrass and dollarweed (3/4x and 1x), goosegrass (1/2x, 3/4x, and 1x), Virginia buttonweed and Florida pusley (all rates). Torpedograss showed injury less than 20% at the highest rate. Although visual injury was noted for many of the weeds, no significant dry weight loss was found except for crabgrass at the 1x rate. Visual ratings based on the untreated check were taken for the herbicide/saltwater treatments on the Seashore paspalum. There was a significant effect of herbicide and salt concentration but no salt by herbicide interaction. All herbicides showed significant difference compared to the untreated control, with atrazine, bromoxynil, metribuzin, Trimec Southern, imazaquin, and bentazon showing greater than 80% reduction in turf quality. Salt concentrations greater than 0.75X resulted in significant loss of quality when averaged for all herbicide treatments.

EFFECT OF TRINEXAPAC-ETHYL ON CENTIPEDEGRASS GROWTH REGULATION AND SEED YIELD. J.A. Ferrell and T.R. Murphy; Department of Crop and Soil Sciences, University of Georgia, Griffin, GA 30223.

ABSTRACT

Centipedegrass is a slow-growing perennial warm-season turfgrass that possesses stolons and no rhizomes. When grown for turf, centipedegrass performs best under low fertility schemes and exhibits vigorous horizontal spread with little vertical growth. However, when grown commercially with the intention of maximizing seed production, fertility and irrigation frequency increases. These management practices lead to a proliferation of foliar growth, thatch, and stolon stacking that in turn may escalate into winter kill and/or delayed spring transition. The objective of this experiment was to determine if trinexapac-ethyl could be used to decrease foliage biomass without reducing centipedegrass seed yields. Trinexapac-ethyl (Primo MAXX) was applied at 11 or 22 fl. oz/A, at 21 days before mowing stopped (DMBS), 21 and 7 DBMS, or 7 DBMS. One-half of all plots were then treated again with 11 fl. oz/A of trinexapac-ethyl at 30 days before seed harvest (DBH). Trinexapac-ethyl reduced centipedegrass foliar biomass by 10 to 45% for all treatments without the 30 DBH application, and 40 to 60% with the additional application at 30 DBH. Although seedhead number was not reduced at any trinexapac-ethyl treatment timing or application rate, seed yield was decreased between 30 and 60% for most treatments. An exception occurred with trinexapac-ethyl applied sequentially at 7 DBMS (11 or 22 fl. oz/A) and 30 DBH, in that foliage growth was decreased by approximately 45% and seed yield was not statistically reduced.

HYBRID BERMUDAGRASS RESPONSE TO PRIMO MAXX TANK MIX COMBINATIONS WITH FLURPRIMIDOL AND PACLOBUTRAZOL. F.C. Waltz, Jr., J.A. Ferrell, and T.R. Murphy, University of Georgia, Griffin, GA 30223.

ABSTRACT

Over the past 40 years, the use of plant growth regulator (PGRs) to reduce shoot growth have been reported to lessen the effects of mowing, reduce labor costs, aid in maintaining difficult areas, improve worker safety, reducing organic waste, and improving plant water conservation. Based on mode of action and entry into the pant, PGRs are classified into two groups, Type I and Type II. Type I compounds are primarily foliarly absorbed and inhibit cell division and differentiation in meristematic points, whereas Type II PGRs act by inhibiting gibberellic acid biosynthesis.

For acceptance in the turf market PGRs must suppress vertical shoot growth, without adversely inhibiting root growth, lateral stolon development, or cause objectionable discoloration (non-green color). Previous research has reported "moderate" discoloration from single PGR applications lasting 2 to 4 weeks. Since height suppression typically lasts 4 to 6 weeks, multiple applications are necessary during the growing season and long-term discoloration is undesirable. Also, duration of height suppression has been shown to be rate dependent, with shorter effects at lower rates. Therefore, tank mix combinations of PGRs at below label rates may provide acceptable growth suppression without discoloration.

During summer 2003, a study was initiated to investigate the effect of repeated PGR tank mix combinations on 'Tifway' bermudagrass (*Cynodon dactylon* X *C. transvaalensis*). Plots were 1.8 m x 4.6 m in a randomized complete block design with 4 replications. Using a CO_2 backpack sprayer set to deliver 412 l ha^{-1}, initial treatments were applied on July 3, 2003 and the sequential application was made 4 week later (July 31, 2003). The plots were maintained similar to a golf course fairway, mowed twice weekly at 0.13-cm, and fertilized on July 29, 2003 with 48.8 kg N ha^{-1}.

Treatments included trinexapac-ethyl (0.48 l ha^{-1} formulated), flurprimidol (0.14 kg ai ha^{-1}), paclobutrazol (0.14 kg ai ha^{-1}), trinexapac-ethyl + flurprimidol (0.48 l ha^{-1} formulated + 0.14 kg ai ha^{-1}), and trinexapac-ethyl + paclobutrazol (0.48 l ha^{-1} formulated + 0.14 kg ai ha^{-1}). An untreated control was included.

Turfgrass quality, a visual assessment including turfgrass color, canopy density, texture, and overall health, was evaluated on a 0 to 10 scale, 0= poor quality or dead turf and 10= high quality, healthy turf, 8 was considered minimally acceptable. Following the sequential application, turfgrass color was rated on a 0 to 10 scale, 0= brown, dead turf and 10= dark green grass, 8 was considered minimally acceptable. Using a Toro walk-behind reel-type mower set at 0.13-cm, clippings were collected from a 2.6-m^2 area centered in the plots. Percent clipping reduction was calculated after clippings were dried and weighed.

Turfgrass quality ratings were acceptable (≥ 8) for all treatments, including the control, at all rating dates. At 4 weeks after initial treatment, and 2 and 4 weeks after the repeat application, treatments containing trinexapac-ethyl had quality rating greater than nine and were significantly improved compared to the control and, flurprimidol and paclobutrazol alone. At 2 and 4 weeks after the sequential treatment, plots treated with flurprimidol and paclobutrazol were not different from the untreated.

Similar to turfgrass quality, color ratings were acceptable (≥ 8) for all treatments and ratings. At 2 weeks after the sequential application, the tank mix combinations had improved color compared to trinexapac-ethyl, flurprimidol, or paclobutrazol alone. Although not significant compared to flurprimidol and paclobutrazol, trinexapac-ethyl and the tank mix combinations had the highest color ratings (≥ 9) 4 weeks after repeat application. By 6 weeks after application, there were no differences in color between the treatments.

Compared to the untreated control at 2 weeks after initial and sequential treatments, clipping weights were reduced by 40 to 82% in plots treated with trinexapac-ethyl and tank mix combinations. At four weeks after initial application, the trinexapac-ethyl + paclobutrazol combination had lower clipping weights (44%) compared to the control. Although not significant, a 16% increase in clipping weight compared to the untreated was measured in paclobutrazol treated plots 2 weeks after the sequential application. In this single year study, the addition of trinexapac-ethyl to flurprimidol and paclobutrazol had a general improvement in turfgrass quality, color, and a reduction in clipping weight.

TIFWAY BERMUDAGRASS GROWTH REGULATION USING PRIMO AND CUTLESS.

B.T. Bunnell* and L.B. McCarty. Clemson University, Department of Horticulture, Clemson, SC. 29634-0375.

ABSTRACT

Plant growth regulators (PGRs) are frequently used in highly maintained turfgrass situations such as golf courses and athletic fields to reduce vegetative growth and suppress seedheads. Other advantages of PGRs include reduced scalping, increased turf density, and improved turf color. The objective of this study was to evaluate two commercially available PGRs on clipping weights, horizontal regrowth, and injury of Tifway bermudagrass.

The study was performed for 12 wks from 16 June to 8 September, 2003 on Clemson University's registered Tifway bermudagrass [*Cynodon dactylon* (L.) Pers. x *C. traansvaalensis* Burtt-Davy] research plot. The study evaluated tank mix combinations including three rates of Primo Maxx 1 EC (trinexapac-ethyl) and Cutless (flurprimidol). Primo rates were 0, 6.0, and 12.0 oz A^{-1} (0, 0.052, and 0.105 kg ai ha^{-1}). Cutless rates were 0, 4.0, and 8.0 oz A^{-1} (0, 0.14, and 0.28 kg ai ha^{-1}). Tank mixes included all combinations of 3 rates of Primo and Cutless, resulting in 9 treatments. Tank mix applications were made every 3 weeks throughout the study duration.

Clipping were harvested at 4, 8, and 12 weeks after initial treatment (WAIT) with a walk mowing set to a 16 mm height. Clipping weights were compared to the untreated plot to calculate percent clipping reduction. Percent horizontal regrowth was measured biweekly and averaged over the entire study. Visual ratings for Tifway bermudagrass injury were taken weekly. Injury was rated on a 0-100% scale with 30=maximum level of acceptable injury.

At 4 WAIT, clippings were reduced 81 to 95% with Primo at 12 oz A^{-1} plus all rates of Cutless and Primo at 6 oz A^{-1} plus Cutless at 4 and 8 oz A^{-1}. Tank mix applications containing Primo at 6 oz A^{-1} plus Cutless at 0 oz A^{-1} and Primo at 0 oz A^{-1} plus Cutless at 8 oz A^{-1} reduced clippings approximately 50%. At 8 WAIT, only tank mixes containing Primo at 12 oz A^{-1} significantly reduced clippings compared plots receiving no PGR applications. Primo at 12 oz A^{-1} plus Cutless at 0 or 4 oz A^{-1} reduced clippings by 75%. A 94% clipping reduction followed the tank mix containing the high rate of Primo and Cutless. At 12 WAIT, the tank mix of Primo at 12 oz A^{-1} plus Cutless at 8 oz A^{-1} reduced clippings by 50%. Other tank mix combinations containing Primo at 6 or 12 oz A^{-1} plus Cutless, although not significant, reduced clippings 25 to 40%. The 4, 8, and 12 WAIT ratings were pooled to achieve a cumulative Tifway bermudagrass clipping regulation. Clipping weights were reduced 46 to 70% with all tank mixes containing either Primo at 12 oz A^{-1} or Primo at 6 oz A^{-1} plus Cutless at 4 and 8 oz A^{-1}.

Percent horizontal regrowth was reduced by PGR applications. Horizontal regrowth was reduced approximately 15% following Primo at 6 oz A^{-1} plus Cutless at 4 or 8 oz A^{-1} and all tank mixes containing Primo at 12 oz A^{-1}. Cutless at 4 and 8 oz A^{-1} plus Primo at 0 oz A^{-1} did not reduce horizontal regrowth.

Acceptable Tifway bermudagrass injury occurred at 1 and 2 WAIT with all tank mixes. Greatest injury of 25% at 2 WAIT followed the tank mix combination of Primo at 12 oz A^{-1} plus Cutless at 8 oz A^{-1}. All plots full recovered by 3 WAIT.

In summary, greatest clipping reduction and Tifway bermudagrass injury followed the tank mix containing the high rates of Primo and Cutless at all rating dates. All tank mixes containing Primo reduced horizontal regrowth except Primo at 6 oz A^{-1} plus no Cutless. Cutless alone did not reduce horizontal regrowth. Future research should continue to evaluate different rates and frequencies of these tank mixes. Additional work should investigate residual clipping reduction using these products on various turfgrasses.

FORAMSULFURON (REVOLVER™): WEED CONTROL IN WARM SEASON TURF.

A.M. Wiese, L.C. Mudge, D. Myers, H.C. Olsen and J.L. Corbett, Bayer Environmental Science, Montvale, NJ 07645.

ABSTRACT

Foramsulfuron, 1-(4,6-dimethoxypyrimidin-2-yl)-3-[2-(dimethylcarbamoyl)-5-formamidophenylsulfonyl]urea, is a sulfonylurea herbicide being developed for warm season turf use by Bayer Environmental Science. The trade name of this new product is Revolver™. For control of one to three leaf goosegrass (*Eleusine indica* (L.) Gaertn.), Revolver rates of 0.4 to 0.6 oz product/1000 ft2 are recommended. For tillered goosegrass, a tank mix of Revolver at 0.4 to 0.6 + Sencor at 0.3 oz product/1000 ft2 with sequential applications is recommended. Dallisgrass (*Paspalum dilatatum* Poir.) broadcast and spot treatments will continue on an experimental basis in 2004. *Poa annua* and *Poa trivialis* control can be achieved using 0.1 to 0.4 oz/1000 ft2 with lower rates used for warmer temperatures and smaller weeds. Revolver is labeled for weed control on Bermudagrass (*Cynodon dactylon* (L.) Pers.*)* and Zoysiagrass (*Zoysia japonica*). Transition of overseeded fairways and greens is improved with Revolver and improved bermudagrass base can be achieved with overseed chemical removal. The Revolver label was approved in 2003 with initial listed weeds including ryegrass, tall fescue (*Festuca arundinacea* Schrreb.), *Poa trivialis* and *Poa annua* L. and goosegrass.

SECTION III. WEED MANAGEMENT IN PASTURES AND RANGELAND

REGIONAL LARGE PLOT COMPARISONS OF COMMERCIAL HERBICIDES FOR CONTROL OF TROPICAL SODA APPLE. J.J. Mullahey, W. Kline, K. Langeland, P. Hogue, L. Gary, G. Mikulecky, S. Crawford, T. Seawright, and M. Zielinski; University of Florida and Dow AgroSciences, Milton, FL 32583.

ABSTRACT

Tropical soda apple (Solanum viarum) is an invasive non-native plant that has become a serious weed problem in pastures throughout Florida and the southeastern United States. In 1990, tropical soda apple (TSA) infested pasture in Florida was approximately 20,000 acres, in 1993, 325,000 acres, and in 1995 1 million acres were reported infested in Florida. Rapid spread of this weed has occurred from seeds transported in cattle, hay, sod, grass seeds, and wildlife (deer, feral hogs, birds). Current best management practices developed by the University of Florida, IFAS recommend the use of Remedy herbicide applied at 2 pts/ac. However, new herbicides for use in pastures are available but information is lacking on how these new products will control TSA.

In April of 2003 five herbicide field demonstration plots in Florida were established in the following counties: Hendry, Okeechobee, Highlands, Hardee, and Manatee. Six herbicide treatments were applied (April 22-24, 2003) to plots (14' x 150') and the percent control was measured up to 150 days after application. Herbicide treatments were Pasturegard (3 pts/ac), Remedy (2 pts/ac), Weedmaster (4 pts/ac), Banvel (4 pts/ac), Curtail (4 pts/ac), and 2,4-D amine (4 pts/ac). Pasturegard™ is a new, non-restricted use broadleaf weed management herbicide that will be available from Dow AgroSciences for use in range & pasture weed control, with registration expected to occur in time for the 2004 season. Visual control ratings were recorded by two different groups of individuals: county extension agents (90, 120, and 150 DAT) and a team consisting of industry/university specialists (48 and 147 DAT). For the county agents evaluations, acceptable control (90% or higher) of TSA was achieved with Remedy, Pasturegard, and Banvel at 90 and 120 DAT. However, only Remedy provided greater than 90% control at 150 DAT followed by Pasturegard (83%), Banvel (68%), Weedmaster (50%), Curtail (50%), and Velpar (45%). There were no significant differences among treatments at any of the rating periods due to the large variation in the data. One explanation for the high variation was the five county agents collecting data. In the future, all agents need to receive better training on how to visually rate TSA control.

Evaluations by the industry/university specialists group were made on June 9, 2003 (48 DAT) and again on September 16, 2003 (147 DAT) at the Hendry County and Okeechobee County locations. There were significant differences between treatments at both rating dates. In Hendry County, ratings taken in June, at 48 DAT, averaged 83, 93, 37 and 5% visual control, respectively, for Pasturegard, Remedy, Weedmaster, and 2,4-D amine. Ratings taken at 147 DAT averaged 65%, 85%, 27% and 5% respectively for Pasturegard, Remedy, Weedmaster, and 2,4-D amine.

At the Okeechobee site, ratings taken at 48 DAT averaged 73%, 92%, 22% and 13% respectively for Pasturegard, Remedy, Weedmaster, and 2,4-D amine. Ratings taken at 147 DAT averaged 98%, 99%, 23% and 18% respectively for Pasturegard, Remedy, Weedmaster, and 2,4-D amine. The improvement in TSA control at this site between the June rating vs. the September rating was probably due to heavy grass growth at this location, which shaded out any potential re-growth or emergence of TSA.

For all locations, Remedy at 2 pts/acre continues to provide excellent TSA control and was the best herbicide at all sites. Pasturegard at 3 pts/acre was less effective on average but not statistically different (5% level) from Remedy in either trial. Weedmaster, 2,4-D amine, and Velpar were statistically different (5% level) from both Remedy and Pasturegard at both sites and did not provide acceptable TSA control. In September new TSA seedlings were emerging in all of the plots. The

herbicides tested provided control of the sprayed plants but the herbicides did not control new TSA seedlings. Not being able to control emerging TSA seedlings with an herbicide continues to be a weak area in our current control strategy.

RESULTS FROM STATEWIDE EVALUATION OF NEW HERBICIDES AND FORMULATIONS FOR CONTROLLING TROPICAL SODA APPLE. W. Kline, J. Mullahey, and K. Langeland; Dow AgroSciences, Duluth, GA and University of Florida, Milton and Gainesville, FL.

ABSTRACT

In recent years cattle producers in south and central Florida, have had increasing pressure from tropical soda apple (TSA) (Solanum viarum) invasion in pastures. When cattle are shipped out of the state of Florida, there is a high level of concern about contamination of pastures, feedlots, etc. by cattle that have eaten TSA fruit containing viable seed. Interest in herbicides or combinations of herbicides for control is a high priority for producers, County Agents, and Univ of Florida Extension weed scientists. Historically combinations of mowing and Remedy™ Herbicide have been used with generally good success, but cost per acre for these treatments are always of concern to the producers and can influence Univ Extension recommendations.

Pasturegard™ is a new non-restricted use broadleaf weed management herbicide that will be available from Dow AgroSciences for use in range & pasture weed control, with registration expected to occur in time for the 2004 season. Comparison treatments between Pasturegard (3 pts/ac), Remedy (2 pts/ac), Weedmaster (4 pts/ac), and 2,4-D amine (4 pts/ac) were applied on April 22&23, 2003 in two replicated trials (3 reps in each trial). One trial was installed near Labelle, FL; the other trial was installed near Okeechobee, FL. Applications were with a fixed horizontal boom using TT11003 nozzles on 18 inch spacing. The boom was mounted on a 4 wheeler at approx 4 ft above the ground. All applications were at 40 GPA total volume.

The dominant weed at these sites was TSA and the populations were mature, well developed plants at both sites, averaging 2 to 3 ft tall when treated with the herbicides. Evaluations were made on June 9, 2003 (48 DAT) and again on September 16, 2003 (147 DAT). There were significant differences between treatments at both rating dates.

At the Labelle site, ratings taken in June, at 48 DAT, averaged 83, 93, 37 and 5% visual control, respectively, for Pasturegard (3 pts/ac), Remedy (2 pts/ac), Weedmaster (4 pts/ac), and 2,4-D amine (4 pts/ac). Ratings taken in September, at 147 DAT, averaged 65%, 85%, 27% and 5% respectively for Pasturegard (3 pts/ac), Remedy (2 pts/ac), Weedmaster (4 pts/ac), and 2,4-D amine (4 pts/ac).

At the Okeechobee site, ratings taken in June, 48 DAT, averaged 73%, 92%, 22% and 13% respectively for Pasturegard (3 pts/ac), Remedy (2 pts/ac), Weedmaster (4 pts/ac), and 2,4-D amine (4 pts/ac). Ratings taken in September, 147 DAT, averaged 98%, 99%, 23% and 18% respectively for Pasturegard (3 pts/ac), Remedy (2 pts/ac), Weedmaster (4 pts/ac), and 2,4-D amine (4 pts/ac). The improvement in TSA control at this site between the June rating vs. the September rating was probably due to heavy grass growth at this location, which shaded out any potential re-growth or emergence of TSA.

Based on the herbicides that were evaluated this year on tropical soda apple, and 5 MAT ratings the following conclusions can be drawn. Remedy at 2 pts/acre continues to perform very well for TSA control and was the best on average at both sites; Pasturegard at 3 pts/acre was less effective on average but not statistically different (5% level) from Remedy in either trial. Weedmaster at 4 pts, and 2,4-D amine at 2pts were statistically different (5% level) from both Remedy and Pasturegard at both sites and were not effective for control of TSA (mature plants) in these trials.

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ANNUAL GRASS CONTROL WITH IMAZAPIC. J. Tredaway Ducar and T.J. Butler, Berry College, Mt. Berry, GA 30149; and Texas A&M University Agricultural Research and Extension Center, Stephenville, TX 76401.

ABSTRACT

Previous research has indicated that imazapic at 3,4, and 6 fl. oz/acre will control large crabgrass > 90% POST (Boyd et al. 2003) and > 70% PRE (Butler and Tredaway Ducar 2003). Imazapic will control field sandbur in a light infestation at 4 fl. oz/acre while requiring a 6 fl. oz/acre rate in a heavier infestation (Tredaway Ducar et. al 2002). Although imazapic was labeled for use in pasture and rangeland in 2002, there are many weeds for which we are still unsure of the effect that imazapic will have on them. Many of these are left as blanks in the state recommendation guides.

Field trials were conducted at Mt. Berry, Georgia and near Stephenville, Texas in 2003 to evaluate the efficacy of imazapic for annual grass control in Coastal, Tifton 85, and Tifton 44 bermudagrass varieties. Weeds evaluated included large crabgrass (*Digitaria sanguinalis*), junglerice (*Echinochloa colona*), barnyardgrass (*Echinochloa crus-galli*), green foxtail (*Setaria viridis*), and broadleaf signalgrass (*Brachiaria platyphylla*). Treatments evaluated included imazapic at 1, 2, 3, 4, and 6 fl. oz./A with a non-ionic surfactant (0.5% v/v in Georgia and 0.25% v/v in Texas). Treatments were arranged in a randomized complete block design with four replications with plots measuring 8 feet by 25 feet. Herbicides were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 15 gallons per acre. Postemergence weed control and bermudagrass phytotoxicity was evaluated 30, 60, and 90 days after herbicide application (DAA).

In evaluating bermudagrass injury, Tifton 85 and Coastal in Texas at 30 DAA was injured 18% at 4 fl. oz/acre and 15% at 3 fl. oz/acre which were not different from each other but together were significantly higher than the 1 and 2 fl. oz rates, which had 4% injury. At 60 DAA, the 1 and 2 fl. oz rates injury was reduced to zero, and the 3 and 4 fl. oz rates decreased to 6 and 7%, respectively. In Georgia, the Tifton 44 showed similar results with the 6 fl. oz rate providing the most injury (19%). The 2 and 4 fl. oz rates were not different from each other. At 60 DAA, the 3, 4, and 6 fl. oz rates decreased injury to 8, 5, and 14%. At 90 DAA, all rates provided the same amount of injury (6%).

Two *Echinochloa* sp. were evaluated, jungle rice and barnyardgrass. Junglerice was controlled >85% 90 DAA with the 3 and 4 fl. oz rates of imazapic; barnyardgrass was controlled 99% 90DAA with the 2, 4, and 6 fl. oz rates of imazapic. Large crabgrass control in Texas was 90% or better with 2, 3, or 4 fl. oz/acre at 30 DAA; however, control decreased with time. At 60 DAA, control was 80, 83, and 90% respectively, and at 90 DAA, 70, 77, and 85%, respectively. In Georgia, control did not decrease as much as it did in Texas. At 2, 4, and 6 fl. oz/acre large crabgrass control was 97, 99, and 98% at 30 DAA, respectively. At 60 DAA, control remained the same. At 90 DAA, control decreased to 80, 85, and 90% respectively. Broadleaf signalgrass control was >86% with the 3 and 4 fl. oz rates at all evaluation timings. However, at the 2 fl. oz rate, control was 90, 87, and 50% for 30, 60, and 90 DAA, respectively. The 1 fl. oz/acre rate did not control broadleaf signalgrass. Green foxtail control was 96% or greater 30 and 60 DAA but then reduced to 80% at 90 DAA. At the 4 fl. oz rate, early control at 30 DAA was 90% but decreased throughout the season to 86% at 60 DAA and finally to 70% at 90 DAA. Green foxtail control at the 2 fl. oz rate was <54% at all evaluation timings. These findings conclude that there are more species that imazapic could expand on their label and the weed spectrum is much greater than what is currently known.

IMPACT OF PASTURE HERBICIDES ON SEEDLING COOL SEASON GRASSES. D.E. Breeden and W.W. Witt; Department of Agronomy, University of Kentucky, Lexington.

ABSTRACT

Cool season perennial grasses constitute approximately 2.5 million ha of pastures and hayfields in Kentucky with the majority being tall fescue (*Festuca arundinacea* Schreb.), an introduced European cool season grass. However, more than 90% of tall fescue is infected with the fungal endophyte (*Neotyphodium coenophialum*) whose toxins cause reproductive problems and weight loss in livestock. Consequently, herbicidal methods for removing endophyte infected tall fescue from Kentucky bluegrass pastures must be evaluated with emphasis on minimizing injury to desirable cool season forage grasses such as Kentucky bluegrass (*Poa pratensis* L.), orchardgrass (*Dactylis glomerata* L.), and timothy (*Phleum pratense* L.). Endophyte infected tall fescue must be removed from Kentucky bluegrass horse pastures to prevent late term abortions in thoroughbred mares. The objectives of this study were to (1) determine the efficacy of selected pasture herbicides for control of seedling tall fescue and (2) determine the sensitivity of desirable seedling cool season grasses to selected pasture herbicides. Greenhouse dose-response studies were conducted with imazapic, chlorsulfuron, metsulfuron methyl, diflufenzopyr + dicamba, picloram + fluroxypyr, clopyralid, and triclopyr at concentrations of 0, 5, 10, 20, 40, 80, and 160 ppb to determine their efficacy for control of seedling tall fescue. In addition, herbicide injury to desirable seedling cool season forage grasses was evaluated. Data were log transformed and analyzed using linear regression in PROC Mixed of SAS®. A heterogeneity of slope test was conducted and a pairwise comparison of species with respect to the slope of regression on concentration was conducted ($p<0.05$ level). I_{50} and I_{25} concentration values were calculated from regression equations. Analyses of slopes indicated that seedling cool season grass dry weight and height reductions were significantly different from each other with respect to the selected herbicides. I_{50} values could not be calculated for height due to the fact that 50% inhibition was not reached for the majority of herbicides at the greatest concentrations evaluated. Metsulfuron methyl, imazapic, and chlorsulfuron reduced dry weight of Kentucky bluegrass with I_{50} concentrations of 59, 75, and 80 ppb, respectively, while I_{50} values for tall fescue were 77, 142, and 81 ppb, respectively. Orchardgrass dry weight inhibition by metsulfuron methyl, diflufenzopyr + dicamba, and imazapic produced I_{50} values of 96, 126, and 153 ppb, respectively, while timothy I_{50} values for metsulfuron methyl and diflufenzopyr + dicamba were 63 and 80 ppb, respectively. ALS inhibiting herbicides were most effective at controlling tall fescue but they caused the most injury to Kentucky bluegrass. Furthermore, synthetic auxin herbicides did not reduce height or dry weight of tall fescue or Kentucky bluegrass. However, diflufenzopyr + dicamba did reduce height and dry weight of timothy and orchardgrass.

EFFECTIVENESS OF METSULFURON, DICAMBA, AND 2,4-D (CIMARRON™ MAX) FOR CONTROLLING SILVERLEAF NIGHTSHADE (*SOLANUM ELAEAGNIFOLIUM*).

F.T. Moore, P.A. Baumann, and M.E. Matocha; Texas Cooperative Extension, College Station, TX 77843.

ABSTRACT

Cimarron™ Max herbicide, developed by DuPont™, is a two part product composed of metsulfuron methyl (Cimarron™) and dicamba + 2,4-D (Range Star™). Product rates and treatment timings were evaluated for the control of silverleaf nightshade (*Solanum elaeagnifolium*) in 2002 and 2003 field trials. Both trials were conducted at the Texas Agricultural Experiment Station Farm in Burleson County, Texas, on a silt loam soil with a pH of 7.5 and 1.4% organic matter. Treatments were applied at two plant growth stages: early bloom and full berry. Plot size was 10 ft. x 20 ft. and treatments were replicated three times and arranged in a RCB design. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 15 GPA. The rates of Cimarron™ Max evaluated were Cimarron™ 0.25 oz./ac + Range Star™ 16 oz./ac, Cimarron™ 0.5 oz./ac + Range Star™ 32 oz./ac, and Cimarron™ 1.0 oz./ac + Range Star™ 64 oz./ac. A single treatment of Grazon™ P+D at 32 oz./ac was included as a standard. Treatments were evaluated both years for in-season control of shoots. Control was measured on a percentage basis, which ranged from 0, no control, to 100, complete control. Additionally, shoot regrowth in the 2002 field trial was quantified the following season to assess control of the perennial plant. Regrowth was quantified by counting all living shoots in a 21.5 ft^2 area in each plot. Regrowth ranged from 24-100 shoots/21.5 ft^2 across the entire trial.

Evaluations conducted 4 weeks after treatment (WAT) in 2002 for the early bloom applications showed that control achieved by the low rate of Cimarron™ Max (65%) was significantly less than that of the other three treatments (88-100%). However, 5 WAT in 2003, significant differences in control were observed between the low and medium rates of Cimarron™ Max (62 and 83%, respectively). Additionally, the control provided by both treatments was significantly less than the high rate of Cimarron™ Max (92%) and Grazon™ P+D (98%). No significant differences in control were observed 12 and 10 WAT, respectively, for either year (86-98%). Furthermore, no significant differences in control were observed from late season evaluations conducted 28 and 22 WAT, respectively, for either year (65-89%). Evaluations conducted in 2002 and 2003, 3 and 4 WAT, respectively, for the full berry applications resulted in no significant control differences among the four treatments for either year (92-100%).

Assessments of regrowth from the 2002 field trial showed that Cimarron™ Max applied at the low rate resulted in shoot regrowth that was 69% of the population evident in the untreated area. The other three treatments also applied at early bloom resulted in significantly lower plant populations, ranging from 24-51% of the untreated area. Additionally, the low rate of Cimarron™ Max was not significantly different in shoot regrowth than the untreated area. Regrowth assessments of all treatments applied at full berry were not significantly different from the untreated area.

JOHNSONGRASS CONTROL WITH COMBINATIONS OF CHLORSULFURON, NICOSULFURON, AND 2,4-D. M.E. Matocha, P.A. Baumann, F.T. Moore. Texas Cooperative Extension, College Station, TX 77843.

ABSTRACT

Texas pasturelands are in constant need of safeguarding against invasive annual and perennial grass and broadleaf weed species. Tank mixtures of herbicides are often required to achieve desired control of both grass and broadleaf weeds. A study was conducted at the Texas Agricultural Experiment Station Farm on a Weswood silt loam. Postemergence treatments of Telar® (chlorsulfuron), Accent® (nicosulfuron), rimsulfuron, and Plateau® (imazapic) were applied in different rate combinations with 2,4-D. All treatments were applied to actively growing johnsongrass *(Sorghum halepense)* that ranged in height from 12 to 37 inches and averaged 24 inches. The plots were 10 by 20 feet in size with 3 replications arranged in a RCB design. A CO_2 backpack sprayer calibrated at 15 GPA was used for application of treatments. Each treatment (excluding the check) included 12.6 oz/ac of 2,4-D ester. Telar was applied at 0.50, 0.75, 1.0 and 1.33 oz/ac rates. Accent was applied at 0.66, 1.0 and 1.33 oz/ac rates. Telar at the 0.50, 0.75 and 1.0 oz/ac rates was tank-mixed with Accent at either 0.66 or 1.33 oz/ac. Rimsulfuron was applied at 1.0 and 2.0 oz/ac. Imazapic at 6 oz/ac was included as a standard treatment.

Results from the 24 DAT evaluation showed no appreciable differences in control among the treatments when Telar® (0.50-1.0 oz/ac) was tank-mixed with Accent® at 1.33 oz/ac which provided 78 to 82% control. These treatments also resulted in no significant difference in control when compared to all rates of Accent used alone (74 to 83%). Telar® neither adversely affected nor improved the performance of Accent. Rimsulfuron at the high rate provided 65% control, which was not significantly different from the Accent or Telar and Accent combinations. At 24 DAT, all rates of Telar coupled with 2,4-D performed poorly providing less than 10% control

Evaluations made at 41 days following application showed comparable control to that observed 24 DAT. At 56 DAT, ratings indicated that all treatments provided less than 70% control except for Telar at the low rate combined with Accent at the high rate, which provided 70%. Telar coupled with 2,4-D resulted in significantly less control of johnsongrass when compared to all other treatments at this rating date. When evaluated 91 days following application, ratings declined sharply and no treatment provided greater than 53% control.

PERENNIAL BROADLEAF WEED CONTROL IN PASTURES T.J. Butler and J.P. Muir. Texas A&M Research and Extension Center, Stephenville, TX 76401.

ABSTRACT

Field trials were conducted in central Texas to evaluate labeled herbicides for perennial broadleaf weeds. A randomized complete block design RCBD experiment with three replications was established during the 2002 and 2003 growing seasons with eleven broadcast herbicide treatments on Western horsenettle (*Solanum dimidiatum*), silverleaf nightshade (*Solanum eleagnifolium*), and pale Yucca (*Yucca pallida*) applied in both the vegetative and flowering stages. Plot size was 8 x 30 ft, and herbicide treatments were applied with a CO2 sprayer delivering 15 GPA. In addition eight herbicides applied as 1% foliar application were applied to greenbriar (*Smilax bona-nox*) along fencerows.

The best control of Western horsenettle occurred during the flowering timing application. The best herbicide treatments were 2 pt Surmount (90%) and 1 pt Tordon22K (85%), followed by 2 pt 2,4-D LV6 (72%), 2 pt Grazon P+D (70%), and 2 pt Redeem (65%). The other herbicide treatments (2 pt Weedmaster, 2 pt Pasturegard, Cimarron Max rate II, and 3 pt 2,4-D amine) all provided unsatisfactory control of 50%. During the vegetative timing application, only 2 pt Surmount provided acceptable control (85%), while all other treatments ranged from 5-50%. Control of silverleaf nightshade was numerically higher during the flowering timing application, however this was not significant. All treatments (2 pt 2,4-DLV6, 3 pt 2,4-D amine, Cimarron Max rate II, 2 pt, Pasturegard, 2 pt Grazon P+D, 2 pt Redeem, 2 pt Surmount, 1 pt Tordon22K, and 2 pt Weedmaster), except Fuego1:8 (58%), provided greater than 89% control of silverleaf nightshade, which were not different from each other.

The best-broadcast treatment of Yucca was with Cimarron Max rate III (68%) and '3 pt Remedy + 0.5 oz Cimarron' (68%). Cimarron Max rate II controlled Yucca by 30%, which was greater than 3 pt Remedy alone (15) or Cimarron Max rate I (15%). There was no control of Yucca with 3 pt/A of Outlaw, Pasturegard, Surmount, or 2 pt/A Tordon22K. These broadcast treatments were compared to the local standard individual plant treatments (IPT): 1) '25% Remedy + 75% diesel' foliar application and 2) 2 ml concentrated Remedy on the whorl of the Yucca plant. Both IPT treatments gave 99% control, which was higher than the best-broadcast treatment.

With greenbriar, all 1% foliar treatments (Pasturegard, Surmount, Remedy, Banvel, Tordon22K, and Outlaw did not provide control (<15%). These foliar treatments were compared to the local standard: '25% Remedy + 75% diesel basal spray, which provided 75% control of greenbriar.

SECTION IV. WEED MANAGEMENT IN HORTICULTURAL CROPS

SANDEA RATE AND TIMING IN SWEETPOTATO. T.F. Garrett[1], M.W. Shankle[1], S.T. Kelly[2], and J.L. Main[1], [1]Mississippi State University, Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, MS 38863; [2]LSU AgriCenter, Winnsboro, LA 71295.

ABSTRACT

A trial was conducted at the Ferguson Farm in Pontotoc County, Mississippi and at the Ken Thornhill Farm in Gilbert, Louisiana to evaluate the use of Sandea 75WG (halosulfuron-methyl) in sweetpotato. Only a small number of herbicides are labeled for use in sweetpotato, none of which effectively control pigweed *Amaranthus spp.* and/or yellow nutsedge *Cyperus esculentus* L. These weed species are ever increasingly becoming a problem in sweetpotato production by reducing yields and quality.

A trial area was prepared by conventional tillage methods in the spring of 2003. Granular fertilizer was applied broadcast according to soil test recommendations. An insecticide treatment of Capture 2 EC (bifenthrin) at 0.3 lb ai/A was applied and incorporated prior to planting. Commercially field grown 'Beauregard B-63' slips were obtained for this trial in Mississippi and 'Beauregard B-14' slips were used in Louisiana. Slips were transplanted using a mechanical transplanter on June 25th in Mississippi and on June 2nd in Louisiana. Command 3 ME (clomazone) at 1.25 lb ai/A in Mississippi and at 0.75 lb ai/A in Louisiana was applied following planting. The experimental design was a two-factor factorial in a randomized complete block design with 4 replications. Plots were three rows spaced 40 inches apart and plants were spaced 12 inches apart within the row in Mississippi. Plots were two rows spaced 40 inches apart and plants were spaced 12 inches apart within the row in Louisiana. All Sandea treatments were applied post-transplant with a CO_2 backpack sprayer. Treatments of Sandea were applied at 14, 21, 28, 35, 42, and 49 DAP at rates of 0.012, 0.024, 0.032, and 0.048 lb ai/A. Visual observations of plant injury and yellow nutsedge control were made at 1, 2, 3, 4, and 5 weeks after initial treatment in Mississippi. Visual observations of plant injury, yellow nutsedge, and pigweed control were made at 29, 45, and 63 days after transplant (DAP) in Louisiana.

In Mississippi, roots were harvested on October 8th for a total of 105 growing days. In Louisiana, roots were harvested on October 10th for a total of 130 growing days. Roots were graded into US No. 1, Canner, Cull, and Jumbo grade yields using the National Sweetpotato Collaborator's standards and weighed. Analysis of variance was carried out on weed control, plant injury, and yield using Duncan's Multiple Range Test (α =0.05) in Mississippi and Fisher's protected LSD (α=0.05) in Louisiana.

In Mississippi, highest plant injury was 26 and 21% for Sandea applied at 14 and 35 DAP at 2 weeks after treatment (WAT). This was greater than all other application times. At 4 WAT, plant injury was less than 5% for the 14, 21, 28, and 35 DAP application times. Data was not collected for the 42 and 49 DAP. A Sandea rate effect with regard to plant injury ranged from 9 to 19% at 2 WAT and 3 to 9% at 3 WAT. Plant injury was less at the 0.25 and 0.50 oz/A than injury at 0.66 and 1.00 oz/A at 3 WAT. In Louisiana at 29 DAP, highest plant injury was 29 and 28% for Sandea applied at 14 and 21 DAP. This was greater than all other application times. At 63 DAP, plant injury was less than 2% for all application times. No Sandea rate effect was observed with regard to plant injury in Louisiana.

In Mississippi, yellow nutsedge control was at least 92% for 14 and 21 DAP application times at 2 WAT. This control was greater than 35, 42, and 49 DAP application times, but no different than the 28 DAP timing. Yellow nutsedge control was at least 94% across all application times rated at 4 WAT. Yellow nutsedge control was 97% for Sandea at 0.25 oz/A at 4 WAT and higher rates did not improve weed control. In Louisiana at 45 DAP, pigweed was control was 78% for the 28 DAP

application time. This was greater than all other application times. At 63 DAP, yellow nutsedge control was at least 85% for 14, 21, 28, and 35 DAP application times. This control was greater than 42 and 49 DAP application times. Pigweed and yellow nutsedge control was not different among Sandea rates.

In Mississippi, yield was not different among Sandea rates. US No. 1 grade yield ranged from 170 to 85 boxes/A for 28 and 49 DAP application times, respectively. US No. 1 yield with Sandea applied at 14, 28, and 42 DAP was greater than the 49 DAP application time. In Louisiana, yield was not different among Sandea rates. US No. 1 grade yield ranged from 510 to 375 bu/A for 28 and 49 DAP application times, respectively. Greatest total marketable yield was 774 bu/A at the 28 DAP application time, but was not different than 21 and 35 DAP application times.

Results from this preliminary research indicate that Sandea would be a useful crop protection product for use in sweetpotato. Data collected throughout the season, suggests Sandea at 0.50 oz/A applied at 21 to 28 DAP would be appropriate if suitable weed species are present.

SWEETPOTATO TOLERANCE TO POSTEMERGENCE APPLICATIONS OF CGA362622, HALOSULFURON, AND THIFENSULFURON-METHYL. A.W. MacRae, D.W. Monks, R.B. Batts, J.K. Buckelew, and A.C. Thornton; Department of Horticultural Science, N.C. State University, Raleigh, NC.

ABSTRACT

Three experiments were conducted to determine the timing and rate of CGA362622 (Envoke), halosulfuron (Sandea), and thifensulfuron-methyl (Harmony GT) that will minimize injury and marketable yield loss of sweetpotato. Each experiment was conducted at two sites with the Clinton site having cultivars Beauregard and Hernandez transplanted on 6-25-03 while the on-farm site having the cultivar Beauregard transplanted on 6-4-03. The experiments were of a factorial design arranged in a random complete block with four replications. Each chemical was applied at five rates (plus a non-treated check) at 1, 2, and 4 weeks after transplant (WAP). CGA362622 and thifensulfuron-methyl were applied at 0.038, 0.075, 0.11, 0.15, and 0.30 oz ai/A while halosulfuron was applied at 0.19, 0.38, 0.56, 0.75, and 0.94 oz ai/A. All plots were maintained weed-free via hand removal. Data taken were visual stunting at four intervals and yield quality, grading at three levels, Jumbos (greater that 3.5 inches in width), Ones (greater than 1.75 inches but less that 3.5 inches), and Canners (greater than 0.75 inches but less than 1.75 inches). Marketable yield was determined by combining the jumbos and ones data.

For halosulfuron, the Clinton site showed moderate stunting after the application of the halosulfuron and did not affect the yield of sweetpotato. Stunting was greatest with the 1 WAP application of halosulfuron. For the on-farm site severe stunting was observed with the 1 and 2 WAP applications of halosulfuron. This stunting caused a reduction in final yield. The mild stunting observed with the 4 WAP application did not reduce marketable yield. For thifensulfuron-methyl, the Clinton site showed a reduction in marketable yield with the 1 WAP application with a rate response observed. For the on-farm site severe stunting was observed with the 1 and 2 WAP applications of thifensulfuron-methyl. This stunting caused a reduction in final yield. Moderate stunting was observed with the 4 WAP application of thifensulfuron-methyl causing yield reduction. For CGA362622, the Clinton site showed moderate to high levels of stunting with a reduction in marketable yield with 1 and 2 WAP applications. For the on-farm site severe stunting was seen with CGA362622 at all applications. This stunting caused a reduction in final yield. These different results between sites may be related to the different production practices used at the two sites. The Clinton site had Lorsban applied and incorporated more than four weeks before planting. The grower site had Lorsban applied and incorporated, with one half being applied the day before transplant and the remaining half applied just prior to transplant. It is possible that there was an interaction between the Lorsban and the three chemicals tested resulting in an increase of stunting and loss of yield. At the time of the 4 WAP application at the grower site the Lorsban would have been partially degraded likely resulting in less stunting and greater yield. Thus, it appears from this work that application of halosulfuron must take place at least four weeks after transplanting sweetpotato. Furthermore, it appears that application of thifensulfuron-methyl and CGA362622 must not take place during the first four weeks after transplanting sweetpotato. Further tests are needed to verify our work and to determine when yield reduction by thifensulfuron-methyl and CGA362622 will not occur.

USE OF VALOR AND COMMAND IN MISSISSIPPI DELTA SWEETPOTATO. J.L. Main, M.W. Shankle and T.F. Garrett; Pontotoc Ridge-Flatwoods Branch Experiment Station; North Mississippi Research & Extension Center; Mississippi State University; Pontotoc, MS 38863.

ABSTRACT

A trial was conducted at the Alcorn State University Demonstration and Technology Transfer Farm in Mound Bayou, Mississippi to evaluate the use of Valor 51WDG (flumioxazin) herbicide in sweetpotato. Producers in close proximity to this station in the delta of Mississippi are increasing acreage in sweetpotato production. Only a few herbicides are labeled for use in sweetpotato, so producers are primarily limited to clomazone applied pre-transplant followed by a post-emergence application of a graminicide. Although the approval of clomazone for use in sweetpotato was a tremendous benefit to sweetpotato producers, the control of both pitted and entireleaf morningglory (*Ipomea lacunosa* L., and *Ipomea hederacea* L.) as well as other broadleaf species is still a problem in this area.

Trial area was prepared by disk cultivation, do-all, and bedding in the early spring of 2003. Granular fertilizer was broadcasted at the rate of 50-25-100 lb/ac (N-P_20_5-K_20) as ammonium nitrate, 0-46-0, and 0-0-60, respectively. Beds were then re-hipped on April 30th and May 28th. Pre-transplant treatments were applied on May 29th using a CO_2 backpack sprayer. Commercially field grown 'Beauregard B-63' slips were obtained for use in this trial. Plants were transplanted using a mechanical transplanter on May 30th. Treatments were assigned to plots in a randomized complete block design with four replications. Plots were three rows spaced 40-in apart and plants were spaced 12-in apart within the row. Post-transplant treatments were applied immediately after transplanting. Missing plants were replaced on June 5th. Visual ratings of injury and weed control were taken at 2, 3, 4, 6, and 9 weeks after treatment (WAT). Pre-transplant treatments included; Valor at 0, 2, and 3 oz/A (0, 0.063 and 0.095 lb ai/A, respectively), Valor at 0, 2, and 3 oz/A with 1.66 pt/A (0.62 lb ai/A) Command 3ME (clomazone), Valor at 0, 2, and 3 oz/A with 2 pt/A (0.75lb ai/A) Command and Valor at 0, 2, and 3 oz/A with 2.66 pt/A (1 lb ai/A) Command. Post-transplant treatments included Valor at 2 and 3 oz/A with and without 1.66 pt/A Command. Roots were harvested on Oct. 25th for a total of 103 growing days. Roots were graded into US No.1, Canner, Jumbo and Cull grades using National Sweetpotato Collaborator's standards and weighed. Analysis of variance was conducted and means were separated for weed control, plant injury, and yield using Fisher's protected LSD (α=0.05).

Morningglory control was at least 90% at 3 WAT in all plots that received Valor. Morningglory control declined over the observation period for all treatments. The 3 oz rate of Valor provided the best morningglory control of the two rates. All plots that received Command had at least 80% grass control at 9 WAT. Plant injury with post-transplant applications of Valor with or without Command was greater than pre-transplant Valor applications. In addition, plant injury was higher for the 3 oz/A rate of Valor than the 2 oz/A rate for pre- and post-transplant applications. Total marketable yield ranged from 14 to 403 boxes/A for the untreated and Valor at 3 oz/A + Command at 2.66 pts/A, respectively. US No. 1 yield followed the same trend and ranged from 0 to 294 boxes/A for the untreated and Valor at 3 oz/A + Command at 2.66 pts/A, respectively. US No. 1 yield was lower with Valor alone than a tank-mix of Valor + Command with the exception of Valor at 2 oz/A applied post-transplant.

This research illustrates that a 3 oz/A rate of Valor in a tank mix with Command at 2.66 pts/A applied pre-transplant provides an high rate of control for grass and morningglory species with minimum plant injury.

POSTDIRECTED HERBICIDE SCREEN IN PLASTICULTURE TOMATOES. J.K. Buckelew, D.W. Monks, and A.W. MacRae, N C State University, Raleigh, NC 27695.

ABSTRACT

Studies were conducted in 2003 in Clinton and Fletcher, NC to determine tomato (*Lycopersicon esculentum* 'Amelia') tolerance to, and control of thirteen weeds by, registered and non-registered herbicides of tomato. Treatments were 7.7 g ai/ha, 15.4 g ai/ha, and 30.8 g ai/ha trifloxysulfuron (CGA 362622), 34.4 g ai/ha and 51.6 g ai/ha imazamox (Raptor), 275 g ai/ha metribuzin (Sencor), 69.3 g ai/ha and 103.4 g ai/ha flumioxazin (Valor), 1.5 g ai/ha and 2.5 g ai/ha thifensulfuron-methyl (Harmony GT), 17.3g ai/ha cloransulam-methyl (Firstrate), and 25.8 g ai/ha and 38.7 g ai/ha halosulfuron-methyl (Sandea).

Treatments were applied June 2 and June 20 at Clinton and Fletcher, respectively. Treatments were applied with a CO_2 backpack sprayer and flat fan 8002XR nozzle, traveling at 4.8 km/hr, using a spray volume of 187 L/ha. All treatments were applied postdirected and contacted approximately the bottom 10 cm of tomato stem. Tomato stage at time of application was pre-bloom and prior to sucker removal. Plant height was 30 cm tall. The weeds were sown into each plot within 24 hours of tomato planting, and not generally taller than 7.5 cm at time of treatment. The weed species included sicklepod (*Senna obtusifolia* L.), redroot pigweed (*Amaranthus retroflexus* L.), pitted morningglory (*Ipomoea lacunosa* L.), large crabgrass (*Digitaria sanguinalis* (L.) Scop.), velvetleaf (*Abutilon theophrasti*), goosegrass [*Eleusine indica* (L.) Gaertn.], johnsongrass [*Sorghum halapense* (L.), Pers.], fall panicum (*Panicum dichotomiflorum* Michx.), ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.], Mexican groundcherry (*Physalis ixocarpa* Brot. Ex Hornem.), eastern black nightshade (*Solanum ptycanthum* Dun.) hairy galinsoga [*Galinsoga ciliata* (Raf.) Blake], and jimsonweed (*Datura stramonium* L.). Data collected included visual phytotoxicity ratings at 1, 2, and 4 WAT (on a scale of 1 to 100, with 0 = no injury or control to 100 = plant death or total weed control), tomato canopy height at 2 and 4 WAT, and yield weight and quality.

All rates of flumioxazin, imazamox, and cloransulam-methyl caused tomato injury of 30% or higher at 4 WAT at both locations, except for Clinton, where the low rate of flumioxazin caused 24% injury and cloransulam-methyl caused 11% injury. Also, for flumioxazin, imazamox, and cloransulam-methyl treatments, means of tomato canopy heights 4 WAT at Clinton were reduced from 10 to 53% compared to the nontreated (except for the higher rate of flumioxazin, which was not different from the nontreated check), and mean tomato heights at Fletcher were reduced 34 to 61% compared to the nontreated check. At both locations treatment means for total yield weight, which included cull weight, was not significantly different from the nontreated check for all rates of trifloxysulfuron, metribuzin, thifensulfuron-methyl, and halosulfuron-methyl. Of these herbicides that did not injure tomato and reduce yield; trifloxysulfuron gave excellent (90 to 100%) control of redroot pigweed, Mexican groundcherry, hairy galinsoga, and good (75 to 90%) to excellent control of jimsonweed; metribuzin gave excellent control of redroot pigweed, velvetleaf, Mexican groundcherry, eastern black nightshade, hairy galinsoga, and jimsonweed; thifensulfuron-methyl gave excellent control of redroot pigweed and hairy galinsoga; and halosulfuron-methyl gave good to excellent control of redroot pigweed, and excellent control of velvetleaf, hairy galinsoga, and jimsonweed.

TOLERANCE OF SELECTED TOMATO VARIETIES TO POSTEMERGENCE APPLICATIONS OF SANDEA. A. Rankins, Jr., W.B. Evans, M.W. Shankle, and K.E. Cushman; Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Experiments were conducted in 2003 at the Horticulture Research and Education Center in Verona and Truck Crops Branch Experiment Station in Crystal Springs to evaluate tomato tolerance to topical applications of Sandea (halosulfuron). The experimental design was a split plot, where tomato variety was the main plot factor and herbicide treatment was the subplot factor, with four replications. 'Mountain Spring', 'Merced' and 'Celebrity' were evaluated at both locations, while 'Sunsation' and 'Florida 47' were evaluated at Verona and Crystal Springs, respectively. Herbicide treatments included (1) 0.75 oz/A Sandea 14 days after transplanting (DAP) followed by (fb) 0.75 oz/A Sandea 28 DAP, (2) 0.50 oz/A Sandea 14 DAP fb 0.75 oz/A Sandea 21 DAP fb 0.75 oz/A Sandea 28 DAP, and (3) untreated check with no Sandea.

Seeds of each cultivar were planted into 48-cell flats and grown under normal greenhouse conditions for tomato seedling production. Seedlings were transplanted to the field by hand 2 ft apart in 16 ft long plots. Sandea was applied with CO_2 backpack sprayer delivering 20 gallons per acre. Visual estimates of herbicide injury based on biomass reduction and tomato height were quantified 28, 35, and 42 DAP. Tomatoes were harvested at the pink to red stage two or three times weekly for a total of 10 harvests. Harvested tomatoes were separated based on size and degree of blemishes into three categories: grade 1, grade 2, and culled. Data were analyzed and separated by Fisher's Protected LSD at the 5% significance level.

At Verona, there were no adverse phytotoxic effects resulting from Sandea applications based on tomato height and visual reductions in green biomass, subsequently, there were no significant reductions in marketable tomato yield, regardless of tomato variety. Similar results were observed at Crystal Springs. Again, Sandea applications reduce tomato height, biomass, or yield, regardless of variety. Results from these data indicate that Sandea may be a viable option for controlling nutsedges in the tomato row if the current Sandea label is expanded to include topical applications in Mississippi tomato production.

METHYL BROMIDE ALTERNATIVES FOR CONTROLLING NUTSEDGE IN PEPPER: DO THEY EXIST? A.S. Culpepper and D.B. Langston, Department of Crop and Soil Sciences and Department of Plant Pathology, University of Georgia, Tifton, GA 31793.

ABSTRACT

Methyl Bromide is currently the fumigant of choice for pepper production on plastic mulch for control of weeds, nematodes, and soilborne diseases. However, Methyl Bromide has been identified as contributing to the depletion of the atmospheric ozone layer. Research has shown several fumigants are effective in managing nematodes and soilborne diseases but nutsedge control can be extremely variable. Thus, an experiment was conducted to evaluate fumigant and herbicide combinations for the control of nutsedge in pepper.

The experiment was conducted in the fall of 2003 near TyTy, Georgia. Soil was a sandy loam with 92% sand, 3% silt, and 5% clay. Treatments were arranged factorially with two levels of nutsedge (yellow and purple), two levels of herbicides (no herbicide or herbicide system), and seven levels of fumigants (Table 1). The herbicide system included Command 3 EC at 1 qt/A plus Devrinol 50 WDG at 3 lb/A plus Dual Magnum 7.62 EC at 1.1 pt/A applied to a preformed bed immediately prior to laying plastic. The plastic laying process did not disturb soil treated with the herbicide system. Fumigant rates and application methods are listed in Table 1. The study was conducted as a randomized complete block design with three replications. Data were analyzed using analysis of variance and treatment means separated using Fisher's Protected LDS at P = 0.05.

Table 1. Fumigant treatment options, rates, and application methods were as follows*:

1. Methyl Bromide 67:33 (400 lb/A broadcast) injected in the bed to a depth of 6-8 inches with a super-bedder plastic layer.
2. Telone II (12 gal/A broadcast) injected 10-12 inches deep with a Yetter rig followed with Chloropicrin (150 lb/A broadcast) injected 6-8 inches in the bed with a super-bedder plastic layer.
3. Telone C35 (35 gal/A broadcast) injected 10-12 inches deep with a Yetter rig followed with Chloropicrin (150 lb/A broadcast) injected 6-8 inches in the bed with a super-bedder plastic layer.
4. Telone II (12 gal/A broadcast) injected 10-12 inches deep with a Yetter rig followed with K-Pam (46 gal/A broadcast) incorporated 3-4 inches deep with a tilrovator and followed with a super-bedder plastic layer.
5. MIDAS 98:2 (175 lb/A broadcast) injected in the bed to a depth of 6-8 inches with a super-bedder plastic layer.
6. Inline (35 gal/treated acre) injected through two lines of drip tape the day following laying plastic.
7. Plastic with no fumigant.

*Mulch was low density polyethylene (LDPE) mulch laid with the super-bedder plastic layer.

By late-season (85 day after laying plastic), the nutsedge species by herbicide interaction and the fumigant by herbicide interactions were significant for nutsedge control. Pooled over fumigants and without herbicides, yellow nutsedge was controlled 21% more effectively than purple nutsedge. The addition of the herbicides to the fumigants improved control of both species 24 to 27%; however, control of purple nutsedge (62%) was less than that of yellow nutsedge (80%).

Methyl bromide alone provided 75% control when pooled over nutsedge species. Only Telone C35 plus Chloropicrin provided control similar to Methyl Bromide. Other fumigant options controlled nutsedge less than 58%. Adding herbicides to fumigant systems improved control 9 to 40%. Compared to Methyl Bromide alone, the following fumigant/herbicide systems provided similar nutsedge control: Telone C35 plus Chloropicrin with or without the herbicide system, MIDAS with the herbicide system, and K-Pam + Telone II with the herbicide system.

Visual pepper injury from fumigants or the herbicide system was minor and transient. Fumigant and herbicide main effects were significant for yield. Compared to the no fumigant option, all fumigants except Inline improved the total fruit number and weight harvested. Methyl Bromide and K-pam plus Telone II improved yields similarly (75 to 89%) compared to the non-fumigated control. Telone C35 plus Chloropicrin, MIDAS, and Telone II plus Chloropicrin improved yields (47 to 59%) compared to the non-fumigated, however yields were less than those treated with Methyl Bromide. The addition of the herbicide system improved yield 38% compared to no herbicide system, when pooled over fumigants.

Several additional treatments were included to compare the response of nutsedge, fumigants, and herbicides when applied under either virtually impermeable film (VIF) or low density polyethylene (LDPE) mulch. Treatments included a factorial arrangement of four fumigant options (Inline, Telone C35 plus Chloropicrin, Telone II plus Chloropicrin, and no fumigant), two plastic mulches (LDPE or VIF), two nutsedge species (yellow or purple) and two herbicides systems (same as above). Methyl Bromide with LDPE mulch was included as a comparison treatment.

In terms of nutsedge control, mulch by fumigant interaction means were significant and results did not change when comparing treatments within the factorial or comparing those treatments including the Methyl Bromide comparison. Pooled over herbicide systems and nutsedge species, VIF film improved nutsedge control of Inline, Telone II plus Chloropicrin, and no fumigant by 16 to 40%. VIF did not improve activity of Telone C35 plus Chloropicrin; however, control by Telone C35 plus Chloropicrin using LDPE mulch exceeded 90% leaving little potential for VIF mulch to improve control. Compared to Methyl Bromide, Telone C35 plus Chloropicrin using either type of mulch and Telone II plus Chloropicrin using VIF mulch provided control similar to Methyl Bromide.

HYDRAMULCH FOR WEED CONTROL IN MELON AND PEPPER PRODUCTION.

[1]J.P. Warnick, [1]C.A. Chase, [1]E.H. Simonne, [2]J.M. Scholberg, and [3]E.N Rosskopf. [1]Horticultural Sciences Department and [2]Agronomy Department, University of Florida, Gainesville, FL 32611; and [3]USDA-ARS, Ft. Pierce, FL 34945.

ABSTRACT

Hydramulch (HM) is a biodegradable mulch that consists primarily of cotton byproducts, gypsum, and newsprint. The mulch is formulated as a slurry, which is sprayed on to the soil surface and dries to the consistency of paper egg cartons. A study was conducted to evaluate whether hydramulch could result in weed suppression and crop production exceeding that of a nonmulched control and comparable to polyethylene mulch (Poly). Three experiments were conducted at each of two sites in spring 2003 in southeastern Florida (SF) and in north central Florida in Gainesville (GNV) on a certified organic farm. The experimental design in all cases was randomized complete block and treatments were: three HMs, which differed in their gypsum content by a 6 % increment were compared with white-on-black Poly in SF and black Poly in GNV, and the nonmulched control. In SF, two experiments with the mulch treatments replicated four times were planted with either Boynton Bell pepper or with Passport muskmelon. The third experiment had eight replications and was left uncropped. At GNV, mulches were replicated three times in the cropped experiments and four times in the noncropped experiment. HM was applied 2-cm thick to 15-cm high raised beds in SF; whereas plots were flat in GNV and HM thickness was 4 cm.

HM was durable for the entire growing season at GNV. However, HM in SF was prone to cracking and blow off. The crop canopy protected the HM in the muskmelon experiment. HM was as effective a barrier to broadleaf weeds and grasses as Poly when applied at 4 cm; however, like Poly it was susceptible to nutsedge penetration. There was no difference in weed suppression due to the change in HM formulation. Pepper and muskmelon shoot growth were greater with Poly than with HM. Melon yields with Poly were better than with HM, and yields with HM were not significantly different from those with the nonmulched control.

RESPONSE OF CUCUMBER AND EGGPLANT GROWTH AND YIELD TO HALOSULFURON. T.M. Webster, USDA-ARS, Tifton, GA and A.S. Culpepper, University of Georgia, Tifton.

ABSTRACT

The pending elimination of methyl bromide has created a significant challenge for growers to manage previously suppressed pests. Among the most challenging pests to manage in vegetable crops are purple nutsedge (*Cyperus rotundus*) and yellow nutsedge (*Cyperus esculentus*). Halosulfuron has been proposed as an alternative to methyl bromide for nutsedge management in many vegetable crops. While halosulfuron is very effective in controlling both nutsedge species, crop tolerance is often the factor limiting adoption of this tactic for a broad range of vegetable crops. The objective of these studies was to evaluate eggplant and cucumber tolerance to halosulfuron applied postemergence (POST) and through drip tape irrigation (DRIP).

Studies were conducted in Tifton, GA in the spring and fall of 2002 and 2003 (4 site-years). The soil was a Tifton Loamy Sand (83% sand, 9% silt, 7% clay) with <1% organic matter and pH 6.0. Plots were 7.6 m long and 1.8 m wide with a 0.76 m bed-top covered with 1.25-mil low-density polyethylene mulch. The study design was a randomized complete block with four replications. To minimize the effect of nematodes and soil-borne plant pathogens, the entire area was treated, two weeks prior to planting, with 133 kg ai/ha 1,3-dichloropropene and 75 kg ai/ha chloropicrin (1500 ppm injected through drip irrigation over six hours, and then flushed with water for one hour). The cucumber variety was 'Speedway', while eggplant variety was 'Santana'. In the cucumber study, with the exception of the nontreated control, the entire area was treated with halosulfuron at 39 g ai/ha through the drip tape irrigation prior to transplant. Following transplant, the following six treatments were imposed: halosulfuron POST at 26 g/ha applied at 1 week after transplant (WATr), 2 WATr, and 3 WATr; and halosulfuron applied at 26 g/ha DRIP at 1 WATr, 2 WATr, and 3 WATr. Eggplant treatments included a nontreated control, halosulfuron applied prior to transplant at 26, 39, and 52 g/ha through the drip tape irrigation, and halosulfuron applied through the drip tape irrigation at 26 g/ha at 1 WATr, 2 WATr, and 3 WATr. Early season plant growth (plant diameter for cucumber and plant height and width for eggplant) was measured prior to first harvest. As there were multiple harvests with both crops, data on fruit number and weight were organized into first harvest, second harvest, final harvest, and total cumulative harvest. Data were analyzed using analysis of variance and treatment means separated using Fisher's Protected $LSD_{0.05}$.

Cucumber plant diameter was reduced by all POST treatments and by the DRIP-1 WATr, relative to the nontreated control. Both of the other DRIP treatments and the PRE treatment had plant diameters similar to the nontreated control. Cucumber fruit yield at the first harvest was lower in all POST treatments, relative to the nontreated control and all DRIP treatments. However by the second harvest, with exception to POST-1WATr, all treatments had yields equivalent to the nontreated control. The total cumulative cucumber yield was reduced for 1 WATr treatments (POST and DRIP) and POST-2WATr, relative to the nontreated control. All other treatments were equivalent to the nontreated control.

Eggplant canopy width was reduced by all PRE treatments, while all treatments applied after transplant had similar canopies to the nontreated control. The nontreated control was significantly higher at first and second harvests than all PRE treatments and DRIP-1WATr. There were no differences in eggplant yield among treatments at the final harvest. Total cumulative eggplant yield was reduced by the highest PRE treatment (halosulfuron at 52 g/ha), while all other treatments were equivalent to the nontreated control.

This data indicates that halosulfuron may have a potential use in both cucumber and eggplant when applied through drip tape irrigation. This is significant because many growers are trying to grow multiple crops on the same polyethylene bed (e.g. a spring and then a fall crop). Many of the proposed alternatives to methyl bromide require a freshly prepared bed and the expense of new

polyethylene mulch and drip tape irrigation. Additional research on application of halosulfuron through drip tape irrigation is needed before we can recommend this practice to growers.

EVALUATION OF OUTLOOK (DIMETHENAMID-P) APPLIED PREEMERGENCE TO SEEDED DRY-BULB ONION IN NORTH CAROLINA. R.B. Batts and A.W. MacRae, Department of Horticultural Sciences, North Carolina State University, Raleigh, NC 27695-7609.

ABSTRACT

Dry-bulb onion production in North Carolina is heavily dependent on postemergence (POST) application of Goal (two pounds oxyfluorfen formulation) for weed control. Inconsistent or poor performance often results from the products that are labelled for preemergence (PRE) use. This is primarily due to the high organic nature of the soils used in the onion production region of the state. The organic content of the soil can reduce activity of the herbicide, resulting in the need for use of high herbicide rates. According to the label, Goal applications may begin only after the onions have two true leaves. Often, winter annual broadleaf weeds can become too large to be effectively controlled by these Goal applications. Therefore, more preemergence herbicide options are needed in dry-bulb onion production. This experiment investigated the response of onion to Outlook (six pound dimethenamid-p formulation) preemergence

Trials were conducted in two growing seasons, approximately one mile apart near Engelhard, NC. Soil for these trials was a Roper muck with pH 4.9 and 10+% humic matter content in 2001-2002 and pH 4.7 and humic matter 9.6% in 2002-2003. Experimental design was a randomized complete block with treatments replicated 4 times. Treatments included Goal applied PRE at either 10 or 18 oz product/a with or without a late preemergence (LPRE) application of Prowl (pendimethalin) plus Gramoxone Extra (paraquat) applied at labelled rates just prior to onion emergence. Each of these treatments was followed by (fb) 0.5 pt/a of Goal to 2-, 5-,and 8-leaf onion or only to 5-and 8-leaf onion. A weed free treatment was also included. This treatment was hand weeded two or three times throughout the season and also received the LPE program and Goal at the 2-, 5-, and 8-leaf onion stage. Crop injury and weed control was evaluated at 2 and 4 weeks after application. Onions were harvested and graded by hand at season's end. Data was subjected to analysis of variance (ANOVA) and means were separated by l.s.d. with p=0.05.

No injury was observed at 4 weeks after treatment (WAT) with either rate of Outlook in season 1. In season 2, injury at 4 WAT was less than 1 and 3.5% from 10 and 18 oz/a, respectively. This injury was expressed as crop stunting. At 4 weeks after the 2-leaf application of Goal, injury was <2% from Outlook alone, while injury reached 5% in plots where Goal was applied. This short-lived phytotoxicity from Goal, expressed as leaf chlorosis, was also seen after each POST application in both years.

Common chickweed and cress species were present both years, while henbit was present only in the second season. Chickweed control at 4 weeks after PRE treatments was >90% regardless of Outlook rate and presence or absence of LPRE treatment. However, control with the LPRE treatment following 10 oz/a or Outlook (97%) was higher than control from 10 oz/a alone (93 and 94%) at this stage. No benefit was seen when the LPRE treatment followed the 18 oz/a rate of Outlook. Both years, mid- and late-season chickweed control was lower with the 10 oz/a rate of Outlook, when compared to the other Outlook systems, if both the LPRE and the 2-leaf Goal application were omitted. Only in season 2 did the omission of both of these treatments reduce chickweed control when the 18 oz/a rate of Outlook was used. All systems provided excellent control of cress and henbit.

Marketable yield for 10 oz/a fb LPRE and Goal at 2-, 5- and 8- leaf onion was not different from the weed free treatment. Similar to chickweed control, marketable yield was lower when the LPRE was omitted following Outlook at 10 oz/a. This significance was even greater if the 2-leaf Goal application was also omitted. Marketable yield for Outlook at 18 oz/a was not different from the weed free treatment if either the LPRE or the 2-leaf Goal application was included, but was different when both were omitted. Similar trends for total yield were seen, but fewer treatments were different from the weed free treatment.

This data suggests that there exists potential for use of Outlook preemergence in North Carolina onion production.

SIX SWEET CORN (*Zea mays* L.) CULTIVAR RESPONSE TO FORAMSULFURON APPLIED 21 DAYS AFTER PLANTING T.L. Grey and A.S. Culpepper Crop and Soil Science Department University of Georgia Coastal Plain Experiment Station P.O. Box 748, 115 Coastal Way Tifton, GA 31794.

ABSTRACT

Foramsulfuron (trade name Option®) is a new sulfonylurea herbicide developed for field corn that has potential for use in sweet corn weed control. Formasulfuron offers control of a number of important sweet corn broadleaf weeds including cocklebur (*Xanthium strumarium*), common ragweed (*Ambrosia artemisiifolia*), pigweed (*Amaranthus*), and morningglory (*Ipomoea*) species as well as crabgrass (*Digitaria sanguinalis*), foxtail (*Setaria*) and panicum (*Panicum*) grass species. Foramsulfuron could be used to control many of these species in fresh market sweet corn production. However, research into specific cultivar response must first be conducted to evaluate cultivar tolerance.

Two sweet corn trials were initiated in 2003, one was spring planted in March and the other fall planted in August. Each experiment was conducted in a different area of the same field. Six sweet corn cultivars were conventionally planted and included GSS 0966 Bt, BSS 0977 Bt, yellow supersweet Prime Plus, the bicolor supersweets Big Time and Sun Sweet, and the yellow supersweet Vail. Treatments included a nontreated check for comparison for each variety and foramsulfuron postemergence applied at 43 g ai/ha (1.75 oz of Option® herbicide per acre) 21 days after planting. Each treatment contained methylated seed oil and 28% urea-ammonium nitrate solution and was applied with a back pack boom sprayer.

Foramsulfuron applied topically to sweet corn cultivars visually stunted growth 8 to 19% at 7 days after treatment (DAT). Minor chlorosis was observed at this time. At 14 DAT, injury ranged from 4 to 8% in the spring trial and less than 6% in the fall trial. No injury was visually detectable by 20 DAT. Sweetcorn height reductions were noted for the nontreated versus foramsulfuron for the spring test. For that trial at 7 DAT, 5 of the 6 varieties exhibited some height reduction from foramsulfuron. By 18 DAT there were no significant height differences between treated and non-treated corn. For the fall test, there was variability for height following the same trend for the spring test. Total sweet corn ear yield was variable for the two test. The spring test was much more productive with 5 of the 6 treated foramsulfuron varieties yielding greater than the nontreated controls. This trend was not evident for the fall planting which was planted late due to wet weather. Fall growing conditions were less favorable than spring which could contribute to a reduction in recovery from foramsulfuron injury. The percent marketable ears reflected the ear yield for both trails. These data indicate that foramsulfuron has potential use in Georgia sweet corn production. Future trials will emphasis these same experiments and sweet corn varieties.

WEED CONTROL AND CROP INJURY POTENTIAL IN FIELD-GROWN CANNAS.

R.W. Wallace; Department of Horticultural Sciences, Texas A & M University Agricultural Research & Extension Center, Lubbock, 79403.

ABSTRACT

Canna lilies (*Canna x generalis*) are grown commercially on the Texas High Plains for the reproduction and sale of rhizome segments. Weed control options are limited for this ornamental crop, therefore, research was conducted in 2003 to evaluate and screen selected herbicides and their combinations for crop injury and control of Palmer Amaranth (*Amaranthus palmeri*) in field-grown cannas (var. "Red President").

The trial was conducted at the Pride of the Plains Bulb Farm located in Olton, TX. Cut canna rhizome segments were transplanted in late April and preemergence herbicides were applied to 2-row plots measuring approximately 6.7' x 20'. Postemergence herbicides were applied in mid-June. All herbicides were applied using a CO_2-backpack sprayer equipped with a hand-held boom containing four Teejet 8002VS nozzles that sprayed 20 GPA at 30 PSI. Plots were fertilized, cultivated, irrigated and hand weeded according to grower practices. Canna rhizomes were machine-harvested by plot in early December and weights recorded. The experimental design was a randomized complete block with 4 replications.

Preemergence (PRE) applications of s-metolachlor, dimethenamid-P, halosulfuron, pendimethalin, flumioxazin, flumetsulam, isoxaflutole, rimsulfuron, mesotrione and sulfentrazone resulted in minor stunting (< 13.0%) to cannas 63 days after treatment (DAT). However, imazapic applied PRE caused almost complete death of treated plants. Weed control was generally poor to good with all PRE treatments, but a cultivation plus handweeding were still required. The greatest control was found in plots treated with pendimethalin or isoxaflutole. When applied PRE, s-metolachlor followed by postemergence (POST) treatments of halosulfuron, trifloxysulfuron, mesotrione, cloransulam, imazamox or fluroxypyr resulted in significantly ($\alpha = 0.05$) higher injury (23% or greater) to cannas 13 DAT. Weed control was improved with POST treatments. Canna yields were not significantly reduced with any herbicide applied PRE when compared to the untreated control, except for imazapic. With the exception of fluroxypyr, all POST treatments significantly reduced canna yields. Further research is needed to evaluate herbicide rates and application timings for improved safety and weed control.

Acknowledgement: The author wishes to thank the Pride of the Plains Bulb Farm, Olton, TX for financially supporting this research.

SYNERGY OF TANK MIXTURE OF GLYPHOSATE WITH OTHER HERBICIDES ON SOME GRASS AND BROADLEAF WEEDS. S. Singh and M. Singh; University of Florida, Citrus Research and Education Center, Lake Alfred, FL 33850.

ABSTRACT

Glyphosate is most commonly used herbicide for effective POST weed management in Florida citrus. Lower efficacy of glyphosate on some weed species has been instrumental in their increased infestation due to its continuous use in many groves. A tank mix application of glyphosate with another herbicide is required to avoid shift in weed flora and eventually evolution of resistant biotypes. Greenhouse experiments were conducted on Brazil pusley, Spanishneedles, Guineagrass, yellow nutsedge and Johnsongrass using mixtures of glyphosate with butafenacil and trifloxysulfuron for synergistic weed control. Plants were raised in the potting mixture and sprayed at the 4-6 leaf stage with 4 replicated pots (4-5 plants in each pot). The seventeen treatments consisted of glyphosate at 280, 420, 560 g/ha, trifloxysulfuron at 7 g/ha, butafenacil 33 and 67 g/ha, glyphosate plus butafenacil at 280+33, 280+67, 420+33, 420+67 g/ha, glyphosate plus trifloxysulfuron plus butafenacil at 280+7+33, 280+7+67, 420+7+33, 420+7+67 g/ha, glyphosate plus trifloxysulfuron at 280+7 and 420+7 g/ha along with control. Plants were sprayed using a chamber track sprayer fitted with a Teejet 8002 flat fan spray nozzle delivering 190 L/ha volume at 140 kPa. After spray the pots were arranged in a complete random block design in greenhouse with natural light (12 h) at 25/16°C (day/night temperature) and 70% RH. Plants were watered as per need and fertilized once with a slow release fertilizer. Visual mortality data was recorded weekly for 5 weeks after treatment (WAT). Experiments were repeated under similar conditions and data were averaged for ANOVA.

Trifloxysulfuron at 7 g/ha provided similar control of yellow nutsedge to that of glyphosate at 280 g/ha at 5 WAT. Tank mixture of glyphosate with trifloxysulfuron at 280+7 g/ha increased yellow nutsedge mortality by 50% and was similar to glyphosate at 560 g/ha. Butafenacil alone was not effective, but its tank mix with glyphosate and trifloxysulfuron provided significantly higher control of yellow nutsedge. Application of butafenacil at 67 g/ha was more effective on Brazil pusley than glyphosate at 520 g/ha and significantly increased the efficacy when used as tank mix with glyphosate, but lower potency was observed when trifloxysulfuron was added to the mixture. Effect of trifloxysulfuron was reduced after 3 weeks and only 11% mortality of Brazil pusley was recorded 5 WAT; the mixture with glyphosate, however, increased mortality. Butafenacil or trifloxysulfuron had no synergistic effect when mixed with glyphosate on Guineagrass and Johnsongrass. Increased efficacy of glyphosate at 280 g/ha tank mixed with butafenacil or trifloxysulfuron was observed against Spanishneedles, but not at higher rates.

EVALUATING CARFENTRAZONE EFFICACY ON PROBLEMATIC WEEDS IN FLORIDA CITRUS. R.S. Buker III, M. Singh and S. Singh; University of Florida Citrus Research and Education Center, Lake Alfred, FL.

ABSTRACT

In a 1992 survey of common weeds in Florida citrus, 67% of the weeds were grass species. However, during the time period from 1992 to 2003, the common weed species in Florida has changed. In a sample of 50 citrus producers throughout Florida three new weeds *Ipomoea spp*., *Momordica charantia*, and *Commelina diffusa* were listed in the top five. *Momordica charantia* and *Commelina diffusa* were not even listed 11 years ago. During the time period from 1992 to 2003 a survey of herbicide use was conducted in Florida. In 1999, there were only three primary herbicides used. Glyphosate, diuron, and bromacil were applied to at least 50% of the Florida citrus acreage, but no other herbicide was applied to more than 35% of the acreage. Glyphosate is currently the most commonly used herbicide in Florida citrus, being applied to 90% of the acreage. Unacceptable control of *Ipomoea spp*., *Momordica charantia*, and *Commelina diffusa* following glyphosate applications have been reported by citrus growers.

Efficacy of carfentrazone and glyphosate control of these species was evaluated in greenhouse trials under natural lighting from July to August of 2003. Each of the above mentioned species were treated with either carfentrazone or glyphosate. Carfentrazone was applied at 0, 4.5, 9, or 18 g a.i. /ha with a crop oil concentrate at 1% v/v, while glyphosate was applied at 0, 280, 560, or 1120 g a.i./ha with a 0.25% v/v non-ionic surfactant. Plants were grown for four weeks following treatment and fresh weights were recorded from harvested shoots.

Data were subjected to ANOVA, and means of significant treatments were regressed. Efficacy of carfentrazone and glyphosate were evaluated using GR_{50}. Carfentrazone reduced the growth of *Ipomoea hederacea* and *Momordica charantia* 50% with 2.3 g a.i. /ha. Glyphosate reduced the growth of *Ipomoea hederacea* and *Momordica charantia* 50% with 178 and 166 g a.i./ha, respectively. *Commelina diffusa* was the most difficult species to control with these herbicides. The GR_{50} for *Commelina diffusa* using carfentrazone and glyphosate was 4 and 1109 g a.i./ha. Based on these data, carfentrazone is highly efficacious in controlling some common problematic weeds in Florida citrus.

EFFICACY OF VALOR IN SWEETPOTATO. S.T. Kelly, J.M. Cannon, M.W. Shankle and J.L. Main. LSU AgCenter, Winnsboro, LA and Pontotoc Ridge-Flatwoods Branch Experiment Station, Mississippi State University, Pontotoc, MS.

ABSTRACT

Three experiments were conducted in 2003 to evaluate Valor (flumioxazin) for weed control and crop tolerance in 'Beauregard' sweetpotato (*Ipomoea batatus*). Experiments one was conducted on a producer field near Wisner, LA. Treatments consisted of Valor (1,2 or 3 oz/A) applied pre-transplant, post-transplant, or post-transplant with 0.25% (v/v) non-ionic surfactant and were applied in 20 gallons per acre (gpa). Sweetpototato (*Ipomoea batatus* 'Beauregard' B-14) was mechanically transplanted on July 21, 2003. Pre-transplant treatments were applied immediately before planting. Post-transplant treatments were applied immediately after planting. The entire plot area was treated with Command (2 pt/A) for grass control. A plot that received no Valor was also utilized to represent a standard treatment. Experimental design was a randomized complete block with four replications. Soil type was a silt loam. Sweetpotato were harvested at 115 days after transplanting and graded into three fractions: ones and twos, canner, and jumbos. Means were separated at the 5% level of significance using Fisher's Protected LSD. Valor applied prior to transplanting caused 5% or less injury at 11 days after planting (DAP). When applied after transplanting, Valor caused 13% or less injury at 11 DAP which was not different from the Command-treated plots. When applied after transplanting in combination with surfactant, significant injury was observed with 2 oz/A and greater. By 39 DAP, sweetpotato had recovered, and no injury was observed. Sweetpotato vine cover at 39 DAT was similar between the Command standard and Valor treatments applied without surfactant. Valor at 2 or 3 ounces/A applied post-transplant with surfactant reduced sweetpotato vine cover compared to all other treatments. These data indicate that Valor may be safely applied to sweetpotato pre-transplant. Total yield ranged form 422 to 824 bu/A. Few differences were observed, but Valor applied post-transplant in combination with surfactant tended to have lower yields. No differences in ones & twos were observed among any of the treatments, but again, those plots treated with Valor plus surfactant tended to have the lowest yield. As observed with total yield and yield of ones & twos, very few differences were observed among treatments for canner yield. No differences were observed between treatments for jumbo yield.

Experiment two was conducted at three locations, Chase, Wisner, and Sterlington, LA. These experiments were conducted to determine if injury with post-transplant applications of Valor can be reduced by tank-mixing with Command. Experimental design was a randomized complete block with factorial arrangement of treatments with 4 replications at each location. Factor A consisted of Valor rate (0, 2, or 3 oz/A) and Factor B consisted of Command rate (0, 1.8, or 2.3 pt/A). Transplanting dates were May 13, June 5, and July 7, 2003 at Sterlington, Wisner, and Chase, respectively. Yield data was collected at Chase only and graded as previously described. ANOVA was conducted and means separated as previously described. There was no interaction of Valor with Command at the Wisner location for hophornbeam copperleaf (*Acalypha ostryifolia*) control. When averaged over Command rates, Valor controlled hophornbeam copperleaf at least 88%, while control with Command was not different from the untreated. Injury at this location was not observed at 3 or 19 DAT. At the Sterlington location, data analysis indicated that Valor rate was the most influential variable for injury and vigor at 3 or 24 DAT, respectively. Significant injury was observed with Valor at 3 DAT (28%), while vigor was reduced by either rate of Valor. At 14 DAT, injury was variable with any treatment combination, and no consistent safening effect was observed. By 24 DAT, no injury in the form of burning was observed, but a reduction in growth was observed. At the Chase location, an interaction of Valor with Command was observed for sweetpotato injury at 17 DAT. However, only significant reductions in injury due to Valor was observed when using 3 oz/A. In this case, the amount of injury was reduced by the addition of Command. This interaction was not observed by 25 DAP. At this time, injury was influenced more by Valor rate than the addition of Command. Significant injury was observed with each rate of Valor, but injury was 15% or less by this time. Pigweed (*Amaranthus* spp.) control at 112 DAP was 88% or greater with any Valor treatment. An interaction between Valor and Command was not observed for any

of the yield parameters measured. This would indicate that the early injury observed did not influence yield. These data indicate that Command was the more influential variable when determining yield. Yield in the Command-treated plots was higher than if Command was not used. This appears to be mostly a function of grass control, since a postemergence grass herbicide was not used to control emerging annual grasses in the Valor plots.

A third experiment was conducted at Pontotoc, MS also evaluating Valor plus Command tank-mixes. Command (2 pt/A) was tank mixed with Valor (1, 2, or 3 oz/A). All pre-and post-transplant treatments were applied as previously described. Visual injury and weed control evaluations were made at 12, 18, and 25 DAT. Weed species present included broadleaf signalgrass (*Brachiaria platyphylla*), redroot pigweed (*Amaranthus retroflexus*), entireleaf morningglory (*Ipomoea hedercea* var. *integriuscula*), and pitted morningglory (*Ipomoea lacunosa*). No yield data was taken. Analysis of variance was conducted and means separated as previously described. Sweetpotato plant injury was not observed with Valor+Command applied pre-transplant. Plant injury with Valor at 1, 2, and 3 oz/A plus Command applied post-transplant was 18, 33, and 50% at 18 DAT. Crop injury increased to greater than 50% for Valor+Command applied post-transplant with the addition of surfactant. Broadleaf signalgrass was controlled at least 80% with Valor+Command treatments post-transplant. Redroot pigweed was controlled 100% with any treatment including Valor at 18 and 25 DAT. Morrningglory control was at least 80% for all Valor+Command treatments. These data indicates that Valor applied pre-transplant will control pigweed and morningglory species in sweetpotato production without injury to sweetpotato cuttings.

SECTION V. FOREST VEGETATION MANAGEMENT

EFFECTS OF SOIL PREPARATION AND HERBACEOUS WEED CONTROL ON LOBLOLLY PINE GROWTH AND SURVIVAL. M.H. Pelkki, J.A. Earl and R.A. Williams[1]; Arkansas Agricultural Experiment Station and School of Forest Resources, University of Arkansas at Monticello and [1]West Florida Research and Education Center – IFAS, University of Florida, Milton, FL.

INTRODUCTION

Many abandoned farms and pastures are being replanted to trees. The Conservation Reserve Program and Streamside Buffer Program along with other incentive programs are providing a catalyst for landowners to plant their farms and pastures back to forestland. Arkansas has suffered many plantation losses due to compacted soils and tremendous amounts of herbaceous vegetation. Recently, CRP participants had to have their soil tested for a hard pan and if present, the site had to be ripped to break up the pan (personal communication with Arkansas Forestry Commission personnel). This study is an attempt to use various soil enhancement activities in combination with and without herbicides and their impact on loblolly pine (*Pinus taeda*) seedling growth and survival.

METHODS

This study is a first attempt at using different techniques for soil enhancement in improving loblolly pine growth and survival in old agricultural fields. The soil enhancements included subsoil and ripping treatments with a control area left for comparison. A 20 acre soybean field was selected for this study site which is located on the Pine Tree Experiment Station in St. Francis County, Arkansas. The field was randomly divided into 9 equal sections, so that each treatment could be replicated 3 times across the field. The study area was in soybeans in 2002 and after they were harvested the soil treatments were applied. The subsoil and ripping treatments were completed in the fall of 2002. Planting was done in January 2003 after allowing the soil treatments to set for at least 30 days.

Two weed control plots were established in each of the nine sections across the field. Half of the plots were treated for herbaceous weed control and half were left as untreated checks (Figure 1). The weed control plots were 5 feet wide by 120 feet in length. The same herbicide combination was applied to all plots receiving herbaceous weed control. The herbicides included Oust (sulfometuron) at 3 ounces per acre and Escort (metsulfuron) at 1 ounce per acre. The herbicides were applied at a 10 gallon per acre rate using a band spray pattern over the top of the newly planted loblolly pine seedlings. The study followed a Complete Randomized Block Design.

RESULTS

This study had excellent survival at the end of the first growing season. Adequate rainfall occurred throughout the growing season and the worst level of survival was 84 percent on areas receiving no soil or herbicide treatments. All other treatments and combinations of treatments had over 95 percent seedling survival. Pine seedlings had 100 percent survival on areas treated for herbaceous weed control and 84 percent survival without weed control at the end of the first growing season. Subsoil and ripping soil treatments had pine survival rates of 98 percent (Table 1). Areas receiving soil treatments and herbaceous weed control did not have greater pine survival than areas with soil treatments without herbaceous weed control. These seedlings survived despite competing with vigorous herbaceous weeds including horseweed, panic grass, goat weed (croton), cocklebur, foxtail and milkweed.

Pine seedling height growth was not greatly impacted by any of the treatments compared to no treatment. The only significant difference was found on the ripped areas where untreated (no herbaceous weed control) seedlings (1.49') had more height growth and treated (herbaceous weed

control) seedlings (1.02'). Ground line diameter growth was significantly greater for seedlings receiving herbaceous weed control (.23") compared to seedlings without weed control (.17"). The seedlings planted on areas that were subsoiled outgrew seedlings planted on areas that were ripped or controlled in both height and ground line diameter growth.

Volume growth calculated in cubic inches really shows the differences between the treatments. The most dramatic growth difference was between treated seedlings (73.2 cubic in.) and untreated seedlings (39.4 cubic in.) on areas that received the subsoil treatments. All treated seedlings for herbaceous weed control outgrew seedlings without weed control (Table 1).

The weed control component evaluated by bare ground measurements saw dramatic results throughout the growing season. The April evaluations found no significant differences in bare ground percentages on all of the study plots. April evaluations were 40 to 50 percent bare ground percentages. The June evaluations saw dramatic and significant differences occurring between the sites treated for weeds and those not receiving weed control (Table 2). The evaluations in September found that treated sites had about 50 percent of the area clear of weeds while the untreated areas were down to less than 10 percent bare ground (Table 2).

CONCLUSIONS

Soil treatments did enhance loblolly pine seedling growth and survival compared areas with no soil disturbance. However, the first year results were not very dramatic although the treated areas did show modest growth and survival gains. Herbicide and herbaceous weed control also improved seedling survival and growth during the first growing season. At the end of the growing season however, the untreated areas were down to less than 10 percent bare ground. I believe that this large amount of herbaceous vegetation will hinder the pine seedling growth during the second growing season. A problem when planting agricultural areas back into trees is the intense herbaceous vegetation component. This herbaceous vegetation must be controlled or limited to achieve successful regeneration on the site.

Figure 1. Study design.

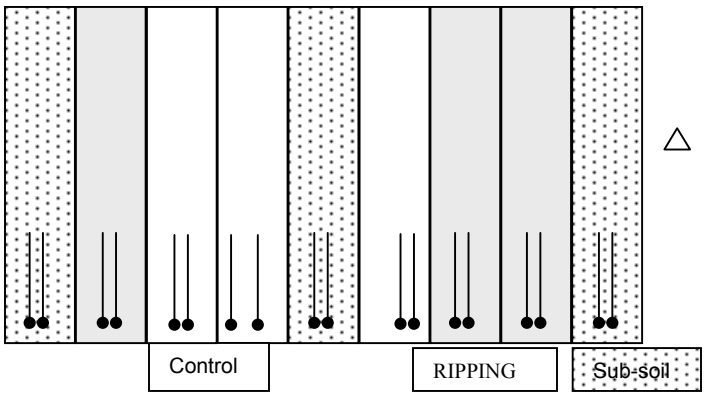

Table 1. Loblolly pine growth and survival.

Species	Ht. Ft.	GLD in.	Survival %
Control:			
Treated	.95a	0.2a	100
Untreated	1.23a	0.16a	84
Subsoiled			
Treated	1.27a	.28a	98
Untreated	1.34a	.16b	98
Ripped			
Treated	1.02b	.20a	96
Untreated	1.49a	.19a	100
All soil preparations:			
Control	1.12a	.18a	92
Subsoil	1.31a	.22a	98
Ripped	1.26a	.19a	98

Significant at the .05 level

Table 2. Percent of bare ground through the growing season.

Treatment	April	June	September
Control:			
Treated	46a	93a	63a
Untreated	40a	16b	6b
Subsoiled			
Treated	51a	100a	55a
Untreated	48a	26b	5b
Ripped			
Treated	47a	100a	43a
Untreated	43a	28b	8b
All soil preparations			
Treated	47a	98a	54a
Untreated	45a	24b	7b

Significant at the .05 level

RESTORING PRODUCTIVITY TO COGONGRASS-INFESTED LAND THROUGH REFORESTATION. W.H. Faircloth, M.G. Patterson, J.H. Miller, and D.H. Teem. Auburn University, Auburn, AL, and U.S. Forest Service-Southern Research Station, Auburn, AL.

ABSTRACT

Cogongrass (*Imperata cylindrica*) is an invasive grass that is rapidly colonizing the Gulf coastal plain, with potential to spread well into the interior of the Southeastern U.S. Cogongrass is particularly harmful to forested land. In such situations, cogongrass hinders plantation establishment, may contribute to crowning fires in young stands, decreases wood and fiber production, and displaces native plants and animals. Of particular interest are options that landowners/managers may have when faced with cogongrass-infested land. A study was implemented by Auburn University researchers in cooperation with researchers from the U.S. Forest Service, Southern Research Station, to investigate establishment options for loblolly pine (*Pinus teada* L.). A site was selected near Theodore, AL (Mobile Co.), within 10 miles of the original introduction point of cogongass. The study site, previously in row crop agriculture but fallowed since the late 1980s, was heavily infested with cogongrass and an overstory of chinese privet (*Ligustrum sinense*), wax myrtle (*Myrica cerifera*), tallowtree (*Triadica sebifera*), and yaupon (*Ilex vomitoria*). Brushy overstory was cut and removed in spring 2001, leaving a continuous stand of cogongrass. The study site was a sandy loam soil (pH 5.6) with high site index (90) for loblolly pine.

Treatments were a factorial arrangement of mechanical site preparation (SP), chemical SP, and pine release in an RCB design with four replications. A complete control plot was also included as a positive control, for a total of nine treatments. Chemical SP applications were made Oct. 2001 and consisted of imazapyr (0.42 kg ai/ha) plus glyphosate (4.48 kg ai/ha) plus surfactant (0.5% v/v). Mechanical SP was performed Dec. 2001 with a trailing fire plow which removed the top 10-15 cm of the cogongrass rhizome mat. "Super" seedlings (2.5 gen) were planted in January 2002 on a 2.5 x 2.5 m spacing (1605 trees/ha). Pine release treatments were made in May or Oct. 2002 and consisted of various combinations of imazapyr, sulfometuron, and metsulfuron applied on a 2.5m band over the row. Complete control plots were treated with a double rate of site prep herbicides and released with the three-way tank-mix mentioned previously; these plots were not mechanically site prepared. Experimental units consisted of 100 trees in a 10x10 square, with the center 36 trees serving as the measurement plot. Response variables included pine tree survivability, growth, as expressed by ground-line diameter (GLD) and height, and plant biomass. Trees were measured immediately after planting and again in January of 2003. Biomass measurements were partitioned into three categories: live cogongrass, dead cogongrass (thatch), and all other species. Collections were made by removing the aerial portions of each category from a 25x25 cm square. Ten such samples were collected in each measurement plot in the summers of 2002 and 2003. Samples were dried at 63 C for 72 h then weighed. Data were analyzed using SAS Proc Mixed with non-orthogonal contrasts and estimates at the 0.05 level. The main effects of mechanical SP, chemical SP, and release will be presented until further data are obtained from the study which will facilitate an in-depth review.

Pine survivability was greatest in the mechanically site prepared treatments. A maximum mortality of 6.25% was found in the complete control plots one year after planting (YAP). Increase in mortality could be directly attributed to release herbicides or lack of cogongrass control, as the non-treated plots averaged 6% mortality. Loblolly pine height increase (1 YAP) was highest for the chemical SP only and chemical SP + release treatment (44 cm/yr). When combined, mechanical and chemical SP treatments clearly stunted growth versus other treatments as these plots showed increases 1 YAP of only 24 to 27 cm/yr. Mechanical alone or mechanical SP plus release resulted in a 33-35 cm/yr increase. Stunting in mechanical SP plus chemical SP plots can be explained by increased herbicide uptake by trees due to removal of organic matter by scalping. Ground-line diameter increase 1 YAP was greatest in the complete control plots (6.1 mm/yr). Mechanical SP, chemical SP, and release all resulted in greater increases in GLD versus the non-treated (2.6 mm/yr).

The presence of a release treatment consistently resulted in GLD equivalent to the complete control.

Initial biomass measurements from 2002 may only be used to compare chemical and mechanical SP treatments, as release treatments were not applied until Oct. in all plots. Live cogongrass biomass ranged from 10 kg/ha (mechanical SP plus chemical SP) to 1960 kg/ha (non-treated). Both mechanical and chemical SP reduced biomass from the non-treated. Cogongrass thatch was completely removed in the mechanical SP plots and was greatest in the chemical SP plots (1760 kg/ha), as expected. Other species were most present in the complete control plots where cogongrass was suppressed (2880 kg/ha). Mechanical SP also greatly reduced the occurrence of other species (270-800 kg/ha). Biomass measurements from 2003 reflect the aggressive nature of cogongrass, as regrowth occurred in all plots. Least cogongrass regrowth was found in the mechanical SP plus chemical SP plus release plots (790 kg/ha). All factors reduced live cogongrass biomass versus the non-treated (7410 kg/ha). Thatch measurements reflected live measurements. Much as in 2002, the complete control plots suppressed cogongrass and resulted in the greatest amount of biomass from other plant species (8310 kg/ha).

In summary, loblolly pine was successfully established with minimal mortality. Pine growth (both height and GLD) was consistently highest with chemical SP alone or combined with release treatment. Mechanical SP alone was acceptable, however, when combined with chemical SP, stunting of growth 1 YAP was evident. Cogongrass control summer 2003 was best with the combination of mechanical SP, chemical SP, and release.

RECOVERY OF COGONGRASS AFTER SITE PREPARATION WITH IMAZAPYR AND TRICLOPYR IN A CUTOVER SITE IN NORTHWESTERN FLORIDA. C.L. Ramsey, S. Jose, P. Daneshgar, R. Collins, and B.J. Brecke; UF/IFAS, University of Florida, Milton campus, Milton FL. 32583.

ABSTRACT

A site preparation field study was installed in the winter of 2002/2003, on International Paper property in Santa Rosa county FL. The cutover site was an 18 year-old loblolly pine plantation, which rapidly became infested with cogongrass after timber harvesting in 2000. The primary objective of the study was to determine the resiliency of cogongrass to a new tank mix of imazapyr and triclopyr. The tank mix is currently being operationally tested by the unit foresters with International Paper. Another objective was to determine the effects of cogongrass competition on loblolly pine growth and survival. The study was completely randomized, with five replications. The majority of the cutover site was broadcast treated on October 15, 2002 with a tank mix of imazapyr (Chopper) at 48 fl oz/acre combined with triclopyr (Garlon 4) at 48 fl oz/acre. The surfactant was Timberland 90 applied at 12.8 fl oz/acre. Several acres were left untreated by the contract crew. The four treatments included: 1) control (untreated) inside the cogongrass infestation, 2) site preparation plots inside the cogongrass infestation, 3) site preparation plots outside of the cogongrass infestation, with native vegetation, and 4) site preparation plots outside of the cogongrass infestation that were kept weed-free throughout the 2003 growing season. Bare-root loblolly pines were planted on March 6, 2003 on a 1.8 x 1.1 m spacing. Aboveground and belowground biomass for cogongrass and native vegetation was collected on a monthly basis. The effects of cogongrass and native vegetation competition on pine photosynthesis, stomatal conductance, and transpiration were also measured on a monthly basis, starting in July. Pine survival, diameter, and height growth will be analyzed at the end of the 2003 growing season. The cogongrass live rhizome biomass for plots in treatment 2 declined until September 2003 and then rapidly increased in October, 2003. Cogongrass did re-infest the plots treated with the herbicide tank mix, but the re-infestation was very patchy. Results from this study will be used to quantify the negative effects of cogongrass during the first year of loblolly pine growth.

PINE RESPONSE AND VEGETATION CONTROL FROM BANDED AND BROADCAST HERBICIDE APPLICATIONS ON BEDDED LOWER COASTAL PLAIN SITES IN NORTH FLORIDA. D.K. Lauer and R.S. Meldahl; Silvics Analytic, Richmond, VA and School of Forestry and Wildlife Sciences, Auburn, AL.

ABSTRACT

A study was initiated by the Auburn University Silvicultural Herbicide Cooperative to examine slash (*Pinus elliotii* Engelm.) and loblolly (*Pinus taeda* L.) pine response and efficacy of operational banded and broadcast pre-plant herbicide applications combined with early bedding at four lower coastal plain locations. Early bed, late bed, and double bed treatments were included for comparison. Each of these site preparation treatments was included with and without operational first year herbaceous weed control (HC). An integrated pest management approach was taken by examining the impact of these treatments on both competing vegetation and pine growth.

Early pine growth was strongly related to the quality of vegetation control following both mechanical and herbicide treatments. Both early and late bed treatments performed poorly in control of competing vegetation. Performance of HC following single bedding was variable, improved by combining this practice with late bedding instead of early bedding, and improved when HC suppressed woody shrubs. Double bedding provided better control of woody shrubs than did single bedding, but level of control varied by location. Double bedding shifted vegetation composition from woody to herbaceous such that combining HC with double bedding increased pine response. Variation in control from double bedding provided a range of pine response from no better than late bed to nearly as good as pre-plant herbicide. Pre-plant herbicide site prep treatments provided the most consistent vegetation control and pine response across locations. The best pre-plant treatments nearly doubled age 5 volume response at the 3 older locations and age 2 dominant height at the fourth location that has not yet reached age 5. Broadcast pre-plant herbicide applications improved pine response compared to banded pre-plant at the two locations where conditions favored rapid growth of woody shrubs in the untreated area between beds.

INTEGRATION OF SITE PREPARATION AND HERBACEOUS WEED CONTROL ON LOWER COASTAL PLAIN SITES: SECOND YEAR RESULTS. H.E. Quicke and D.K. Lauer; BASF Corporation, Auburn, AL and Silvics Analytic, Richmond, VA.

ABSTRACT

Five study locations were established on lower coastal plain sites to examine post-plant herbaceous weed control strategies following two timings (August vs. November) and three rates (32, 48, and 64 oz/A) of Chopper herbicide for site preparation. All sites were bedded early in the year to allow a minimum of six weeks between bedding and the first Chopper treatment. Chopper site prep treatments were applied to large plots, eight beds in width. Pines were planted in winter following site prep. Post-plant herbaceous weed control (HWC) treatments were assigned at random to the six inner beds in each site prep treatment plot. HWC treatments included no herbaceous control, March of the first year of pine growth, June of the first year of pine growth, March of the second year of pine growth, and June of the first year combined with March of the second year of pine growth.

Chopper site prep treatments included Garlon 4 at 1 pt/A if arborescent hardwoods were present, 2 pt/A otherwise. On four sites, 5 qt/A MSO was included in a total spray volume of 10 gpa. On one site Chopper was applied without the addition of MSO at a spray volume of 30 gpa. HWC treatments were 4 oz Arsenal AC + 2 oz Oust on the four loblolly sites and 6 oz straight Arsenal AC on the one slash pine site.

Vegetation cover was assessed in June, August and October of the first year of pine growth. Pine height and groundline diameter were assessed at the end of the first and second growing seasons. Each location included 3 replications in a split-plot design with herbaceous weed control treatments applied as sub-plots within site preparation main plots. Analysis of variance was used to determine if second year pine stem volume index differed by timing or rate of Chopper site prep and if there were interactions between Chopper timing, Chopper rate and HWC treatments. Additional tests were used to compare HWC treatments.

On the slash pine site (CRIFF D group spodosol), very little cover developed following Chopper site prep (<6% cover in October of the first pine growing season). The best pine growth was from Chopper site prep with no HWC.

On sites that were slow to develop cover (7-14% cover in October of the first pine growing season), pine growth increased as HWC was delayed from 1st year early to 1st year mid-season to 2nd year. These sites included a CRIFF C group spodosol and a sandy-loam soil in the Green Swamp, NC.

On the site where cover developed quickly following Chopper site prep (94% cover in October of the first pine growing season), pine growth decreased as HWC was delayed from 1st year early to 1st year mid-season to 2nd year. This site was on a silt-loam soil near Oakdale, LA.

On the site with intermediate cover development (31% cover in October of the first pine growing season), HWC timing made little difference. This site was on a clayey CRIFF A group soil. This was the only site with a Chopper timing X HWC interaction. The best growth was from August site prep followed by 1st year early HWC.

On two sites, August Chopper applications resulted in better pine growth than November applications. Contrary to expectations, these two sites had less cover following August applications of Chopper. One reason may be that the earlier site prep date controlled herbaceous weeds prior to seeding, resulting in less weed pressure the following year.

The site on a CRIFF A group soil included a double bed treatment with no Chopper site preparation. Double bedding with first year HWC was inferior to bedding + Chopper with no HWC (volume

index 65 vs. 80). HWC after double bedding resulted in less response than HWC after bedding + Chopper (volume index +30 vs. +45). Double bedding with HWC in both the first and second years was inferior to bedding + Chopper with first year HWC only (volume index 104 vs. 128).

Future work includes a third year assessment of pine response. This assessment is required for a full understanding of the impact of the second year herbaceous weed control treatments.

TIMING OF CHOPPER HERBICIDE SITE PREPARATION RELATIVE TO BEDDING ON LOWER COASTAL PLAIN SITES: SECOND YEAR RESULTS. D.K. Lauer and H.E. Quicke; Silvics Analytic, Richmond, VA and BASF Corporation, Auburn, AL.

ABSTRACT

Second year pine response was examined following different timings of Chopper application relative to bedding at four Coastal Plain study locations. Two bedding regimes, mid-year and late-year, were examined at each location. Up to nine applications occurred at various times before or after each bedding regime. Applications occurred as early as February 24 and as late as November 19. The herbicide treatment was 48 oz ac^{-1} Chopper with 5 qts ac^{-1} methylated seed oil applied at a total mix volume of 10 gal ac^{-1}. Garlon 4 was included at 1 qt ac^{-1} at the two locations that had primarily waxy-leafed shrubs and at 1 pt ac^{-1} at the two locations that also had arborescent hardwood. Slash pine was planted at the two locations with waxy-leafed species, loblolly pine at the other two locations. Treatments were replicated three times at each study location. No herbaceous weed control treatments were applied after planting.

Pine groundline diameter (D) and total height (H) were measured two growing seasons after planting. Treatments were compared using average tree volume index. Analysis of variance was used for each study to test if Chopper treatments performed better than the untreated check, and to test if there were differences between applications made before or after bedding. Of particular interest were trends in control related to application timing, and efficacy of treatments made outside the traditional window of six weeks before bedding or waiting until vegetation has resprouted after bedding.

Chopper increased pine response when used before or after mid-season (mid-May through July) bedding at all four locations. Largest pine responses were on sandy soils with evergreen woody species. There were no significant trends in pine response to timing of Chopper applications applied before bedding. Efficacy of treatments suggests that control of woody vegetation is achieved by Chopper applications made up to the day before bedding. The earliest applications (February-March) were not as effective at control of deciduous woody vegetation even though pine response to this application date was similar to that achieved by later dates. Pine responses to Chopper applications made after bedding were similar or greater than responses from pre-bed applications. This is likely due to better herbaceous control. However, the best responses to Chopper applications made after bedding were from those made at least 3 weeks after bedding but before dormancy of targeted species even though resprouting and colonization of herbaceous vegetation appeared to be minor 3 weeks after treatment.

Second year pine responses to Chopper applications made before late-season (October-November) bedding were dependent on timing of application. Response increased as the time between application and late-bedding increased. This may be due to a combination of factors such as improved vegetation control, the relationship between bed quality and decomposition of vegetation, soil moisture regime, or the actual timing of mortality for late-treated woody vegetation. Pine response to Chopper applications made after late bedding did not differ from those made before bedding but provided poorer control of some species.

Chopper applications can be made at any time during the growing season up to the time of bedding or at least three weeks after beds pulled during the growing season. Chopper applications are best made several months before late-season (dormant season) bedding.

A REVIEW OF LONGLEAF PINE ESTABLISHMENT AND COMMON HERBACEOUS RELEASE TREATMENTS ON AGRICULTURAL SITES. M.J. Hainds, D.H. Gjerstad and E.E. Johnson; The Longleaf Alliance and Auburn University School of Forestry and Wildlife Sciences. Solon Dixon Forestry Education Center. Andalusia, AL 36420.

ABSTRACT

Establishing longleaf pine on agricultural sites is often more difficult than on cutover sites. Herbaceous competition is generally more vigorous on agricultural sites. Also, agricultural sites have often received amendments that adjust soil pH. Higher soil pH may increase the risk of injury or mortality to longleaf seedlings from herbaceous release treatments. This paper will examine results of several herbicide screening trials that were conducted on agricultural sites between 1997 and 2002. Virtually all herbicides labeled for longleaf release were included in these herbicide screening trials.

INTEGRATION OF SITE PREPARATION AND HERBACEOUS WEED CONTROL ON UPPER COASTAL PLAIN SITES: SECOND YEAR RESULTS. H.E. Quicke and D.K. Lauer; BASF Corporation, Auburn, AL and Silvics Analytic, Richmond, VA.

ABSTRACT

Three study locations were established on upper coastal plain sites to examine post-plant herbaceous weed control strategies following two timings (July vs. October) and three rates (32, 48, and 64 oz/A) of Chopper herbicide for site preparation. Chopper site prep treatments were applied to large plots, ten beds in width. Pines were planted in winter following site prep. Eight post-plant herbaceous weed control (HWC) treatments were assigned at random to the eight inner beds in each site prep treatment plot. HWC treatments during the first loblolly pine growing season included no herbaceous control, March application and June application. Each of these first year treatments will occur with and without second year HWC applied in the spring.

Chopper site prep treatments included 2 qt Accord on the two sites without waxy leafed shrub competition and 1 qt Garlon 4 on the site with waxy leafed shrub competition. All treatments included 0.5% NIS in a total spray volume of 10 gpa. HWC treatments were 4 oz Arsenal AC + 2 oz Oust. Vegetation cover was assessed in June, August and October of the first year of pine growth. Each location included 3 replications in a split-plot design with herbaceous weed control treatments applied as sub-plots within site preparation main plots.

Contrary to expectations, one site had less cover following the earlier season applications of Chopper. On the other two sites there were no significant differences in cover between the two site preparation timings. The earlier site preparation date may have controlled herbaceous weeds prior to seeding and/or perennial herbs before senescence, resulting in less weed pressure the following year. Woolly croton occurred on two sites and cover of this species was consistently lower following the earlier season site preparation. One site included a treatment without Chopper site preparation and woody cover in October was 53% compared to an average of 7% for the Chopper treatments. On this site the major woody competitors were low gallberry, sumac and blackberry.

Future planned work includes a first and second year pine assessment, application of the second year HWC treatments and assessment of vegetation cover during the second year.

HERBICIDE TREATMENTS FOR DIFFERENT BEDDING TIMINGS AND VEGETATION COMPLEXES IN NORTH FLORIDA. D.K. Lauer, H.E. Quicke, and D.E. Adams; Silvics Analytic, Richmond, VA, BASF Corporation, Auburn, AL and Foley Timber and Land Co., Perry, FL.

ABSTRACT

A study series was installed in north Florida to examine woody shrub control and herbaceous control following pre-plant Chopper treatments. A total of eight study locations were distributed across 3 vegetation complexes and 3 timings of bedding. Vegetation complexes were 1) titi-fetterbush-gallberry-redroot, 2) gallberry-palmetto-panic grass, and 3) blackberry-oaks-broadleaf herbs. All pre-plant applications were made in October after early, mid, or late season bedding. Treatments were arranged in a randomized complete block design with 3 blocks at each location. Treatment plots were 3 beds wide by 80 ft long. Pines were planted in winter and vegetation percent cover was assessed in June and October of the first pine growing season. Pine and vegetation measurement plots are two 30 ft plots centered on the middle bed of each treatment plot.

Studies installed on sites that received early and mid season bedding received a total of 10 treatments. Treatments consisted of an untreated check, straight Chopper at 24, 32, and 48 oz ac^{-1}, Chopper at 24, 32, and 48 oz ac^{-1} tank mixed with 32 oz ac^{-1} Garlon 4, and Chopper at 24, 32, and 48 oz ac^{-1} tank mixed with 64 oz ac^{-1} Gly-Flo (4 lb ai/gal glyphosate). Pre-plant treatments were broadcast using a 3 nozzle (TF-2) boom at 15 gpa with 12.5% methylated seed oil. Chopper treatments were effective with and without Garlon 4 or Gly-Flo on titi-fetterbush-gallberry-redroot sites. Higher rates of Chopper or tank mixes with Chopper improved control of titi (*Cyrilla racemiflora*). Tank mixes with Chopper at 32 oz ac^{-1} or higher were required to improve control of fetterbush (*Lyonia lucida*). Straight Chopper and Chopper tank mixes were effective at controlling woody vegetation on gallberry-palmetto-panic grass sites. Control of October total vegetation (including herbs) increased with increasing Chopper rate. Chopper or tank mixes with Chopper controlled woody vegetation on blackberry-oak-broadleaf herb sites. However, control of herbaceous vegetation depended on species present. All treatments were effective on low panic grass, blackberry, and bracken fern but less effective on crabgrass, poorjoe, and spurges.

The two study locations that received late bedding included 6 treatments. Treatments were an untreated check, Chopper pre-plant treatments at 24, 32, and 48 oz ac^{-1}, and post-plant banded herbaceous weed control with Arsenal AC at 6 oz ac^{-1} or Oustar at 13 oz ac^{-1}. The two post-plant herbaceous weed control treatments did not include pre-plant Chopper treatments and were applied in March using a 2 nozzle (TF-2) boom at 15 gpa. Chopper at 32 oz ac^{-1} or more and the two post-plant herbaceous weed control treatments were effective at vegetation control on the gallberry-palmetto-panic grass site. However, Chopper pre-plant and Arsenal AC post-plant treatments were more effective than Oustar post-plant for control of woody shrubs. Treatments provided only marginal control of herbaceous vegetation on the blackberry-oak-broadleaf herb site but Chopper and Arsenal AC treatments provided effective control of woody vegetation.

HERBACEOUS VEGETATION SUPPRESSION EFFECTS ON THE SOIL/PLANT/MICROBIAL SYSTEM OF A YOUNG LOBLOLLY PINE PLANTATION.

M.A. Blazier, Louisiana State University Agricultural Center, Hill Farm Research Station, Homer, LA 71040.

ABSTRACT

Usage of herbicides to suppress competing vegetation is a common practice in the management of southern pine plantations. The extent to which herbicide applications alter vegetation and soil nutrient dynamics should be explored to characterize the mechanisms by which herbicides re-allocate nutrients within the soil/plant/microbial system. The objective of this study was to assess the biomass and nutrient uptake responses of crop trees, herbaceous understory vegetation, and soil microorganisms of a juvenile loblolly pine plantation in southeastern Oklahoma. A 10% solution of glyphosate was band-applied to 220-ft^2 plots throughout 2001 and 2002 to control herbaceous vegetation. The glyphosate treatment was compared to an untreated control. Soil moisture was enhanced by glyphosate application. Total biomass growth of loblolly pine was increased 40% by glyphosate. Pine foliage concentrations of N, P, K, and B were significantly increased as well. N sequestered by microbial biomass was decreased by the brush control treatments, thereby releasing N available for plant uptake. N released by the brush control treatment was likely readily captured by crop trees. Thus, glyphosate promoted nutrition and growth of crop trees by increasing soil water availability, virtually eliminating herbaceous competition for soil nutrients, and promoting faster turnover of nutrients sequestered in soil microorganisms.

HERBACEOUS WEED CONTROL IN LOBLOLLY PINE SEEDLINGS WITH ARSENAL AC, ESCORT XP, OUSTAR, OUST XP, AND VELPAR DF MIXTURES. J.L. Yeiser, Stephen F. Austin State University, Nacogdoches, TX 75962 and A.W. Ezell, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Loblolly pine seedlings at one site in each of Mississippi (MS) and Texas (TX) were released from herbaceous weeds with an application of Arsenal AC (Arsenal), Escort XP (Escort), Oustar, Oust XP (Oust), or Velpar DF (Velpar) combinations. Herbicide efficacy and seedling performance were followed for one growing season. In TX at 30-150 days after treatment (DAT), the addition of Oust+Escort (3+1, 2.25+.75oz) to Arsenal (4,6oz) enhanced bare ground as well as forb and Rubus control, but not grass control. Common ragweed and wooly croton were the dominant recolonizers of plots and largely responsible for reduced bare ground and increased forb levels. In MS, bare ground was greater and forb and grass cover less on treated than untreated checks through 60 DAT. AT 90 DAT, common ragweed aggressively invaded Arsenal (4,6oz) treated plots establishing forb levels comparable to checks through the 150-day evaluation. In MS and TX, Arsenal+Oust+Escort (6+3+1, 4+3+1oz) plots were among those most weed free. After one growing season, seedling survival was at least 92% in TX and 75% in MS. At both sites, Arsenal+Oust+Escort (4+3+1, 6+3+1oz) and Oustar 13oz provided very similar seedling performance. Seedling herbicide damage was not observed in any plot.

INTRODUCTION

The impact of herbaceous competitors on newly planted loblolly pine seedling growth has been widely tested. The benefits of herbaceous weed control (HWC) are well documented. Consequently, HWC is a standard practice in loblolly pine management. Its wide acceptance justifies the continued refinement of herbicide use rates and mixtures.

Herbicides commonly used in forest HWC are Arsenal, Escort, Oustar, Oust, and Velpar. The objective of this study is to screen combinations of these herbicides for Rubus and HWC in newly planted loblolly pine stands and for resultant seedling survival and growth.

METHODS

A test site was established in each of MS and TX. Sites are summarized in Table 1. Treatment plots consisted of 16 seedlings per row. The measurement plot, internal to the treatment plot, consisted of 12 seedlings, leaving two as buffers on each end. A CO_2 backpack sprayer connected to a "T" boom supporting four, 8002 nozzles was used to apply herbicide in a 5-ft band centered over the top of loblolly pine seedlings. Each test plot received a single herbicide application. Total herbicide volume was 10 GPA. Herbicides were applied post plant but before significant weed emergence. On application day in TX, plots averaged 60% weed free, with mean cover of grass, forbs, Rubus and woody plants 8%, 15%, 15%, and <1%, respectively. On application day in MS, plots averaged 60% weed free, with mean herbaceous, bramble, and woody cover <35%, <1%, and <15%, respectively.

HWC was visually evaluated in 10% intervals at 30, 60, 90, 120, 150 (in MS only), and 180 (in TX only) DAT. Prior to herbicide application (Table 1) and again in Nov-03, pines were measured for total height (H) and ground line diameter (GLD). Volume index (VI) was computed as $VI=H \times GLD^2$.

At both test sites, eleven herbicide treatments and an untreated check were installed in each of four blocks according to a randomized complete block design (Table 3). Treatment effects were partitioned as a one-way analysis of variance using the GLM procedure of SAS. At TX only, another analysis was performed using rate of Arsenal and rate of Oust+Escort as main effects in 2X3

factorial experiment. Means were separated using Duncan's New Multiple Range Test. All tests were conducted at the α=0.05 level.

RESULTS AND DISCUSSION

Texas

Numerically, at 30 and 60 DAT, herbicide treated plots had more bare ground and less forb and grass cover than checks (analysis available but not presented). At 90 DAT (8-Jul-03), herbaceous cover had conspicuously increased on all treatment plots since the evaluation 60 DAT, probably due to the 8 inches of June rainfall. For example, mean bare ground and forb cover went from 76% and 13% at 60 DAT to 32% and 48% at 90 DAT, respectively. The distinction between treated and untreated was very evident through 60 DAT but was dramatically less 90 DAT, and deteriorated thereafter.

Numerically 30 DAT, hexazinone (Oustar 13, Velpar+Oust 21.33+2, 10.67+1oz) and Arsenal+Oust+Escort (6+3+1oz) mixtures were among treatments with highest bare ground. At 90 DAT, weed cover had increased more on Arsenal alone than treatment mixtures and recolonization was inversely related to the number of tank partners. At 180 DAT Arsenal+Oust+Escort (6+3+1oz) was among treatments most weed free. This was due to the enhanced control of Rubus and forbs (common ragweed, wooly croton, horseweed) probably by the 1oz Escort rate that was generally absent from other treatments.

From the factorial analysis of Arsenal and Oust+Escort use rates, the main effect, Arsenal, was not significant for forb or grass cover and the main effect, Oust+Escort, was not significant for grass control. For all evaluations, bare ground was increased and forb and Rubus cover reduced by adding Oust+Escort to the Arsenal (4,6oz) tank (Table 2). Bare ground 30 DAT was greater with the addition of 3+1oz of Oust+Escort to Arsenal rather than Arsenal alone. By 60 DAT, both Oust+Escort rates with Arsenal provided similar but more bare ground than Arsenal alone. Bare ground at 90 and 120 DAT was greater for the 3+1oz rate of Oust+Escort than the 2.25+.75oz rate, which was better than none at all. By 180 DAT, only the 3+1oz rate had more bare ground than Arsenal alone. Forbs 30 and 60 DAT were similarly reduced by 2.25+.75oz and 3+1oz of Oust+Escort, both of which were better than Arsenal alone (Table 2). Forb levels at 90-180 DAT were significantly lower when 3+1oz was mixed with Arsenal rather than Arsenal used alone. The 2.25+.75oz rate of Oust+Escort provided intermediate forb control that was similar to both Arsenal alone and Arsenal mixed with the Oust+Escort (3+1oz). Rubus control 30 DAT was increased with 3+1oz of Oust+Escort over Arsenal alone (Table 2). At 60 through 180 DAT, both rates of Oust+Escort similarly and significantly reduced Rubus levels below that of Arsenal alone.

Seedling survival ranged from a low of 92% to a high of 100% (Table 3). Seedling H, GLD, and VI were not enhanced above checks by three treatments: Arsenal+Oust+Escort 4+2.25+.75oz, Oust+Escort 3+1oz, and Arsenal 4oz. Furthermore, H was not increased above checks by Oust+Escort 2.25+.75oz. VI was similar and greater than checks for 3 of 4 three-way mixtures (Arsenal+Oust+Escort 4+3+1, 6+2.25+.75, 6+3+1oz), 4 of 5 two-way mixtures (Oustar 13, Velpar+Oust 10.67+1, 21.33+2, Oust+Escort 2.25+.75oz), and 1 of 2 stand alone treatments (Arsenal 6oz). Adding Escort+Oust (3+1oz) to a tank of Arsenal (4,6oz) did not increase growth in H or VI but did enhance GLD (Table 4).

Mississippi

In a comparison of treated versus untreated, herbicide treated plots had more bare ground and less grass cover than checks 30-90 DAT; forb cover was less than checks 30-60 DAT (Table 5). Forb patterns began to change 90 DAT; bare ground and grass patterns changed 120 DAT and continued 150 DAT. For example, at 150 DAT, levels of bare ground as well as forb and grass cover were similar for check and Arsenal (4,6oz) plots.

All herbicide mixtures (not Arsenal 4,6oz) 30-60 DAT had similar bare ground, and forb levels (Table 5). Grass levels during this period were similar for all herbicide treatments. At 90 DAT,

similar and best bare ground resulted from Velpar+Oust (21.33+2oz) and mixtures containing Escort, followed by other hexazinone treatments (Oustar 13, Velpar+Oust 10.67+1oz), followed by Arsenal (4,6oz), and lastly, the untreated check. At 90 DAT, similar and least forb levels occurred from Velpar+Oust (21.33+2oz) and mixtures containing Escort, followed by other hexazinone treatments (Oustar 13, Velpar+Oust 10.67+1oz), and lastly followed by Arsenal (4,6oz) and the untreated check. Changes in forb levels 90 DAT especially on Arsenal (4,6oz) plots and generally across all plots were largely due to plot recolonization by common ragweed. Grass cover 90 DAT was comparable for all herbicide treatments. At 120 DAT (not shown), the most weed-free plots were treated with Arsenal+Escort+Oust mixtures (6+3+1, 4+3+1, 4+2.25+.75oz) and at 150 DAT Arsenal+Oust+Escort (6+3+1oz). Grass cover in checks 150 DAT was similar to all treatment plots due to recolonization by common broomsedge.

Seedling survival ranged from a low of 75% to a high of 95% (Table 6). Best and similar survival was recorded for plots treated with Arsenal+Oust+Escort (6+3+1oz), Oustar (13oz), and Oust+Escort (3+1oz) with all remaining treatments having less and similar survival. Total heights were similar and greater on plots treated with Arsenal+Oust+Escort (4+3+1oz) and Oustar (13oz) than on plots treated with Oust+Escort (3+1oz), Arsenal (4,6oz), Velpar+Oust (21.33+2oz), and checks. Ground line diameters on plots treated with three-way mixtures of Arsenal+Oust+Escort (4+3+1, 4+2.25+.75, 6+3+1oz) were largest, followed by Oustar (13oz), Oust+Escort (2.25+.75, 3+1oz), and Arsenal (4oz), followed by Velpar+Oust (10.67+1, 21.33+2oz), Arsenal+Oust+Escort (6+2.25+.75oz), and Arsenal (6oz). Smallest GLDs occurred on check plots.

Table 1. A summary of test sites.

	TEXAS	MISSISSIPPI
County/Town	Nacogdoches/Nacogdoches	Oktibbeha /Sturgis
Physiography	hilly upper coastal plain	hilly upper coastal plain
Soil	sandy clay loam over clay loam pH 5.0	Ruston fine sandy loam pH 5.3
Previous Stand	mixed pine hardwood plantation	natural, mixed pine hardwood
Harvested	Dec-00	2001
Site Preparation-1	May-01, single chop	Apr-01, ULW, rate unknown
Site Preparation-2	Jun-02, Arsenal AC+Accord+Rebound 16oz+2qt+16oz	Sep/Oct-02, burn
Planting	Dec-02 machine-bare root	Jan-03 hand-bare root
Application Date	8-Apr-03	13-Apr-03
Major Forbs	common ragweed, wooly croton	common ragweed, horseweed
	late boneset, dogfennel	late boneset, fireweed
Major Grasses	panicums, sedges	broomsedge, wooly panic grass
Major Woody	sweetgum, oaks, fringetree, yaupon	sweetgum, oaks

Table 2. Bare ground (%), as well as forb and Rubus cover (%) at 30-180 days after treatment (DAT) near Nacogdoches, TX. All Arsenal[1] and Oust[1]+Escort[1] rates are in ounces of product per acre.

Oust + Escort	BARE GROUND			FORB			RUBUS		
	Arsenal			Arsenal			Arsenal		
	4oz	6oz	Mean[2]	4oz	6oz	Mean[2]	4oz	6oz	Mean[2]
30 DAT 8-May-03									
0	46.3	60.0	53.1b	18.8	13.8	16.3a	21.3	10.5	15.9a
2.25+.75oz	56.3	68.8	62.5ab	11.8	6.5	9.1b	20.0	11.5	15.8a
3+1oz	65.0	81.3	73.1a	7.0	6.5	6.8b	12.3	7.0	9.6b
Mean[3]	55.8a	70.0a		12.5a	8.9a		17.8a	9.7a	
60 DAT 8-Jun-03									
0	70.0	66.3	68.1b	17.5	18.8	18.1a	10.0	7.5	16.1a
2.25+.75oz	80.0	86.3	83.1a	9.3	5.0	7.1b	4.0	3.3	3.6b
3+1oz	82.5	93.5	88.0a	9.8	4.0	6.9b	3.0	1.0	2.0b
Mean[3]	77.5a	82.0a		12.2a	9.3a		5.7a	3.9a	
90 DAT 8-Jul-03									
0	17.5	17.5	17.5c	58.8	58.8	58.8a	17.8	14.3	16.5a
2.25+.75oz	27.5	45.0	36.3b	53.8	38.8	46.3ab	4.0	3.5	3.8b
3+1oz	45.0	66.3	55.6a	42.5	26.3	34.4b	3.0	1.8	2.4b
Mean[3]	30.0a	42.9a		51.7a	41.3a		8.5a	6.5a	
120 DAT 8-Aug-03									
0	15.0	13.8	14.4c	52.5	60.0	56.3a	20.0	16.3	18.1a
2.25+.75oz	23.8	42.5	33.1b	50.0	43.8	46.9ab	3.0	2.3	2.6b
3+1oz	40.0	57.5	48.8a	45.0	27.5	36.3b	2.0	1.3	1.6b
Mean[3]	26.3a	37.9a		49.2a	43.8a		8.3a	6.6a	
180 DAT 8-Oct-03									
0	12.5	10.0	11.3b	51.3	60.0	55.6a	25.0	20.0	22.5a
2.25+.75oz	18.8	31.3	25.0ab	50.0	41.3	45.6ab	8.0	7.0	7.5b
3+1oz	36.3	43.8	40.0a	38.8	33.8	36.3b	6.3	4.5	5.4b
Mean[3]	22.5a	28.3a		46.7a	45.0a		13.1a	10.5a	

[1]Arsenal=Arsenal AC; Oust=Oust XP; Escort=Escort XP.
[2]Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).
[3]Treatment means within a row sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

Table 3. Herbaceous weed treatments and loblolly pine seedling survival (S,%), total height (H, FT), ground line diameter (GLD, IN) and volume index (VI, X 10^{-3} FT^3) after one growing season near Nacogdoches, TX. All rates are in ounces of product per acre.

HERBICIDE TREATMENTS	S[1]	H[1]	GLD[1]	VI[1]
Arsenal[2]+Oust[2]+Escort[2] 4+3+1oz	100a	1.84ab	0.414ab	2.76a
Arsenal+Oust+Escort 6+2.25+.75oz	98ab	1.75abc	0.399abc	2.73a
Oustar 13oz	98ab	1.93a	0.409abc	2.63a
Arsenal+Oust+Escort 6+3+1oz	100a	1.75abc	0.420a	2.40a
Velpar[2]+Oust 10.67+1oz	98ab	1.77abc	0.374bcd	2.15ab
Velpar+Oust 21.33+2oz	96ab	1.72bc	0.379abcd	2.04ab
Oust+Escort 2.25+.75oz	100a	1.63cde	0.361cde	2.04ab
Arsenal 6oz	96ab	1.66bcd	0.352de	1.98ab
Arsenal +Oust+Escort 4+2.25+.75oz	96ab	1.60cde	0.346ef	1.54bc
Oust+Escort 3+1oz	92b	1.44e	0.326ef	1.37bc
Check	100a	1.43e	0.293f	1.09c
Arsenal 4oz	100a	1.47de	0.294f	0.98c

[1]Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).
[2]Arsenal=Arsenal AC; Oust=Oust XP; Escort=Escort XP; Velpar=Velpar DF.

Table 4. Analysis of loblolly pine seedling total height (FT), ground line diameter (GLD, IN) and volume index (VI, X 10^{-3} FT^3) after one growing season near Nacogdoches, TX. All Arsenal[1] and Oust[1]+Escort[1] rates are in ounces of product per acre.

Oust + Escort	TOTAL HEIGHT (FT)			GLD (IN)			VI (X 10^{-3} FT^3)		
	Arsenal			Arsenal			Arsenal		
	4oz	6oz	Mean[2]	4oz	6oz	Mean[2]	4oz	6oz	Mean[2]
0	1.47	1.66	1.56a	0.29	0.35	0.32b	0.98	1.98	1.47a
2.25+.75oz	1.60	1.75	1.68a	0.35	0.40	0.37ab	1.54	2.73	2.14a
3+1oz	1.84	1.75	1.79a	0.41	0.42	0.42a	2.76	2.40	2.58a
Mean[3]	1.64b	1.72b		0.35b	0.39b		1.76b	2.37b	

[1]Arsenal=Arsenal AC; Oust=Oust XP; Escort=Escort XP; Velpar=Velpar DF.
[2]Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).
[3]Treatment means within a row sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

Table 5. Percent bare ground (B), forb, and grass cover at 30-150 days after treatment (DAT) near Sturgis, MS.

HERBICIDE TREATMENTS	B[1]	FORB[1]	GRASS[1]	B[1]	FORB[1]	GRASS[1]
Ounces of Product per Acre	30 DAT 13-May-03			60 DAT 13-Jun-03		
Check	17.5c	52.5c	20.5b	5.0c	85.0c	15.0b
Oustar 13oz	90.5a	6.8a	4.0a	92.7a	6.0a	1.3a
Velpar[2]+Oust[2] 21.33+2oz	91.7a	5.0a	4.5a	95.7a	2.3a	2.0a
Velpar+Oust 10.67+1oz	90.0a	6.3a	4.8a	90.2a	7.5a	2.3a
Arsenal[2] 6oz	83.5b	12.5b	5.0a	48.7b	50.0b	1.3a
Arsenal 4oz	75.7b	21.3b	3.0a	49.4b	48.8b	1.8a
Oust+Escort[2] 3+1oz	93.5a	4.0a	2.5a	95.0a	3.5a	1.5a
Oust+Escort 2.25+.75oz	93.5a	3.0a	3.5a	96.2a	2.5a	1.3a
Arsenal+Oust+Escort 6+3+1oz	90.2a	4.0a	5.8a	96.7a	2.3a	1.0a
Arsenal+Oust+Escort 4+3+1oz	92.0a	4.0a	4.0a	97.2a	1.5a	1.3a
Arsenal+Oust+Escort 6+2.25+.75oz	93.5a	3.5a	3.0a	95.5a	3.5a	1.0a
Arsenal+Oust+Escort 4+2.25+.75oz	93.5a	4.0a	2.5a	96.7a	2.5a	0.8a
Ounces of Product per Acre	90 DAT-13-Jul-03			150 DAT-13-Sep-03		
Check	1.0d	90.0c	11.8b	0.0e	93.8d	13.0ab
Oustar 13oz	57.7b	36.3b	1.3a	22.7d	68.8c	8.5a
Velpar+Oust 21.33+2oz	82.9a	14.3a	2.0a	30.0d	60.0c	10.0ab
Velpar+Oust 10.67+1oz	53.9b	41.3b	2.3a	25.7d	65.0c	9.3ab
Arsenal 6oz	19.0c	77.5c	1.3a	1.5e	90.0d	8.5a
Arsenal 4oz	16.5c	80.0c	1.8a	6.0e	87.5d	6.5a
Oust+Escort 3+1oz	86.5a	7.5a	1.5a	43.7c	37.5b	18.8b
Oust+Escort 2.25+.75oz	88.7a	2.8a	1.3a	48.7c	31.3b	20.0b
Arsenal+Oust+Escort 6+3+1oz	93.0a	4.5a	1.0a	81.5a	10.0a	8.5a
Arsenal+Oust+Escort 4+3+1oz	93.4a	1.8a	1.3a	67.0b	18.0ab	15.0ab
Arsenal+Oust+Escort 6+2.25+.75oz	91.5a	6.0a	1.0a	51.2bc	35.0b	7.8a
Arsenal+Oust+Escort 4+2.25+.75oz	91.7a	5.0a	0.8a	68.7b	20.0ab	11.3ab

[1]Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).
[2]Arsenal=Arsenal AC; Oust=Oust XP; Escort=Escort XP; Velpar=Velpar DF.

Table 6. Loblolly pine seedling performance: survival (S,%), total height (H, FT), and ground line diameter (GLD, IN) after one growing season near Sturgis, MS. All rates are in ounces of product per acre.

HERBICIDE TREATMENTS	S[1]	H[1]	GLD[1]
Arsenal[2]+Oust[2]+Escort[2] 4+3+1oz	78b	1.84a	0.53a
Arsenal +Oust+Escort 4+2.25+.75oz	83b	1.73ab	0.52a
Arsenal+Oust+Escort 6+3+1oz	95a	1.75ab	0.51a
Oustar 13oz	95a	1.84a	0.43b
Oust+Escort 2.25+.75oz	85b	1.69ab	0.43b
Oust+Escort 3+1oz	93a	1.60b	0.42b
Arsenal 4oz	75b	1.63b	0.41b
Velpar+Oust 10.67+1oz	83b	1.70ab	0.38c
Arsenal+Oust+Escort 6+2.25+.75oz	83b	1.73ab	0.37c
Velpar+Oust 21.33+2oz	80b	1.52b	0.36c
Arsenal 6oz	80b	1.61b	0.36c
Check	82b	1.55b	0.32d

[1]Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test (α=0.05).
[2]Arsenal=Arsenal AC; Oust=Oust XP; Escort=Escort XP; Velpar=Velpar DF.

SCREENING OUST XP FOR HERBACEOUS RELEASE OF NEWLY PLANTED LOBLOLLY AND SLASH PINE SEEDLINGS. A.W. Ezell and J.L. Yeiser, College of Forest Resources, Mississippi State University, MS 39762 and College of Forestry, Stephen F. Austin State University, Nacogdoches, TX 75962.

ABSTRACT

Sulfometuron methyl has been used for many years to provide herbaceous weed control in southern pine plantations. The formulation of Oust was altered in recent years to improve mixing, solubility and provide overall better results in field applications. DuPont changed the formulation of Oust XP (name given to the altered Oust), and while no difference was expected in efficacy or crop tolerance, field tests were conducted to ensure the new product would perform as well or better than the old formulation.

A total of twelve (12) treatments were applied to first-year loblolly plantations in Mississippi and Texas. Eleven (11) treatments were applied to a first-year slash pine plantation in Louisiana. All treatments were selected to compare the "Improved Oust XP" to Oust XP either alone or in mixtures with other products. In addition to evaluating competition control efficacy during the first growing season, pines were measured pretreatment and again during Dec. 2002 and Dec. 2003. From the measurements, groundline diameter (GLD) and height (total height) growth responses were evaluated.

Overall, the "Improved Oust XP" provides results comparable to "Oust XP", and this "improved" formulation is the current market product with the product name "Oust XP". No phytoxicity was noted in the study from this product and both formulations provided similar competition control.

For pine growth parameters, response varied by state and among treatments. Overall, the treatments were effective, but in the Texas loblolly plantation, only three (3) of the eleven (11) herbicide treatments resulted in significantly greater height growth in either year 1 or year 2, when compared to the untreated plots whereas eight (8) of the eleven(11) treatments resulted in significantly taller trees in Mississippi. In the Texas loblolly study, GLD was significantly increased over the check plots by all treatments in year 1, but only in four (4) treatments in year 2. In Mississippi loblolly plots, GLD was significantly greater in all treatment plots in both years. In slash pine plots, four (4) of the ten (10) herbicide treatments resulted in significantly greater heights in year 1 and year 2, but the treatments were not the same in both years. In GLD measurements, four (4) treatments resulted in significantly greater diameters in year 1, but only one (1) treatment had significantly greater GLD than the check plots in year 2. Although the differences were not always statistically significant, herbicide treatments increased height on these trees and most treatments increased diameter (GLD).

The improved Oust XP should perform as well or better than the earlier formulations. It mixes well, sprays well, and provides competition control as expected from sulfometuron methyl.

HERBACEOUS WEED CONTROL RESULTS FOR TANKMIXES OF OUST, ESCORT, AND ARSENAL AC APPLIED TO LOBLOLLY PINES IN ARKANSAS DELTA. J.A. Earl and M.H. Pelkki; Arkansas Agricultural Experiment Station and School of Forest Resources, University of Arkansas at Monticello, 71656; and R.A. Williams; University of Florida, Milton Campus, Milton FL. 32583.

ABSTRACT

Planting loblolly pines in an old agricultural field certainly has advantages in terms of site preparation because there is no logging slash or stumps from a previous forest. However, like any pine planting, the main competition in the first couple years comes from herbaceous weeds. A study was installed in April 2003 to see which combinations of herbicides did a better job of controlling these herbaceous weed competitors. There were several locations across the South participating in the same trials, but this paper reports on results from an old field planting in St Francis County, Arkansas. The site had primarily been in soybean production during previous years. Soils were a silt loam with a fragipan at about 20 inches (sometimes less). Three soil preparations were made in this field: subsoiling, ripping, and none. For this study, we looked at the effects of herbicides on the soils where no preparations were done.

Eleven herbicide mixtures plus one untreated control were arranged in a randomized complete block design with three replications. The tank mixes were sprayed at a volume of 10 gallons per acre and used varying rates and combinations of Oustar, Velpar L, Oust, Escort, and Arsenal AC. Arsenal was used alone in 4 and 6 ounces of product per acre, and also in four mixes that combine Oust (2.25 or 3 ounces product per acre) plus Escort (0.75 or 1.0 ounces product per acre). Two mixes included Oust (2.25 or 3 ounces product per acre) plus Escort (0.75 or 1.0 ounces product per acre). Velpar (10.67 or 21.33 ounces of product per acre) plus Oust (1.0 or 2.0 ounces product per acre) accounted for two more mixes. Oustar alone was used at a rate of 13 ounces product per acre.

Heights and groundline diameters were measured initially and after one growing season. During the growing season, evaluations were made to determine bareground percents, survival, and major competitors. Overall, the height growth averaged 0.9 feet during the first growing season, while groundline diameters grew about 0.2 inches. Surprising, the best height growth was found on the untreated control at 1.2 feet. The higher rates of Arsenal seemed to have some of the worst height growth, but there are warnings on the product label that the active ingredient can cause stunting in pines. The only significant differences were between the untreated control and some of these higher rates of Arsenal. All groundline diameters were similar in growth, except a couple of the higher rates of Arsenal.

Major competitors identified were horseweed, panic grass, goatweed, cocklebur, and giant foxtail. Most of the tank mixes showed excellent control of competition, with bareground percentages of 85-100 lasting through August. The notable exception was the Arsenal AC alone, and in late season the lowest rate of Velpar + Oust began to wane in efficacy. The overall survival on the site was excellent at 97 percent, with individual treatments ranging from 86 to 100 percent.

MARGINAL PINE RESPONSE FOLLOWING FIRST-YEAR VEGETATION CONTROL AND TIME-OF-PLANTING FERTILIZATION COMPARED ACROSS MULTIPLE LOCATIONS AND SOILS. D.K. Lauer and R.S. Meldahl; Silvics Analytic, Richmond, VA and School of Forestry and Wildlife Sciences, Auburn, AL.

ABSTRACT

Marginal response, defined here as second year pine height response per unit of first year percent cover reduction, was compared among fertilization treatments and across multiple locations of a cooperative study that included time-of-planting fertilization and first year herbaceous vegetation control (HC). Marginal response did not differ (no interactions) among fertilization treatments except on A-group soils where marginal responses were close to zero without fertilization. Marginal responses to first year HC were comparable among fertilized A-group soils and all other soil groups. In the absence of site limitations, a response of 0.025 ft in second year pine height per unit of percent cover should be expected. This equates to a second year height response of 1 foot for a reduction in first year percent cover of 40%. There was no clear relationship between response to HC and soil group after accounting for variation in vegetation control.

Response of competing vegetation to fertilization may limit fertilization response. There was evidence that fertilization increased competing vegetation with or without HC. The estimated decrease in fertilization response due to response of first year competing vegetation averaged 8% on A, B, C, and D group soils and 27% on E group soils. Fertilization increased second year vegetation weight, with woody vegetation accounting for most of this increase on A, B, C, and D group soils.

HERBACEOUS WEED CONTROL FOR LOBLOLLY AND LONGLEAF SEEDLINGS USING ACTIVATED CHARCOAL AND HEXAZINONE AND IMAZAPYR. C.L. Ramsey, S. Jose, and B.J. Brecke; UF/IFAS, University of Florida, Milton campus, Milton FL. 32583.

ABSTRACT

Herbaceous weed control (HWC) field studies were conducted in 2002 and 2003 in northwestern Florida on loblolly and longleaf pine seedlings. The objectives were to investigate the effects of activated charcoal on pine stunting/injury and the duration of weed control for hexazinone (Velpar DF) and imazapyr (Arsenal AC). Both studies were a randomized, complete block design with four replications. Pines were planted on 1.2 x 2.4 m spacing. There were 48 and 60 seedlings per treatment in the 2002 and 2003 studies, respectively. Bare-root loblolly pines were planted on January 8, 2002 and container, longleaf seedlings were planted on January 9, 2003. The applications were on April 3, 2002 and April 12, 2003. In 2002 the HWC loblolly study included two hexazinone rates, 2.24 and 3.36 kg ai/ha (128 and 192 fl oz/ac) and imazapyr applied at 0.42 kg ai/ha (12 fl oz/ac). The charcoal rates were 0, 22, 28, 34, and 39 kg/ha for hexazinone, and 0, 2.8, 5.6, and 8.4 lb/ac for imazapyr applications. Charcoal and the herbicides were tank mixed together then band applied over top of the first year seedlings. The spray volume was 374 l/ha. In the 2003 study the hexazinone and imazapyr rates were 2.24 and 0.525 kg ai/ha (128 and 15 fl oz/ac), respectively. The charcoal rates were 0, 22, 28, 34, and 39 kg/ha for hexazinone, and 0, 2.8, 5.6, and 8.4 kg/ha for imazapyr. Herbaceous weed control was evaluated on a monthly basis, for each growing season. Pine survival and diameter growth were analyzed for herbicide and charcoal effects at the end of each growing season. In 2002 the addition of charcoal did not improve the duration of herbaceous weed control. Also in 2002, charcoal did not increase pine survival for either the imzapyr or hexazinone applications. Second year loblolly pine growth and survival, and first year longleaf pine growth and survival will be analyzed at the end of the 2003 growing season.

SECOND-YEAR RESULTS OF WOODY RELEASE TREATMENTS IN YOUNG LOBLOLLY PLANTATIONS. A.W. Ezell, J.L. Yeiser, and L.R. Nelson; College of Forest Resources, Miss. State Univ., Miss. State, MS 39762, College of Forestry, Stephen F. Austin State Univ., Nacogdoches, TX 75962, and Dept. of Forest Resources, Clemson Univ., Clemson, SC 29634.

ABSTRACT

The inclusion of Oust XP in fall site prep applications has proven to be extremely effective for providing residual herbaceous weed control the growing season after treatment. An increasing acreage is being mechanically site prepared with woody release treatment applied in the second growing season. The objectives of this study were to evaluate the efficacy of adding Oust XP to woody release treatments for residual herbaceous control and to evaluate pine growth response to the various treatments.

A total of six woody release treatments were applied to loblolly pine plantations at the end of their second growing season in the field. Applications of the six treatments were replicated three times at sites in Texas, Mississippi, and South Carolina. Two additional treatments were applied in Mississippi (Table 1). Pine heights and diameters were measure at the time the treatments were applied (Sept. 2001) and again in Dec. 2002 and Dec. 2003.

In Mississippi, all treatments resulted in significantly greater diameter growth as compared to the untreated plots. In addition, diameter growth of the trees in three of the four treatments which contained Oust XP was significantly greater than the diameter growth of trees in other herbicide treatment plots. In Texas, the diameter growth of trees in plots with Oust XP was significantly greater than untreated trees, but not significantly different than trees in other herbicide treatment plots.

In an evaluation of height growth in Mississippi, all treatments with Oust XP exhibited significantly greater response as compared to untreated plots, but no consistent response was noted in the comparison among herbicide treatments with or without Oust XP. In Texas, addition of Oust XP resulted in greater height growth the first year of observation in comparison to other herbicide treatments or untreated check. However, in the second-year observations, none of the treatments were significantly different.

Adding Oust XP does provide good residual herbaceous weed control the growing season following woody release applications. Pine growth response was variable, but the general trend was that both height and diameter growth was increased by the addition of Oust XP.

Table 1. List of treatments in the 2001 DuPont Fall Oust Release Study.

Treatment No.	Herbicide and Rate/Acre
1	Untreated
2	Arsenal AC (16 oz.) + COC [a] (3.2 oz.)
3	Arsenal AC (12 oz.) + COC (3.2 oz.)
4	Arsenal AC (12 oz.) + Escort XP (1 oz.) + COC (3.2 oz.)
5	Arsenal AC (12 oz.) + Escort XP (1 oz.) + Oust XP (2 oz.) + COC (3.2 oz)
6	Arsenal AC (12 oz.) + Eagre (12.8 oz.) + Escort XP (1 oz.) + Oust XP (2 oz.) + Entry II (10 oz.)
7[b]	Eagre (25.6 oz.) + Escort XP (2 oz.) + Oust XP (2 oz.) + Entry II (10 oz.)
8[b]	Eagre (25.6 oz.) + Escort XP (4 oz.) + Oust XP (2 oz.) + Entry II (10 oz.)

HERBICIDE COMPARISONS FOR MID-ROTATION COMPETITION RELEASE IN LOBLOLLY AND SLASH PINE. A.B. Wilson, W.N. Kline, and B.D. Shiver; Boise, DeRidder, LA, Dow AgroSciences, Duluth, GA, and University of Georgia, Athens, GA.

ABSTRACT

Different combinations of herbicides were applied with a tank-mounted skidder, in an attempt to effectively control competing vegetation in a loblolly and slash pine plantation at mid-rotation. Treatments were applied October 15, 2002. One year after treatment, there are no significant diameter or height responses on the crop trees. Competing vegetation was reduced in percent cover and total height. Additional measurements will be taken at two, three, and four years after treatment.

INTRODUCTION

In recent years, a number of studies have shown the benefits of controlling competing vegetation in pine plantations. Plants compete for limited site resources (water, nutrients, sunlight, and growing space). Typically, the earlier crop trees are released from competition, the greater the growth response. A problem arises when difficult-to-control species are growing alongside crop trees. In the gulf coastal plain, several species of arborescent and non-arborescent plants can grow just under or into the canopy of pines, making herbicide application difficult. Also, foresters are limited to a select group of herbicides that have proven effective in controlling species such as yaupon and waxmyrtle.

METHODS AND MATERIALS

Two sites in Allen Parish, Louisiana were selected for the study. The loblolly pine site is on a Malbis soil, planted in 1986, fertilized in 1995 with 35 pounds of nitrogen plus 40 pounds of phosphorus, commercially thinned in 2000, and fertilized again in 2002 with 200 pounds of nitrogen plus 25 pounds of phosphorus. The slash pine site is located on a Caddo soil, planted in 1986, fertilized in 1995 with 35 pounds of nitrogen plus 40 pounds of phosphorus, commercially thinned in 2001, and fertilized again in 2002 with 100 pounds of nitrogen plus 25 pounds of phosphorus. A randomized complete block design was chosen for the study with five treatments for the loblolly pine site (Table 1) and two for the slash pine site (Table 2). In order to ensure adequate coverage in these dense stands, a tank-mounted skidder was used to apply the herbicide mixture at 45 gallons per acre at 40 pounds per square inch pressure. Nozzles were mounted on a boom 20 feet above the ground. The skidder traveled the thinned-down-rows for access and sprayed a swath approximately 50 feet wide. Four spray swaths, 350 feet long, constituted a treated plot. Treatments for both sites were applied October 15, 2002. Within each plot, three permanent 0.1 acre, measurement plots were established. All pine trees were tagged and measured for DBH and height. Visual assessments for competing vegetation (percent cover by species, average height of species, and percent control) were also recorded.

Competing species included American beautyberry, American holly, blackgum, Chinese tallow, red maple, sumac, sweetgum, water oak, waxmyrtle, and yaupon. Sweetgum, waxmyrtle, and yaupon constituted more than 50% of the competing vegetation cover (Table 3) on both sites.

RESULTS AND DISCUSSION

From past mid-rotation release studies, responses are not usually evident until two or three years after treatment. One year after treatment, competing vegetation was reduced in percent cover and total height (Table 4). DBH and height response for loblolly and slash pine is positive for almost all treatments when compared to the untreated plots (Table 5, Table 6). Additional measurements are planned for 2, 3, and 4 years after treatment.

Table 1. Treatment list for loblolly pine

Treatment Number	Herbicide and Rate
1	2 qt. Garlon4 + 16 oz. Arsenal
2	3 qt. Garlon4 + 12 oz. Arsenal
3	5 qt. Garlon4
4	2 qt. Garlon4 + 48 oz. Chopper
5	Untreated

Table 2. Treatment list for slash pine

Treatment Number	Herbicide and Rate
1	2 qt. Garlon4 + 32 oz. Chopper
2	Untreated

Table 3. Major competing species

Species	Per Cent Cover (Initial)		Height (ft) (Initial)	
	Loblolly Site	Slash Site	Loblolly Site	Slash Site
yaupon	52	19	15	14
waxmyrtle	9	20	8	11
sweetgum	9	13	19	23

Table 4. Major competing species

Species	Per Cent Cover (One Year After Treatment)		Height (ft) (One Year After Treatment))	
	Loblolly Site	Slash Site	Loblolly Site	Slash Site
yaupon	13	3	17	7
waxmyrtle	0	0	-	-
sweetgum	5	0	30	-

Table 5. Growth for loblolly pine (one year after treatment).

Treatment	DBH (in)	Height (ft)
2 qt. Garlon4 + 16 oz. Arsenal	0.29	3.3
3 qt. Garlon4 + 12 oz. Arsenal	0.28	3.1
5 qt. Garlon4	0.24	3.2
2 qt. Garlon4 + 48 oz. Chopper	0.31	3.1
Untreated	0.25	2

Table 6. Growth for slash pine (one year after treatment).

Treatment	DBH (in)	Height (ft)
2 qt. Garlon4 + 32 oz. Chopper	0.41	3.5
Untreated	0.32	2.8

A COMPARISON OF MID-ROTATION HERBICIDE TREATMENTS FOR WOODY AND HERBACEOUS COMPETITION CONTROL. A.W. Ezell, College of Forest Resources, Mississippi State University, Starkville, Mississippi.

ABSTRACT

Increasing amounts of fertilization and mid-rotation brush control are being undertaken in southern pine plantations. These herbicide treatments are directed toward woody species primarily, and the influence of herbaceous competition control at this timing has not been evaluated. A total of six treatments (Table 1) were applied to a 120-acre study area of a recently thinned 16-year-old loblolly pine plantation. The objectives of the study are (1) to evaluate the efficacy of different herbicide treatments for controlling hardwood species, (2) evaluate the herbaceous competition control provided by adding Oust XP to the brush control treatment, and (3) evaluate the pine growth response to the herbicide treatments and fertilizer.

Treatments were applied to six, 20-acre blocks, and twenty plot centers were established in each block. At each plot center, hardwood stems were tallied on a circular 0.025-acre plot and pines were tagged and measured on circular 0.1-acre plot. All herbicides were applied in 2002.

The addition of Oust XP provided excellent control of broadleaf forbs during the 2003 growing season. Grass and sedges were not a major problem on this site (@10% coverage) with Andropogon being the single greatest species of this group. Broadleaf coverage was less than 2% until August and only 11-13% in August-September in plots receiving Oust XP. In other herbicide treatment areas, broadleaf cover was ≥ 90% June-September. Control of woody species on the site was very good. The ULW fb 12 oz. Arsenal AC/A provided results comparable to 16 oz. Arsenal AC/A; both of which provided slightly better overall control than 12 oz. Arsenal AC/A. The number of hardwood stems increased in the "untreated" block, and greatly increased in the "fertilizer only" block.

Table 1. List of treatments in the DuPont Mid-Rotation Brush Control Project.

Treatment No.	Treatments (per acre rates)
1	Velpar ULW (2.5 lbs.) - Spring fb Arsenal AC (12 oz.) + Entry II (10 oz.) - Fall Fb fertilizer
2	Arsenal AC (16 oz.) + Oust XP (3 oz.) + Entry II (10 oz.) - Fall Fb fertilizer
3	Arsenal AC (16 oz.) + Entry II (10 oz.) - Fall Fb fertilizer
4	Arsenal AC (12 oz.) + Entry II (10 oz.) - Fall fb fertilizer
5	Fertilizer only
6	Untreated

RELATIONSHIP OF AGE 8 PINE RESPONSE TO OCCUPANCY OF WOODY SHRUB AND HERBACEOUS VEGETATION ON LOWER COASTAL PLAIN SITES IN GEORGIA AND NORTHERN FLORIDA. D.K. Lauer and R.S. Meldahl; Silvics Analytic, Richmond, VA and School of Forestry and Wildlife Sciences, Auburn, AL.

ABSTRACT

Pine response following control of competing woody shrub and herbaceous vegetation was investigated with a study series that incorporated vegetation control with bedding on spodosols. Treatments were designed to examine first year shrub control and repeated shrub control crossed with first year herbaceous control. Age 8 pine response was compared among treatments using both a traditional analysis of variance approach and a modeling approach. The modeling approach related response to actual vegetation levels to develop a better understanding of the relationship between occupancy of competing vegetation and limits to productivity.

Competing vegetation was found to be a major limiting factor to productivity on these soils. There was variation in response among locations, but the variation was one of magnitude such that the pattern of response was similar at all four locations. Pine response was greater to shrub control than to herbaceous control, with these effects being additive. The gain from continuing shrub control past the first year was positive but not significant at any location. First year herbaceous control, first year shrub control, and repeated shrub control increased age 8 volume, averaged over the four locations, by 157, 463, and 561 ft^3 ac^{-1}, respectively (untreated check averaged 564 ft^3 ac^{-1}). Increases in age 8 volume from the best performing treatments of first year herbaceous with first year shrub, repeated shrub without first year herbaceous, and repeated shrub with first year herbaceous averaged 656, 615, and 699 ft^3 ac^{-1}, respectively.

The modeling approach related age 8 dominant height response to vegetation variables and related quadratic mean dbh and dbh percentiles to height response. The dominant height model indicated that there was a fixed gain from initiating vegetation control and that pine growth was limited by occupancy of uncontrolled first year woody shrub cover, first year herbaceous cover, and fifth year shrub cover. These findings indicate that major increases in productivity can be achieved by site preparation treatments designed to control woody shrub vegetation and that productivity will increase with the quality of first year herbaceous control and long-term shrub control. The consistency of the results across four locations of varying productivity suggests that response to vegetation control is related more to vegetation levels than to variation in site productivity on spodosols.

EVALUATION OF SCREENING TECHNIQUES FOR WOODY PLANT HERBICIDE DEVELOPMENT. M.P. Blair and S.M. Zedaker; Department of Forestry, Virginia Tech, Blacksburg, VA.

ABSTRACT

Two rapid screening techniques were evaluated for their effectiveness in determining initial herbicide activity and ability to predict field response of woody plants. Four species, green ash (*Fraxinus pennsylvanica*), sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipfera*), and loblolly pine (*Pinus taeda*), were screened with imazapyr, formulated as Arsenal AC, and triclopyr, formulated as Garlon 4, using a traditional field screen, a rapid greenhouse screen, and a rapid seed screen.

The field screen was performed using a 2-year-old and a 3-year-old plantation and was treated using standard research application equipment. Five rates were used per chemical, beginning with a standard labelled rate (24 oz/ac for imazapyr and 128 oz/ac for triclopyr). Parameters measured included pre-application height, height 8 WAT, height 1 YAT, effect code 1 YAT, and mortality 1 YAT. The rapid greenhouse screen was performed twice, once using the same rate titration as the field screens and once using a further diluted rate titration in an attempt to obtain a more diverse dose response curve. The rapid greenhouse screens were treated using 1-year-old seedlings in a hood sprayer, placed in a greenhouse with 12-hour photoperiods for 8 WAT, placed in a cooler at 40 degrees Fahrenheit for 2000 hours to allow dormancy inductions, and then returned to the greenhouse for six weeks to allow flush-out. Parameters measured included height 8 WAT, effect code 8 WAT, leaf necrosis 8 WAT, height 1 physiological year after treatment (PYAT) (as opposed to one chronological year), effect code 1 PYAT, and mortality 1 PYAT. The rapid seed screen used stratified seeds and the same rate titration as the second rapid greenhouse screen. Seeds were treated in Petri dishes using a volume/volume mix and placed in a growth chamber for 20 days. Seeds were evaluated every other day, and parameters measured included germination and live tissue length.

Each parameter measure from a rapid screen (either greenhouse or seed) was used as an independent variable in simple linear regression models with field parameters as dependent variables. Models were tested in a linear form and a log(y) transformation.

There were over 800 models tested for significance. Of the 800 models tested, approximately 250 were significant at the $p < 0.1$ level. Percent control of height and effect code were the most common dependent variables, while common independent variables included percent leaf necrosis, percent control of height, mortality, and effect code. Percent control of seed tissue from the rapid seed screen had more significant linear models than percent control of germination. There were more significant models created using the triclopyr screen data. This indicates that rapid screens may need to be specific to a family of chemistries.

DOUBLE SAMPLING TO COMBINE OCULAR AND TRANSECT ESTIMATES OF HERBACEOUS COVER IN HERBICIDE SCREENING STUDIES. S.A. Knowe and V.L. Ford; Department of Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville; MeadWestvaco, Rupert, WV.

ABSTRACT

Forest vegetation managers typically use ocular estimation to assess cover of herbaceous vegetation. Although this can be accomplished quickly and cheaply, little research is available to determine the accuracy and precision of ocular estimates of cover. Both accuracy and precision can affect the statistical validity of results, particularly in experiments that are used to compare various methods of controlling herbaceous vegetation.

Data from seven herbaceous competition control studies in the Piedmont of Virginia were used to compare ocular, transect, and double sampling estimates of herbaceous cover. Site preparation included piling and disking at 1 location, piling only at 2 locations, burning only at 1 location, chopping and burning at 1 location, and applying 7 lbs a.i./acre of hexazinone (ULW formulation) and burning at 2 locations. Herbaceous competition control treatments included 0, 0.05, 0.10, 0.15, and 0.20 lbs a.i./acre of sulfometuron methyl. Each competition control treatment was replicated 3 times in a randomized complete block experimental design at each location. Ocular estimates of herbaceous cover were obtained in 6x10 ft subplots centered on 30 seedlings per treatment plot in mid-July, and then averaged. Transect estimates of cover were obtained by laying out a tape measure along a row of planted seedlings, counting the number of sample points (1 ft intervals) covered by vegetation, and dividing by the total number of sample points. Each transect estimate was based on 182 to 185 sample points per treatment plot. Species composition was obtained from the transect estimates. A simple linear regression was used to predict transect cover (difficult to obtain) by using the ocular estimate of cover (easy to obtain) at each location. Adjusted mean cover was obtained for each treatment. The standard error adjusted means were computed by combining the standard error of a predicted mean from the regression equation and the standard error of the mean from the analysis of variance on observed transect cover. Observed and adjusted means were compared by using Tukey's HSD with a 95% confidence level.

Graphical comparisons of observed transect and ocular estimates of cover revealed a tendency for the ocular estimates of cover to be biased. Cover was overestimated on sites with predominately broadleaved weeds and moderated levels of cover. In contrast, cover was underestimated on sites with grasses and low levels of cover. On all sites, the adjusted means more closely approximated the transect estimates. Statistical differences were more likely to be detected among treatments when using adjusted means than either observed ocular or transect estimates of herbaceous cover.

These preliminary results indicate that double sampling can be used to increase the accuracy and precision of estimated cover of herbaceous vegetation. However, additional research is needed to compare different sampling intensity and patterns of matched transect and ocular estimates of cover.

SECOND-YEAR RESULTS USING FOLIAR AND SOIL-ACTIVE HERBICIDES FOR BAMBOO CONTROL. L.R. Nelson; Department of Forestry and Natural Resources, Clemson University, Clemson, SC29634.

ABSTRACT

Herbicide trials on golden bamboo were installed using two protocols. Bamboo on the study site was drum-chopped and burned in winter of 2002. On 4/12/02 resprouts were treated with directed foliar sprays. Treatments included 2.5 % V/V glyphosate (isopropylamine salt-3 lb/gal) plus 3 % V/V imazapyr (isopropylamine salt-2lb/gal) plus 10% vegetable oil; 5% V/V glyphosate and 10 % V/V glyphosate. The 10 % rate of glyphosate was applied again to the same plots on 6/17/02. In the second protocol hexazinone (75% soluble granule) was applied on 4/30/02 in treatments of 2, 3 and 4 lb ai/ac. Evaluations were based on ocular estimates of percent control. At the end of the second season after application, the glyphosate plus imazapyr treatment provided 93% control followed by 58 and 27 % for the 10 and 5 % rates of glyphosate, respectively. The 2, 3 and 4 lb rates of hexazinone provided 90, 80 and 78% control, respectively.

IMPACT OF HERBICIDE AND FIRE ON LONGLEAF ECOSYSTEM RESTORATION.

T.R. Clason, USDA/NRCS, Louisiana State Office, Alexandria, LA 71302.

ABSTRACT

Longleaf pine ecosystem restoration resurrects the species composition, biological structure, and functional dynamics that characterize a longleaf forest. Since species composition influences both structure and dynamics of the system, establishing and maintaining the plant species matrix is the key to a successful restoration program. A longleaf pine ecosystem restoration research project was established at the Louisiana State University, Lee Memorial Forest, in Sheridan, Louisiana. Forest management practices that include longleaf pine reforestation methods, competing vegetation suppression and prescribed burning are being used to develop environmentally sound, cost-effective, conservation management systems for longleaf pine ecosystem restoration.

PROCEDURES

The study area was a 30-acre mature, mixed pine stand of longleaf, loblolly, slash, and shortleaf pine having an understory rich in species diversity. Overstory pine was stem mapped by species and size, and understory plants inventoried by composition and density. Growing season burns were applied to the entire stand in 1996 and 1997. A seed tree regeneration harvest in the fall of 1997 left a residual longleaf basal area of 30 ft^2/acre. Containerized longleaf pine seedlings were planted in January 1998 at 110 seedlings per acre.

Following the seed tree harvest, the study area was divided into 27 0.4-acre plots. Nine vegetation management treatments were replicated three times and randomly assigned within a complete block design. Treatments were factorial combinations of three burning frequencies, and three post-plant herbicide application methods, band, spot and untreated. Growing season burning regimes included 1) Annual burns from 1999 to 2004, 2) Biennial burns from 2000 to 2004, and 3) Triennial burns from 2001 to 2004. Post-plant herbicide treatments were applied in March 1998 using 8 oz hexazinone ai and 1.5 oz sulfometuron-methyl ai per treated acre.

RESULTS

Residual seed tree growth, containerized seedling survival and growth, natural regeneration establishment and understory plant development were monitored to determine treatment impact on the ecosystem. Containerized seedling survival during the first growing season differed among application methods. Spot treatment survival rate (70 percent) was significantly less than the strip and untreated treatments, which had similar survival rates (77 percent). First annual prescribed burn had no detectable impact on seedling survival but subsequent burns in 2000 and 2001 reduced seedling survival by 13, 15 and 18 percent for the annual, biennial and triennial burn treatments. After 4 years, 95 percent of the surviving seedling on all treatments had initiated height growth, averaging 60 seedlings per acre. Residual seed trees have not produced an adequate seed crop, so treatment impact on natural regeneration has not been evaluated. Understory plant matrix declined across all treatments reducing number of grass, forbs, and woody brush species by 40 percent, but no treatment impact was detected.

CARFENTRAZONE-ETHYL: A NEW HERBICIDE FOR INDUSTRIAL VEGETATION MANAGEMENT, FOREST MANAGEMENT AND AQUATIC WEED CONTROL. R.D. Iverson, R.M. Herrick and K.G. Watson, FMC Corporation, Philadelphia, PA.

ABSTRACT

QuickSilver™ IVM Herbicide is a new herbicide for vegetation management, approved by the Environmental Protection Agency (EPA) on March 4, 2003. The active ingredient, carfentrazone-ethyl, is an EPA "reduced risk" herbicide and is also registered for use in agronomic crops and turfgrass management. The product is a selective, contact herbicide effective against annual broadleaved weeds in a rate range of 1.0-2.0 fl oz/A (0.016-0.031 lbs ai/A). QuickSilver IVM Herbicide is a non-phenoxy herbicide, works fast on targeted weeds, has cool weather activity, is non-volatile, is rainfast within one hour, and does not harm native grass species.

Greenhouse and field trial data demonstrate that QuickSilver IVM Herbicide provides excellent control of species such as kochia (*Kochia scoparia*), Russian thistle (*Salsola kali*), field bindweed (*Convolvulus arvensis)*, pigweed (*Amaranthus spp.*), tall waterhemp (*Amaranthus* tuberculatos), prickly lettuce (*Lactuca serriola*), wild sunflower (*Helianthus* annuus), wild mustard (*Sinapsis* arvensis), and curly dock (*Rumex crispus*) when applied alone or as a tank mix partner. An active field trial program to evaluate QuickSilver IVM Herbicide against a broad spectrum of broadleaved weeds is underway throughout the country.

QuickSilver IVM Herbicide provides a new option for vegetation management and represents a new tool for weed resistance management programs.

INITIAL EFFECTS OF COMPLETE WEED CONTROL ON SURVIVAL AND GROWTH OF TWO BOTTOMLAND HARDWOOD SPECIES ESTABLISHED ON FORMER AGRICULTURAL FIELDS. M.E. Corbin[1], E.S. Gardiner[1] and D.F. Jacobs[2]. [1]USDA Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research, Stoneville, MS 38776 USA. [2]Purdue University, Department of Forestry and Natural Resources, West Lafayette, IN.

ABSTRACT

Green ash (*Fraxinus pennsylvanica*) and water oak (*Quercus nigra*) plantations were established on former agricultural fields in the Lower Mississippi Alluvial Valley of Arkansas, Louisiana, and Mississippi to determine nursery source and competition control effects on early survival and growth of seedlings. Seedlings were obtained from nurseries in Arkansas, Louisiana and Mississippi, while weed control treatments included complete weed control and no weed control. Green ash seedlings exhibited high survival averaging 94 % regardless of competition control, but survival was influenced by nursery source. Height and diameter growth of green ash was increased by competition control, but the magnitude of this response was determined by nursery source. First-year survival of water oak seedlings increased almost 10 % with competition control, and was also influenced by nursery source. Water oak seedlings exhibited a significant amount of shoot dieback resulting in negative growth where competition control was not practiced. The extent of water oak shoot dieback was also influenced by nursery source.

INTRODUCTION

Deforestation in the Lower Mississippi Alluvial Valley (LMAV) reduced the original bottomland hardwood forests from 9.8 million hectares (ha) to about 2.2 million ha by 1978. The primary cause of bottomland hardwood forest loss has been conversion to agricultural production. Approximately 96 % of the cleared land in the LMAV has been devoted to this purpose (1). Over the last decade, however, large acreage has been removed from agricultural production, and much of this land has been enrolled in governmental conservation programs that promote afforestation. The most popular conservation programs for afforestation in the LMAV are the Conservation Reserve Program and the Wetland Reserve Program, administered by the Farm Services Agency and the Natural Resource Conservation Service, respectively. For example, nearly 139,000 ha in the tri-state region of Louisiana, Arkansas and Mississippi were enrolled in the Wetland Reserve Program by 2001, and an additional 95,000 ha had qualified for future easements (3).

Because of the scale of current afforestation practices in the LMAV, it is imperative that we find ways to improve seedling field performance. Increasing early survival and growth in these hardwood plantations will ultimately reduce the rate of plantation failure and number of sites requiring replanting. Controlling herbaceous competition on these former agricultural fields is a silvicultural option that can potentially increase seedling survival and growth. Herbicide use for weed control in hardwood plantations has been well documented as a pre-emergent application, but there is not much information on post-emergent applications of herbicides in hardwood plantations. Most studies currently underway involve screening herbicides labeled for agricultural uses for potential in hardwood plantation applications (2). In addition to competition control, seedling field performance may be improved through cultural practices in the nursery that promote development of favorable seedling morphology. Morphological characteristics such as seedling size, root-shoot ratio, root volume, and number of lateral roots can be controlled or graded for at the nursery, and may correlate with early field performance (4).

Numerous bottomland hardwood species are planted on the range of sites receiving afforestation in the LMAV. Very little is known about the potential of the various bottomland hardwood species to respond to competition control on various site types. We established three plantations of green ash (*Fraxinus pennsylvanica*) seedlings and three plantations of water oak (*Quercus nigra*) seedlings in the LMAV with the objective of determining if weed control and nursery source influenced

survival and subsequent growth of seedlings. This paper reports initial survival, height and groundline diameter growth of these two bottomland hardwood species relative to competition control and nursery source.

METHODS

Study Sites

Three study sites were established on former agricultural fields of the LMAV in Arkansas, Louisiana and Mississippi. The Arkansas site is located approximately 21 km southwest of Eudora in Chicot County, the Louisiana site is located approximately 18 km east of Delhi in Madison Parish, and the Mississippi site is located approximately 8 km north of Rosedale in Bolivar County. Sites were selected based on availability of suitable soil types for the tree species of interest. At the Arkansas site, green ash was planted on a Perry clay (very-fine, smectitic, thermic Chromic Epiaquerts) while water oak was planted on a Robinsonville loam (coarse-loamy, mixed, superactive, nonacidic, thermic Typic Udifluvents). At the Louisiana site, green ash was planted on a Sharkey clay (very-fine, smectitic, thermic Chromic Epiaquerts) while water oak was planted on a Dundee loam (fine-silty, mixed, active, thermic Typic Endoaqualfs). At the Mississippi site, green ash was planted on a Sharkey clay (very-fine, smectitic, thermic Chromic Epiaquerts) and water oak was planted on a Commerce silt loam (fine-silty, mixed, superactive, nonacid, thermic Fluvaquentic Endoaquepts) (5).

Experimental Design

Prior to planting, a grid was established on all sites according to a randomized block design with three blocks and six plots per block. Blocks were generally established along topographical contours. Treatment plots consisted of five rows with ten planting spots in each row established on a 1.8 m x 1.8 m spacing (total of 50 seedlings). A 1.8-m buffer strip was established around each plot. The six plots in each block were randomly assigned competition control and nursery source treatment combinations. Two levels of competition control were complete weed control and no weed control, and three levels of nursery source were as described below.

For the complete weed control treatment level, a pre-emergent broadcast application of Goal 2XL (oxyfluorfen) was applied at a rate of 4677 ml/ha (64 oz/acre) in early March 2003. Broadcast applications of Select 2EC (clethodim) were applied as needed throughout the growing season at a rate of 585 ml/ha or 877 ml/ha (8 oz/acre or 12 oz/acre) depending on target weed species. Additionally, directed applications of Derringer (glufosinate-ammonium) were applied at a rate of 118 ml/l (4 oz/gal.) of water as needed throughout the growing season.

The 1-0 bareroot seedlings were lifted from three different nurseries the last week of January 2003. Contributing nurseries were the Columbia Nursery in Columbia, LA, Winona Nursery in Winona, MS and AFC Baucum Nursery in North Little Rock, AR. For reporting purposes, nurseries were assigned an anonymous letter designation. All sites were hand planted using hardwood planting shovels. The Mississippi site was planted on February 18 and 19, 2003, while the Arkansas and Louisiana sites were planted on February 26, 2003.

Sampling and Statistical Analysis

Initial height (cm) and groundline diameter (mm) were measured on all seedlings in early March 2003. These same variables were re-measured after the first growing season in December 2003. In October 2003, herbaceous biomass was sampled on each site by clipping 2, 1-m square plots randomly placed in each treatment plot. Biomass samples were dried to a constant temperature, weighed, and data were converted to kg/ha for this report.

Treatment effects on plot means for seedling survival, initial and first-year height, initial and first-year groundline diameter, relative height growth and relative groundline diameter growth were analyzed with analysis of variance using the GLM procedure of SAS software. Means of significant treatment effects were separated with Duncan's New Multiple Range test. All tests were conducted at the $\alpha = 0.05$ level. Because green ash and water oak were established on each site as independent experiments, a separate analysis was conducted for each species.

RESULTS AND DISCUSSION

Biomass

Major competitors present on the study sites included: marestail (*Conyza canadensis*), Johnsongrass (*Sorghum halepense*), ryegrass (*Lolium spp.*), redvine (*Brunnichia ovata*), maypop (*Passiflora incarnate*), trumpet creeper (*Campsis radicans*) and peppervine (*Ampelopsis arborea*). Where competing vegetation was not kept in check with herbicides, development during the first growing season ranged from 4820 to 1362 kg/ha across all sites. Our efforts to control all competing vegetation substantially reduced the development of vegetative biomass on all sites (Table 1). For the green ash sites, competing biomass in treated plots was maintained at less than 5 % of the biomass that developed in control plots. Biomass in water oak plots receiving weed control was maintained at a level less than 3 % relative to biomass in plots that did not receive weed control (Table 1).

Green Ash

Survival

Green ash survived well on all sites showing only 6 % mortality during the first growing season regardless of competition control (Table 2). First year survival of green ash was effected by nursery source with seedlings from nurseries A and B showing greater survival than seedlings from nursery C. Green ash seedlings produced in nursery C exhibited 13.7 % mortality compared to the 1.5 % mortality exhibited by seedlings from nursery A and B.

Nursery effect on growth

As expected, initial height and initial groundline diameter of green ash seedlings varied according to nursery source. Seedlings from nursery C were the largest seedlings averaging 70.5 ± 0.8 cm tall with a 7.5 ± 0.12 mm groundline diameter. Seedlings produced in nursery B had an initial height of 43.3 ± 0.9 cm and an initial groundline diameter of 6.5 ± 0.12 mm. After one growing season, initial differences in seedling height had diminished and seedlings from each nursery shared a similar height (107 ± 8.3 cm) and groundline diameter (19 ± 2.0 mm).

Competition control effect on growth

Initial seedling heights and groundline diameters were not influenced by an assigned competition control treatment. After the first year of treatment, seedlings receiving weed control showed consistently taller heights averaging 138.0 ± 2.9 cm versus 76 ± 3.3 cm for seedlings that did not receive weed control. A similar trend was observed for groundline diameter with seedlings receiving weed control having a mean diameter of 27.8 ± 0.45 mm and control seedlings having a groundline diameter of 11.8 ± 0.58 mm.

Relative height growth and relative diameter growth of green ash seedlings were influenced by the treatment interaction of nursery source and weed control (Table 2). In general, seedlings receiving weed control showed more relative growth than seedlings that did not receive weed control. However, seedlings from nursery B responded to weed control relatively more than seedlings from the other nurseries with a 285 % increase in height and a 445 % increase in groundline diameter

during the first growing season (Table 2). Relative height (101 %) and groundline diameter (303 %) growth of seedlings from nursery C responded the least to the weed control treatment (Table 2). Relative height growth of seedlings that did not receive competition control ranged from 101 % for nursery B to 25 % for nurseries A and C, while relative diameter growth ranged from 120 % for nursery B to 57 % for nursery C (Table 2).

Water Oak

Survival

Nursery source and competition control treatments influenced water oak seedling survival during the first growing season. Seedlings produced in nursery B showed the least mortality averaging 83 % survival across all sites. Seedlings from nurseries A and C shared a similar mortality rate with an average survival nearly 10 % lower than seedlings from nursery B. Competition reduced survival of water oak seedlings to 72 % across all sites, while seedlings that received weed control showed 83 % survival (Table 3).

Nursery effect on growth

The initial size of water oak seedlings varied according to nursery source (Table 3). Seedlings grown at nursery C were 13 cm taller and had a groundline diameter 2 mm larger than seedlings grown at nursery A. Seedlings produced at nursery B were intermediate in height and groundline diameter to those produced at the other nurseries (Table 3). During the first growing season, seedlings produced at nursery C lost their initial advantage in height. Tallest seedlings following the first growing season were those produced at nursery B, while seedlings produced at nursery A remained the shortest and had the smallest groundline diameters (Table 3). Nursery source also influenced relative height growth, with seedlings from nursery B being the only seedlings to to show a positive growth rate (11.1 %). Seedlings from nurseries A and C experienced excessive top-die-back resulting in a more than –15 % decrease in height.

Competition control effect on growth

Initial height and groundline diameter of water oak seedlings were not influenced by assigned competition control treatments (Table 3). One year of competition control increased mean heights 27 % and groundline diameters 47 % relative to seedlings that did not receive competition control. Relative height growth of water oak seedlings was also improved with competition control. Seedlings established in weed-free plots showed a relative height growth of 6 % during the first growing season, while seedling that did not receive weed control experienced a 19 % reduction in their initial height (Table 3).

Nursery source and competition control treatment interacted to determine relative groundline diameter growth of water oak seedlings (Table 3). Seedlings from all nurseries receiving weed control exhibited higher relative groundline diameter growth than seedlings that did not receive weed control. Water oak seedlings produced in nursery B showed the greatest response to weed control (114 %), while seedling produced in nursery C showed the smallest response to weed control (53 %) (Table 3).

CONCLUSIONS

Over the past decade, bottomland hardwood plantations have been established on several thousand ha of former agricultural land in the LMAV. In spite of the tremendous number of seedlings that have been planted over the last decade, quality standards for hardwood seedlings do not exist, and very little is known about post-planting cultural practices to increase survival and growth. Initial findings of this study indicate that nursery source strongly influenced survival and growth of both green ash and water oak seedlings. Competition control did not impact survival of green ash, but

did improve survival of water oak. Interestingly, height and diameter growth of green ash seedlings responded to competition control relative to nursery source. Shoot dieback was prevalent in the water oak plantations we established, but this was largely determined by nursery source and competition control. Initial results of this research warrants further investigation into the roles of nursery cultural practices and competition control on field performance of hardwood seedlings established on former agricultural land in the LMAV. Future research should be directed towards identifying morphological characteristics of seedlings that are linked to field performance.

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Table 1. Development of vegetative biomass in hardwood plantations established on former agricultural fields in the LMAV. Data are presented as means ± standard error for kg/hectare.

	LOUISIANA		*ARKANASAS*		*MISSISSIPPI*	
	Weed Control	No Weed Control	Weed Control	No Weed Control	Weed Control	No Weed Control
Green Ash	181 ± 22 b	4820 ± 3496 a	24 ± 2 b	2481 ± 558 a	287 ± 26 b	2759 ± 274 a
Water Oak	66 ± 2 b	3488 ± 134 a	19 ± 4 b	1515 ± 429 a	105 ± 29 b	1362 ± 232 a

For a site, treatment means within a row sharing the same letter are not significantly different.

Table 2. Mean green ash survival, height and groundline diameter growth in plantations established on former agricultural fields in the LMAV. Data are presented by nursery source and weed control treatment as means ± standard error.

	Nursery A		*Nursery B*		*Nursery C*	
	Weed Control	No Weed Control	Weed Control	No Weed Control	Weed Control	No Weed Control
Survival[1]	98.2 ± .007 a	97.3 ± .011 a	99.5 ± .002 a	99.1 ± .004 a	86.8 ± .025 a	85.7 ± .032 a
Initial Height	58.6 ± 0.78 a	58.1 ± 0.61 a	42.8 ± 1.50 a	43.7 ± 1.06 a	71.4 ± 0.98 a	69.4 ± 1.26 a
Initial GLD	6.5 ± 0.09 a	6.8 ± 0.13 a	6.3 ± 0.19 a	6.5 ± 0.14 a	7.7 ± 0.14 a	7.3 ± 0.18 a
1st Year Height	138.4 ± 5.09 a	79.6 ± 5.23 b	142.4 ± 5.69 a	77.9 ± 6.84 b	133.2 ± 4.31 a	70.7 ± 4.88 b
1st Year GLD	26.4 ± .067 a	11.9 ± 0.90 b	30.0 ± 0.69 a	13.0 ± 1.16 b	26.9 ± 0.41 a	10.5 ± 0.84 b
Relative Height Growth	147.2 ± 0.10 b	40.6 ± 0.10 d	285.5 ± 0.15 a	101.0 ± 0.17 c	101.2 ± 0.08 c	9.1 ± 0.07 d
Relative GLD Growth	346.0 ± 0.15 b	87.6 ± 0.16 de	445.5 ± 0.15 a	120.1 ± 0.19 d	303.3 ± 0.12 c	57.5 ± 0.12 e

[1]Survival, relative height growth and relative groundline diameter growth is expressed as %, height is cm, groundline diameter is mm. Because of interaction, treatment means for relative height growth and relative diameter growth are compared across the entire row. All other means can be compared between competition control treatments for a nursery source.

Table 3. Mean water oak survival, height and groundline diameter growth in plantations established on former agricultural fields in the LMAV. Data are presented by nursery source and weed control treatment as means ± standard error.

	Nursery A		*Nursery B*		*Nursery C*	
	Weed Control	No Weed Control	Weed Control	No Weed Control	Weed Control	No Weed Control
Survival[1]	80.4 ± 0.03 a	65.3 ± 0.05 b	88.2 ± 0.02 a	78.0 ± 0.04 b	80.8 ± 0.04 a	74.0 ± 0.05 a
Initial Height	47.5 ± 0.53 a	47.5 ± 0.57 a	49.2 ± 0.42 a	49.5 ± 0.60 a	60.0 ± 1.03 a	60.7 ± 0.87 a
Initial GLD	4.0 ± 0.08 a	4.1 ± 0.08 a	4.7 ± 0.08 a	4.8 ± 0.11 a	6.1 ± 0.10 a	6.1 ± 0.12 a
Final Height	46.1 ± 3.54 a	34.9 ± 1.75 b	61.4 ± 4.00 a	47.0 ± 2.32 b	51.7 ± 4.85 a	42.6 ± 3.32 b
Final GLD	7.3 ± 0.50 a	4.7 ± 0.13 b	9.6 ± 0.52 a	5.9 ± 0.22 b	8.3 ± 0.56 a	6.4 ± 0.24 b
Relative Height Growth	2.0 ± 0.06 a	-26.6 ± 0.03 b	27.2 ± 0.08 a	-5.0 ± 0.04 b	-10.0 ± 0.07 a	-27.0 ± 0.04 b
Relative GLD Growth	90.8 ± 0.11b	13.7 ± 0.03 d	114.5 ± 0.13 a	27.0 ± 0.02 d	53.2 ± 0.11 e	9.9 ± 0.03 d

[1]Survival, relative height growth and relative groundline diameter growth is expressed as % height is cm, groundline diameter is mm. Because of interaction, treatment means for relative diameter growth are compared across the entire row. All other means can be compared between competition control treatments for a nursery source.

WHITE-TAILED DEER FORAGE PRODUCTION IN MANAGED PINE STANDS AND SUMMER FOOD PLOTS IN MISSISSIPPI. S.L. Edwards[1], S. Demarais[1], B. Watkins[2], and B.K. Strickland[1]. [1]Department of Wildlife and Fisheries, Mississippi State University, [2] BASF Corporation.

ABSTRACT

Nutritional habitat quality in Southeastern forests often is limited by a dense midstory and litter layer impeding the growth of high quality, shade-intolerant forage species. Management actions often are designed to improve the quality of natural forages and to supplement the natural forage base with food plots. A treatment including the selective herbicide ARSENAL® Applicators Concentrate, controlled burning, and fertilizer was applied to naturally regenerated, mature loblolly pine (*Pinus taeda*) stands in Mississippi during 1998-1999 to improve the natural forage base for white-tailed deer (*Odocoileus virginianus*). We compared the nutritional quality and abundance of selected forages produced in treated (n = 4) and untreated (n = 4) areas during years 2 and 3 post-treatment. We also measured quality and abundance of cowpeas (*Vigna unguiculata*) produced in food plots (n = 4). Treated pine stands produced 387 lbs/ac of forage biomass and 30 lbs/ac of digestible protein compared to untreated pine stands which produced 106 lbs/ac of forage biomass and 6 lbs/ac of digestible protein. Cowpea food plots produced 485 lbs/ac of forage biomass and 98 lbs/ac of digestible protein. Extrapolated over a 10-year economic planning horizon, the average annual cost of producing digestible protein was $0.38/lb for treated pine stands compared to $1.09/lb for cowpea food plots. Due to the cost-effective production of quality natural deer forages, this timber management regime referred to as "Quality Vegetation Management" can be used in conjunction with traditional food plots as a habitat management tool to improve nutritional habitat quality.

SECTION VI. VEGETATION MANAGEMENT IN UTILITIES, RAILROADS & HIGHWAY RIGHTS-OF-WAY; INDUSTRIAL SITES

EXPERIENCES WITH WILDFLOWER ESTABLISHMENT ALONG RIGHTS-OF- WAY USING ACTIVATED CHARCOAL AND RESIDUAL HERBICIDES. S.R. King, E.S. Hagood, Jr., P.L. Hipkins, and H.L. Witt; Dept. of Plant Pathology, Physiology and Weed Science, VPI&SU, Blacksburg.

ABSTRACT

Weed control in wildflower plantings on highway rights-of-way in Virginia in previous years has not been satisfactory with a number of preemergence (PRE) herbicides. Those that controlled weeds best also tended to reduce wildflower stands. Twelve replicated trials were established at various locations during 2002 and 2003 to evaluate how well a charcoal slurry protects wildflowers seeds from several herbicides. Wildflower species evaluated included: cosmos (*Cosmos bipinnatus*), ox-eye daisy (*Chrysanthemum leucanthemum*), wallflower (*Cheiranthus allionii*), poppy (*Papaver rhoeas*), dame's rocket (*Hesperia matronalis*), and tickseed *(Coreopsis lanceolata*). Wildflowers were seeded at rates ranging from 7 to 11 lb/A with a Tye® no-till drill. A spray tank for the charcoal slurry was mounted on the drill. Nine 8008 flatfan nozzles were mounted behind the press-wheels of the drill and adjusted to a height and angle to spray a 1.5-inch band of charcoal over each row. Charcoal was applied at 75 lb/A in 150 GPA of water at the same time the wildflower seeds were planted. Herbicide treatments included: diuron at 0.25 to 4 lb ai/A, pendimethalin and prodiamine each at 0.25 to 2.0 lb ai/A, imazapic at 0.25 oz ai/A, and isoxaben at 0.125 lb ai/A. Glyphosate at 2 and 4 lbs ai/A was applied alone in some experiments, in combination with PRE herbicides, or for site preparation at some locations. Herbicide applications were made using a CO_2 backpack sprayer delivering 30 GPA. Each trial was arranged in a randomized complete block design with three replications. Drought, misapplication of charcoal, and planting difficulties resulted in poor stands and limited success of wildflower establishment in 2002. In 2003, modification of equipment and planting practices resulted in greater success establishing stands of wildflowers. Excellent stands of cosmos were achieved at several locations seeded in late-April through mid-May 2003. PRE herbicides did not cause reductions in stands at these locations. An assortment of broadleaf weeds and annual grasses that are deleterious for wildflower establishment were controlled with some of these treatments. Among those were yellow woodsorrell (*Oxalis stricta*), dandelion (*Taraxacum officinale*), large crabgrass (*Digitaria sanguinalis*), and giant foxtail (*Setaria faberi*). Diuron applied at lower rates tended to be weaker than other treatments on henbit (*Lamium amplexicaule*) and common chickweed (*Stellaria media*). Effective control of curly dock (*Rumex crispus*) and wild garlic (*Allium vineale*) was not achieved with any of the treatments.

ROADSIDE WEED CONTROL WITH FLAZASULFURON. D.P. Montgomery, D.L. Martin, and L.M. Cargill; Horticulture and Landscape Architecture Department, Oklahoma State University, Stillwater, OK 74078.

ABSTRACT

Three roadside weed control trials were conducted during 2002 and 2003 to evaluate flazasulfuron for its effectiveness in controlling both winter and summer weed species. Treatments of flazasulfuron at 1.5, 2.25, and 3.0 oz. prod. /A alone, and when combined with Roundup Pro at 1 pt. prod. /A were applied in May of 2002 to evaluate their effectiveness in controlling johnsongrass (Sorghum halapense). In a similar study these same treatments were applied in November 2002 to young downy brome (Bromus Tectorum) and hairy vetch (Vicia villosa) to determine efficacy. In 2003 flazasulfuron at 3.0 and 6.0 oz. prod. /A alone, and when combined with either MSMA at 2 qts. prod. /A or Roundup Pro at 1 pt. prod. /A were applied in early June to marestail (Conyza candadensis) and Illinois bundleflower (Desmanthus illinoensis). All treatments of flazasulfuron alone included a non-ionic surfactant at a rate of 0.25% V/V. In each of these studies treatments were applied to 5 by 15 foot plots using a CO2 powered boom sprayer calibrated to deliver 20 gallons of spray solution per acre. Treatments were replicated 3 times in each study in a randomized complete block design. Visual weed control ratings were taken on one month intervals following applications. Ratings were collected on weed efficacy and bermudagrass injury and/or green-up delay.

Flazasulfuron applied alone did not provide acceptable control of johnsongrass. However, when the 3.0 oz. prod./A rate was combined with Roundup Pro 83% control of johnsongrass was achieved and maintained through 2 and 3 MAT evaluations. This would be acceptable control for current roadside programs and was similar to the standard treatment of Outrider at 1.0 oz. prod./A plus Roundup Pro at 1 pt. prod./A. Very little bermudagrass injury was produced from any flazasulfuron treatments.

Flazasulfuron at 3 oz. prod. /A applied alone in the fall to young downy brome plants produced 83% control at 6 MAT evaluations. Control dropped to moderate and unacceptable levels at lower rates. The addition of Roundup Pro at 1 pt. prod. /A increased downy brome control to 98% the following spring. All treatments of flazasulfuron alone, or combined with Roundup Pro, produced excellent control of hairy vetch. Hairy vetch control at 6 MAT evaluations ranged from 93 to 100%. No treatments produced any bermudagrass injury or green-up delay in this study.

Flazasulfuron at 3.0 or 6.0 oz. prod. /A applied alone or combined with MSMA or Roundup Pro produced excellent control of marestail at 2 and 3 MAT evaluations. Control ranged from 92 to 100%. However, only moderate control of the perennial broadleaf Illinois bundleflower was achieved from flazasulfuron alone. The addition of MSMA or Roundup Pro significantly increased control of Illinois bundleflower at both 2 and 3 MAT evaluations. Illinois bundleflower control with flazasulfuron at 3 oz. prod. /A with the addition of MSMA or Roundup Pro was acceptable at 85 to 88%. Slight temporary bermudagrass injury was produced by all treatments but was acceptable for roadsides. Bermudagrass chlorosis ranged from 5 to 18% and persisted up to 1 MAT.

YEAR LONG CONTROL OF BROADLEAF WEEDS ALONG MISSISSIPPI HIGHWAY RIGHTS-OF-WAY. R.S. Wright, J.D. Byrd, and J.M. Taylor. Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Three experiments were conducted to evaluate broadleaf weed control along Mississippi highway rights-of-way. Applications were made using a CO_2 backpack sprayer calibrated to deliver 25 GPA. All treatments that required surfactant were applied with an 80/20 non-ionic surfactant at 0.25% V/V, except Outrider treatments which require 0.5% V/V. Visual control ratings were made with a scale from 0 to 90%.

Experiment 1 was initiated November 25, 2002, with treatments as follows: 1.0 lb ae/A 2, 4-D amine, 4, 8, or 16 fl oz/A Vanquish 4L, 4 or 6 oz/A Overdrive 70 WG, 3.125 lb/A Karmex 80 DF, 0.5 oz/A Escort 60 DF, 0.5 oz/A Telar 75 DF, or 8 fl oz/A Plateau 2L applied alone and tank-mixed with 1.0 oz/A Oust 75 DF, and 1.0 oz/A Oust applied alone. All treatments provided 80 to 90% control of sow-thistle, except 4 fl oz/A Vanquish, 3.125 lb/A Karmex, or 8 fl oz Plateau when evaluated in March or April. Vanquish at 4, 8, or 16 fl oz/A or 4 oz/A Overdrive alone provided significantly less Carolina geranium control compared to Oust, 2,4-D, Karmex or Telar when evaluated in March. Oust, Telar, or Escort provided excellent control of wild carrot when evaluated as late as May.

Experiment 2 was initiated March 10, 2003, with treatments as follows: 1 or 2 oz/A Landmark II, 1.5 oz/A Landmark, 0.75 or 1.0 oz/A Oust 75 DF, 0.25, 0.33, or 0.50 oz/A Telar 75 DF. All rates of Oust and Telar were tank-mixed with 16 fl oz/A Dupont Glyphosate 4L as separate treatments. Carolina geranium control was 38% when treated with 0.75 or 1.0 oz/A Oust 60 DAT. A rate response was observed with 0.25, 0.33 or 0.5 oz/A Telar for control of Carolina geranium, which ranged from 60 to 88% 60 DAT. Wild carrot was controlled 85 to 90% with 0.75 or 1.0 oz/A Oust, or 0.25, 0.33, or 0.5 oz/A Telar tank-mixed with Dupont Glyphosate 30 DAT.

A third experiment was initiated June 17, 2003, with hemp dogbane the target weed. The treatments were as follows: 16 fl oz/A Roundup Pro, 2.2 qt/A MSMA 6.0 L, 21 or 43 fl oz/A Garlon 3A, 4 or 8 fl oz/A Vanquish 4 L, 6 or 8 oz/A Overdrive 70 WG, 8 or 12 fl oz/A Plateau 2 L, 1.0 or 2.0 oz/A Oust 75 DF, 1.33 oz/A Outrider 75 DF, 0.5 or 1.0 oz/A Telar 75 DF. Garlon 3A at 21 or 43 fl oz/A provided 65 or 68% control of hemp dogbane 29 DAT, respectively. When evaluations were made 59 DAT, hemp dogbane control was reduced 20 or 13% with either rate of Garlon 3A, respectively. Telar at 1.0 oz/A or Vanquish at 8 fl oz/A provided 63 or 65% control of hemp dogbane 59 DAT.

BAMBOO CONTROL WITH HERBICIDES. M. Czarnota[1], F. Linton[2], M. Linton[2], D. Linvill[3]
[1]University of Georgia, Department of Horticulture, 1109 Experiment Street, Griffin GA, 30223 [2]University of Georgia, Bamboo Farm & Coastal Gardens, #2 Canebrake Road, Savannah, GA 31419 [3]University of Georgia, Cooperative Extension Service, P. O. Box 9866, Savannah, GA 31412.

ABSTRACT

As well as having many construction and industrial use, bamboo can be a beautiful addition to any garden. However, when it is growing in an area were it is not wanted, it can be extremely difficult to eradicate. Homeowners, landscapers, and vegetation management officials often face situations were they are required to eliminate a stand of bamboo. Many opinions exist on herbicide mixtures used to control bamboo; unfortunately, these are backed with little scientific evidence. In 2002, a study was initiated to determine the degree of control provided by a single application of selected herbicides. Herbicides in the experiment included Casoron (dichlobenil), Roundup (glyphosate), and Arsenal (imazapyr). At 58 WAT, glyphosate treated plots were providing about 80% control of bamboo, while imazapyr provided nearly complete control of the bamboo (99%). Dry weight of the bamboo shoots collected at the 58 WAT rating modeled the control ratings. Dichlobenil provided no visible control of the bamboo during the duration of the test. Glyphosate did not provide complete control of the bamboo with one application. Repeat applications of glyphosate, in combination with mowing, would probably control this bamboo. Imazapyr provided nearly complete control of bamboo with one application. Unfortunately, the 1.5 lb ai/A rate is extremely high, and could cause severe injury to surrounding plant material. Carryover could also be a major concern, particularly in higher pH soil.

SECTION VII. PHYSIOLOGICAL AND BIOLOGICAL ASPECTS OF WEED CONTROL

SUPPRESSING WEEDS DURING SUMMER FALLOW WITH LEGUMINOUS COVER CROPS. A.S. Collins, C.A. Chase, W.M. Stall, and C.M. Hutchinson, Horticultural Sciences Department University of Florida, Gainesville, FL.

ABSTRACT

The utilization of cover crops is becoming an important component of sustainable agriculture and organic vegetable production systems. Some advantages of using cover crops during the summer fallow period include: weed suppression, soil erosion protection, and contribution of soil organic matter. The cover crops in this study are also legumes, which give the added benefit of enhancing soil nitrogen and they have also been shown to be nematode suppressive. The objectives of these studies were to evaluate three cover crops (*Vigna unguiculata cv.* Iron and Clay*)*, sunn hemp (*Crotalaria juncea*) and velvetbean (*Mucuna deeringiana)* to determine which will be the most competitive with the weed species and to determine the lowest planting density for optimal weed suppression in the field. Smooth amaranth (*Amaranthus hybridus*) and yellow nutsedge (*Cyperus esculentus*) were used as representative weed species for the replacement series experiments because they are commonly found in vegetable fields. When competitiveness of the cover crops was evaluated with yellow nutsedge in spring 2003, they were less competitive than the weed. These trends were unlike our previously reported results when the experiment was performed in the summer. However, in spring 2003 cooler greenhouse temperatures may have been less favorable to cover crop growth than yellow nutsedge. In studies with smooth amaranth in summer 2003 cowpea was more competitive than the smooth amaranth, sunn hemp was less competitive and velvetbean was equally competitive. However, in spring 2003 the trends were similar to the spring nutsedge experiment. An additive field experiment was also performed with a constant density of 15 smooth amaranth plants/m² and the three cover crops planted at 5 densities ranging from 0-50 for cowpea and velvetbean and up to 100 plants/m² for sunn hemp. Cowpea resulted in the greatest suppression of smooth amaranth at a density between 30 and 40 plants/m². There was a quadratic increase in sunn hemp biomass with increasing density and a concomitant quadratic decrease in smooth amaranth density. There was a linear increase in velvetbean biomass and an accompanying linear decline in smooth amaranth such that minimum smooth amaranth dry mass occurred at the maximum velvetbean density.

NEW STRATEGIES FOR DISCOVERY OF HERBICIDE MODES OF ACTION. S.O. Duke, F.E. Dayan, I.A. Kagan, and S.R. Baerson, Natural Products Utilization Research Unit, USDA, Agricultural Research Service, P.O. Box 8048, University, Mississippi.

ABSTRACT

New methodologies and technologies promise to reduce the time and effort needed to discover herbicide modes of action and molecular target sites. Using DNA microarray technology for transcriptional profiling is a potentially effective means for elucidating new modes of action. Theoretically, specific patterns of up- and down-regulated genes might be associated with particular molecular target sites. This could allow the researcher to quickly determine if a new phytotoxin induces a particular transcriptional pattern associated with a target site from a gene transcription library of profiles of compounds with known modes of action. If the results do not fit one of these profiles, the phytotoxin may target a new molecular site, and its effects on gene transcription could provide clues as to what that target is. In addition to genes specifically associated with the molecular target site, stress-related and detoxification-associated genes are likely to be found associated non-specifically in response to exposure to toxic xenobiotics. Separation of target site-specific effects on transcription from effects of these less specific, general toxicant-related genes will simplify this potentially very complicated tool. We are in the early stages of building gene expression profile libraries for both fungicides and herbicides, using whole genome DNA microarrays for effects of on *Saccharomyces cerevisiae* and *Arabidopsis thaliana*, respectively. Examples of results from each study will be discussed.

PHENOTYPIC AND GENETIC CHARACTERIZATION OF HERBICIDE-RESISTANT BIOTYPES OF BARNYARDGRASS. M.S. Malik, R.E. Talbert, N.R. Burgos, S.N. Rajguru, B.V. Ottis, and E.F. Scherder; Department of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR-72701.

ABSTRACT

Barnyardgrass *(Echinochloa crus-galli)* biotypes, resistant to different herbicides, have been reported. An experiment was conducted to compare the growth characteristics of various barnyardgrass biotypes: propanil-resistant (PR), quinclorac-resistant (QR), quinclorac/propanil-resistant (Q/PR), and susceptible (S) barnyardgrass, with the rice cultivar 'Wells' in a non-competitive environment at Stuttgart, AR in 2002 and 2003. Seeds were planted in the greenhouse and 28 seedlings of each biotype and rice were transplanted into separate plots at 1 m spacing. The top growth of four plants were harvested weekly and growth characteristics including height, number of tillers, leaf area and dry weights were recorded at 3 to 10 weeks after emergence. The experimental design was split-plot with biotype as main plot and harvest date as subplot. The QR barnyardgrass from LA had a prostrate growth habit as compared to other barnyardgrass biotypes from AR. QR biotype was also taller than the others with an average height of 120 cm, average height of AR biotypes was 97 cm, while rice was 74 cm tall. Q/PR barnyardgrass had the most profuse growth as it produced 4 times more tillers (230) than rice (60). Also Q/PR biotype had a maximum leaf area of 11200 cm^2/plant and dry weight of about 966 g/plant, 10 weeks after emergence. Crop Growth Rate (CGR) for barnyardgrass biotypes (6 $g/m^2/d$), was about 3 times more than rice (2 $g/m^2/d$) in both years.

Molecular characterization of these biotypes was also done by using Amplified Fragment Length Polymorphism (AFLP) DNA fingerprinting technique. Barnyardgrass biotypes were selfed for two generations. Sixty-four EcoR1 and Mse1 primer pairs were tested using DNA from selfed (S2) plants. Four primer pairs E-AAG/ M-CTG, E-AAC /M-CTT, E-ACC /M-CAC, E-ACG/ M-CTC showed genetic polymorphism between biotypes. Polymorphic markers ranged in size from 150 to 600 base pairs. The QR barnyardgrass was genetically different from S, PR, and Q/PR biotypes. Reciprocal crosses between QR and S biotype will determine if any of these markers are linked to quinclorac resistance. Further tests are needed to find polymorphic markers to distinguish S, PR, and Q/PR biotypes.

DISTANCE OF GENE MOVEMENT FROM CLEARFIELD® RICE TO RED RICE. N.R. Burgos, V.K. Shivrain, O.C. Sparks, M.M. Anders, S.N. Rajguru, E.N. Stiers, and J.W. Moore; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72704.

ABSTRACT

Rice and red rice are genetically compatible. Although primarily self-pollinating, low levels of hybridization between the two plant types occur in nature. In this era of genetic transformations of crops to achieve desirable traits, it behooves us to gain more understanding of the nature and possible consequences of genetic introgression between crops and weedy relatives. The herbicide-resistant Clearfield® rice obtained favorable reviews for red rice control and crop yield in 2003. The sustainability of this technology depends on how well we manage the introgression of herbicide resistance into red rice populations.

Studies were conducted at the Rice Research and Extension Center (RREC) in 2002 and 2003 to determine the effect of distance from pollen source on the frequency of detected red rice hybrids. A central population combination (CPC) design was used where circular plots, 20-m diameter, were established in separate bays in three replications. At the center of each plot, 10-m diameter, Clearfield® rice (CL121 or CL161) was planted at 112 kg/ha seeding rate. Red rice (Stuttgart strawhull) was allowed to grow in the outer circle at 20 to 30 plants/m^2. The experiment was conducted twice (April 25, 2002 and May 21, 2002). After heading, Clearfield rice was removed from the plots. Red rice panicles were collected at 0, 0.5, 1, 2, 3, 4, and 5 m from the edge of the inner circle. The remaining seeds were allowed to shatter naturally and the plots were left undisturbed during the winter. In 2003, volunteer red rice was sprayed three times with Newpath®, 0.07 kg ai/ha. Red rice survivors were recorded and hybridization was confirmed using molecular markers generated by a simple sequence repeat (SSR) primer. Leaf tissues were collected from the survivors. DNA-fingerprints were generated using SSR primer RM 180, and compared to those of strawhull red rice and Clearfield® rice. Screening of hand-collected red rice seed is still ongoing.

Screening volunteer red rice for Newpath® resistance showed that more hybrids were produced within 0 to 0.5 m from Clearfield® rice than farther distances. Beyond this point, few hybrids were detected and they occur at random distances. The farthest distance of confirmed hybrid was 7.8 m from the pollen source. Although red rice was only maintained within 5 m from Clearfield® rice in 2002, natural population of red rice existed between bays. Wind direction did not impact the distribution of red rice hybrids in the field. Overall, CL161 produced twice as much hybrids as CL121 regardless of planting date. More red rice hybrids were detected in the late- than in early-planted trial. Outcrossing rate for the whole study area was 0.01 to 0.02% for CL161 and 0.005 to 0.008% for CL121. At 0 distance, outcrossing was 0.03 to 0.07% for CL161 and 0.007 to 0.016% for CL121. Other studies involving *Oryza rufipogon* and rice reported up to 40-m distance of pollen flow. The same may happen in red rice fields, but for now our data indicates that gene flow from Clearfield® rice to red rice can occur within 10 m.[1]

[1] This research was funded by the Arkansas Rice Research Promotion Board and BASF Co.

PHENOTYPIC AND GENETIC DIVERSITY OF RED RICE (ORYZA SATIVA L.) IN ARKANSAS. V.K. Shivrain, N.R. Burgos, K.A.K. Moldenhauer, D.R. Gealy, and E.E. Gbur; Crop Soil and Environmental Sciences, University of Arkansas, Ar 72701.

ABSTRACT

Red rice (*Oryza sativa* L.) and rice (O. *sativa*) belong to the same genus and species. It is the most troublesome weed in rice growing areas of southern U.S. due to its competitiveness, propensity to lodge, and red seed color which contaminates rice grain. Strawhull and blackhull are two major types of red rice, the former being more abundant than the latter. A study was conducted at the Rice Research and Extension Center (RREC), Stuttgart, AR, in 2003 to determine the phenotypic and genetic variability of red rice. One hundred thirty six red rice accessions were collected from 26 rice-growing counties of Arkansas in summer 2002. The collection site of each accession was separated by at least 5 miles and GPS coordinates were recorded. Each accession was composed of one plant, the seed of which was collected for characterization studies. Arkansas was divided into four regions, northeast (NE), centraleast (CE), central (C), and southeast (SE). Four accessions representing distinct phenotypes were used to identify natural variation in the ALS (Acetolactate synthase) gene. This information may enable us to correlate genetic variability to the weeds propensity to develop herbicide-resistant population in response to selection pressure.

Accessions were planted in the greenhouse on April 20th and transplanted to the field on May 12th. Plants were grown in non-competitive condition. Data collected were: initiation of flowering, plant height, tiller number, culm angle, leaf texture, stem color, awn color, panicle number, flag leaf characteristics (length, width, angle), seed yield, hull color, and awn length. Accessions 4, 9, 50, and 106 were used for the ALS gene study. DNA was extracted using a modified CTAB (Hexadecyltrimethylammonium bromide) protocol. The ALS gene was amplified by PCR using five sets of overlapping primer pairs. Amplified fragments were cloned into a pGEM® T Easy vector and sequenced. These sequences were aligned to the full ALS gene sequence of Stuttgart strawhull and that of ALS-resistant rice line from Japan.

Red rice accessions fall into 2 major categories: strawhull and blackhull types. Besides the two major hull color, straw and black, other hull colors were also observed including brown and orange. There was no difference in plant height and tiller number among strawhull red rice across regions. Among strawhull types, accessions from the NE region produced the most seed (190 g/plant) and flowered earliest. Among blackhull accessions, those from the CE region produced the most tillers (mean=115), but were the shortest blackhull types (mean=133 cm). Blackhull accessions from central Arkansas had the highest seed yield (196 g/plant) and were earliest to flower. The period from planting to flower initiation increased with decreasing latitude. The date of first flower initiation ranged from 11th July to 5th September. Seed yield decreased with decreasing latitude in strawhull types, due to accessions not reaching full maturity, but no such trend was observed in blackhull types. Phenotypic diversity in red rice was documented based on hull color, presence of awns, height, tillering capacity, flowering dates, and seed yield.

Preliminary data on sequence analysis of the ALS gene revealed six nucleotide mutations that resulted in alteration of the amino acid sequence. Most of these mutations fall into 'hot spots' for developing herbicide resistance based on information from other species. These natural mutations indicate a possibility for selection for resistance to ALS inhibitor herbicides in red rice. Thus, it is prudent to rotate to other herbicide chemistries for sustainable red rice management.[a]

[a] We thank Arkansas rice producers for funding this project through Arkansas Rice Research and Promotion Board.

INTERFERENCE OF VARIOUS WEED SPECIES IN PEANUTS. J.B. Willis and D.S. Murray. Department of Plant and Soil Sciences. Oklahoma State University, Stillwater, OK 74078.

ABSTRACT

Experiments were conducted in central Oklahoma at the Agronomy Research Station near Perkins, in 2002 and in Southwest Oklahoma at the Caddo Research Station near Fort Cobb in 2002 and 2003 to measure the interference of eight selected weed species on peanut (*Arachis hypogaea*) yield. This interference data will be used to test CI (competitive indices) that have been assigned to weed species found in Oklahoma peanut. The CI are used to drive a yield prediction model used by decision support systems for Oklahoma peanut.

A randomized complete block design with four replications, was used at all locations. Weeds included in these experiments were selected based on being common and/or troublesome in Oklahoma peanuts and are as follows: common cocklebur (*Xanthium strumarium*), eclipta (*Eclipta prostrata*), johnsongrass (*Sorghum halepense*), prickly sida (*Sida spinosa*), ivyleaf morningglory (*Ipomoea hederacea*), Palmer amaranth (*Amaranthus palmeri*), crownbeard (*Verbesina encelioides*), and barnyardgrass (*Echinochloa crus-galli*). Weeds interfered full-season with Tamspan 90, a Spanish peanut cultivar. Weeds were planted on alternating sides of the center two rows of the four-row plot, at a density of eight weeds per 100 ft^2. In-shell peanut yield was collected from the center two plot rows. Data will be presented in percent yield loss.

Analysis of variance revealed a location interaction but no year interaction at Fort Cobb. The LSD procedure was used to gain treatment mean and a least significant difference value at 5% for each location. The yield loss model that has been adjusted for use in Oklahoma peanut was used to estimate percent yield loss for each treatment. If the predicted yield loss value fell within the LSD value of the treatment yield mean then it was determined that there was no significant difference. Analysis of the Fort Cobb experiments found significant differences with 2 treatments (LSD=13.2%), ivyleaf morningglory and eclipta. At Perkins (LSD=11.7%) a significant difference was viewed in two weed species, johnsongrass and common cocklebur. The data from Fort Cobb will take precedence over the data form Perkins, because in 2002 45% of Oklahoma's peanut acreage was in Caddo County, where Fort Cobb is located and multi-year data was collected. Changes were made to CI of weeds that showed a significant difference at 5% level. Changes to CI were made based on data from Perkins. When data from Perkins were compared to the model, R^2 improved; however when compared to the data from Fort Cobb the R^2 decreased. Based on the data collected at Fort Cobb eclipta and ivyleaf morningglory CI were adjusted from 1.8 to 4.5 and from 3.4 to 5, respectively. The changes improved goodness of fit of Fort Cobb raw data to the yield loss prediction model from R^2=0.61 to R^2=0.73.

OUTCROSSING RATES BETWEEN GUFOSINATE-RESISTANT TRANSGENIC RICE CULTIVARS AND SEVERAL RED RICE ECOTYPES. D.O. TeBeest, D.R. Gealy, and C.C. Wheeler; Department of Plant Pathology, University of Arkansas, Fayetteville; D. Bumpers, National Rice Research Center, USDA-ARS, Stuttgart, AR; Department of Plant Pathology, University of Arkansas, Fayetteville.

ABSTRACT

Recently developed herbicide resistant rice cultivars have provided rice growers in the southern U.S. a viable, and effective new method to control red rice and other weeds. Outcrossing between rice and red rice may compromise the long term effectiveness of this technology. Outcrossing rates between three transgenic glufosinate-resistant rice cultivars and eight genetically and phenotypically distinct red rice ecotypes were estimated in outdoor pot experiments at Fayetteville, AR in 1998, 2000, and 2001. The transgenic rice cultivars were Gulfmont, Cypress, and Bengal (each of these specific transgenic lines has since been discontinued). Red rice ecotypes included strawhull awnless types (Stuttgart strawhull, 15A), blackhull awned types (Stuttgart blackhull, 14F, TX4, 10A, and #8), and a strawhull awned type (11D). Ten plants each of the eight red rice types and three transgenic rice cultivars were pre-germinated and transplanted to numerous pots for placement into the field. Pots containing the eight red rice types were placed in a circular fashion around a single pot of transgenic rice in round plastic pools. Distance between the transgenic rice pot and each red rice pot was about 0.25 m. There were two replicate pools in 1998 and three replicates in 2000 and 2001. Seed from all red rice ecotypes and rice cultivars were collected from mature plants, subsampled, grown up as seedlings in a greenhouse to the one- to three-leaf stage, and sprayed with glufosinate at 0.42 kg/ha (1998) or 2.24 kg/ha (2000 and 2001; to minimize numbers of 'false positive' survivors). Surviving plants were counted and their DNA later evaluated for presence of the glufosinate resistance transgene (BAR) using PCR. More than 35000 seedlings have been screened in the greenhouse. Although not yet complete for all three years, PCR-confirmed outcrossing to date has occurred only between Bengal and 10A red rice, and was estimated at 0.12%, apparently because flowering periods were well synchronized. Outcrossing estimates based on herbicide survival alone were substantially higher than those based on PCR. The glufosinate-tolerant TX4 red rice type had glufosinate survival rates averaging 20% in 1998 and 8% in 2000, while survival rates of 15A were always less than 1%. These results suggest that the particular combination of transgenic rice cultivar and red rice ecotype present in rice fields can affect actual outcrossing rates. Also, the screening method and herbicide screening dosage can markedly affect estimated outcrossing rates.

EFFECT OF WILD RADISH RESIDUES ON YELLOW NUTSEDGE INTERFERENCE WITH TOMATO AND PEPPER. J. Meehan and J.K. Norsworthy; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC.

ABSTRACT

Wild radish (*Raphanus raphanistrum*), like all Brassicaceae, produces glucosinolates that are released upon maceration. Glucosinolates demonstrate limited biological activity; however, upon hydrolysis they can be converted into isothiocyanates. Isothiocyanates exhibit strong allelochemical suppression of plant growth and development.

Tomato and bell pepper are two high value vegetable fruiting crops having a limited number of herbicides available for management. Furthermore, these herbicides offer minimal control of yellow nutsedge (*Cyperus esculentus*), and with the impending loss of methyl bromide, synthetic herbicide use in these crops will likely increase unless other alternative weed control methods are proven effective. In earlier research, it was found that wild radish-amended soil reduced yellow nutsedge root and rhizome growth 21days after planting. Therefore, it was hypothesized that the yellow nutsedge competitiveness in wild radish-amended soil would be diminished, conferring an increased competitive advantage to tomato, but not to bell pepper. Our objectives were to evaluate the effects of wild radish-amended soil on plant growth and development of tomato, bell pepper, and yellow nutsedge, and to evaluate the vegetative reproductive potential of yellow nutsedge in wild radish-amended soil.

A greenhouse, replacement series study was used to investigate the competitive interaction of yellow nutsedge with tomato and bell pepper, with and without wild radish-amended soil. Dried wild radish was incorporated thoroughly into soil at a 1% rate based on the dry weight of soil. 'Sunny' tomato and 'SXP 0990' bell pepper at the 2-lf stage were transplanted into 16-cm diameter pots one week after yellow nutsedge tubers were planted to minimize deleterious affects to the crops. Crop and weed ratios evaluated were 100:0, 50:50, and 0:100.

Tomato and bell pepper did not exhibit growth or developmental inhibition when transplanted one week after amending soils with wild radish. Yellow nutsedge planted alone in wild radish-amended soil did not experience significant shoot reduction, but reduction in tuber production occurred. Tuber production was diminished as much as 88% and dry weight per tuber decreased by 84% when grown in wild radish-amended soil. When tomato and bell pepper were grown in competition with yellow nutsedge, the relative crowding coefficient of tomato and bell pepper increased from 1.40 to 3.12 and 0.73 to 1.81, respectively, in non-amended verses wild radish-amended soil. Conversely, the relative crowding coefficient of yellow nutsedge decreased from 0.72 to 0.33 and 1.37 to 0.55 in wild radish-amended soil when grown in competition with tomato and bell pepper, respectively. This research demonstrates that the aggressiveness of tomato and bell pepper increases while placing yellow nutsedge at a competitive disadvantage in soils amended with wild radish.

ABSORPTION, TRANSLOCATION, AND METABOLISM OF CGA-362622 AND HALOSULFURON IN GREEN AND FALSE-GREEN KYLLINGA. J.S. McElroy, F.H. Yelverton, I.C. Burke, and J.W. Wilcut, Crop Science Department, NC State University, Raleigh, NC 27695.

ABSTRACT

Green kyllinga (*Kyllinga brevifolia* Rottb.) and false-green kyllinga (*Kyllinga gracillima* L.) are rhizomatous perennial sedge species (Cyperaceae) that are weeds of managed turfgrass systems. Both are tolerant to mowing heights ≥1.2 cm and are more invasive under saturated soil moisture conditions. Additionally, both species are difficult to control with currently registered herbicides, most likely due to the difficulty in eliminating rhizomes. Halosulfuron is commonly used to control perennial sedges species, including green and false-green kyllinga, in managed turfgrass. CGA-362622 (trifloxysulfuron) was recently introduced for use in turfgrass systems and research indicates that it provides greater control of green and false-green kyllinga than halosulfuron. Research is needed, therefore, to evaluate the reason for variation in control of green and false-green kyllinga between these seemingly similar sulfonylurea herbicides.

Studies were conducted to evaluate the absorption, translocation, and metabolism of ^{14}C-halosulfuron and ^{14}C-CGA-362622 when foliar-applied to green and false-green kyllinga. Technical grade radiolabeled halosulfuron and CGA-362622 were obtained for these experiments. C^{14}-herbicide was applied (580 bq/µL + 0.25% NIS) in five µL droplets to the upper surface of a single leaf of green and false-green kyllinga plants. Plants were then harvested at distinct time intervals from 4 to 96 hrs. At harvest, plants were divided into four plant parts: Leaf treated with C^{14}-herbicide, primary shoot that contained the treated leaf, roots, and rhizomes. To determine total absorption, the treated leaf was washed to remove non-absorbed C^{14}-herbicide and the amount of C^{14} in the rinsate was quantified. To determine total herbicide translocation throughout the plant, all plants parts were combusted in a biological oxidizer, C^{14} molecules were captured, and the amount captured from each plant part was quantified. To determine total herbicide metabolism over time, additional divided plants were ground with a mortar and pestle to remove cellular contents, captured homogenate was spotted on thin-layer chromatography (TLC) plates, developed, and chemical metabolites were quantified. A C^{14} herbicide standard was used to locate the parent compounds of CGA-362622 and halosulfuron on each TLC plate.

No differences were observed between the two *Kyllinga* spp. with regards to absorption, translocation, or metabolism of either herbicide. The majority of ^{14}C-halosulfuron and ^{14}C-CGA-362622 was absorbed by 4h, with an accumulation of 63 and 47% radioactivity, respectively. Accumulation of both herbicides occurred in the treated leaf and the primary shoot from whence the treated leaf was removed, with minor accumulation occurring in the roots and newly formed rhizomes. Of the total amount of ^{14}C-halosulfuron absorbed into the plant, 77% remained in the form of the parent compound compared to 61% of ^{14}C-CGA-362622. The parent compound was distributed mainly in the treated leaf and primary shoot, while polar metabolites were concentrated in the roots and rhizomes. Non-polar metabolites of ^{14}C-CGA-362622 accumulated in the treated leaf and primary shoot. These data indicate that absorption, translocation, or metabolism could not explain the variation in green and false-green kyllinga control between halosulfuron and CGA-362622.

VARIATION AMONG PALMER AMARANTH (*AMARANTHUS PALMERI*) ACCESSIONS.

J.A. Bond and L.R. Oliver. Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville.

ABSTRACT

Palmer amaranth [*Amaranthus palmeri* (S.) Wats.] is a tremendous hindrance to crop production in the southern United States, and because growth characteristics of the species are not well-documented, growth and development data are needed to improve Palmer amaranth control strategies. An experiment was conducted in 2002 and 2003 at Fayetteville, AR, to compare growth characteristics of Palmer amaranth accessions originating from across the species' indigenous range in the United States. Seed sources were collected from 24 locations representing the geographic range of the species. Treatments were arranged as a 24 by 7 factorial in a randomized complete block experimental design with four replications. The first factor was Palmer amaranth accession and the second factor was harvest intervals of 2, 3, 4, 5, 6, and 8 weeks after emergence (WAE).

At each harvest interval, height and canopy width of designated plants were measured, and the aboveground portion was harvested for destructive measures. Total leaf area and dry weights of stems and leaves were recorded. Leaf area ratio (LAR), stem leaf ratio (SLR), net assimilation rate (NAR), and relative growth rate (RGR) were determined on a per plant basis. Data were subjected to analysis of variance (ANOVA) with means separated by Fisher's Protected Least Significance Difference (LSD) test with a probability of 0.05. Year was considered a random environment to broaden inferences made concerning treatment effects and because primary concern was in comparing accessions across harvest intervals.

No accession by harvest interval interaction was detected for LAR, NAR, and RGR. However, a significant interaction of accession and harvest interval was observed for SLR. Arkansas accessions developed leaf area similar to accessions from NM, TX, and KS. Leaf area ratio was greatest for LA, MS, AL, and SC accessions. Stem leaf ratio of all accessions increased over time as plants allocated more biomass to stems and reproductive structures, but SLR for all accessions was equivalent until 6 WAE. At 6 WAE, NM, TX, and KS accessions displayed greater SLR than LA, MS, AL, and SC accessions. NM, TX, and KS accessions showed higher NAR than LA, MS, AL, and SC accessions, demonstrating more efficient dry matter accumulation. Differences in growth rate were not detected among accessions. Peak RGR occurred at 4 WAE and decreased through the remainder of the season regardless of accession origin.

Variation in growth and development of Palmer amaranth was noted among accessions, but no differences were detected prior to 6 WAE. LA, MS, AL, and SC accessions displayed greater photosynthetic capacity, which may confer a competitive advantage to those accessions. Accessions in the western and eastern portions of the species' range grew differently. Therefore, Palmer amaranth accessions respond to the climatic conditions of their area of origin, but growth patterns cannot always be predicted based on accession origin because AR accessions display variable characteristics, indicating potential for greater diversity of Palmer amaranth within AR compared with other areas.

PERSISTENCE OF RIMSULFURON ON PERENNIAL RYEGRASS AND ANNUAL BLUEGRASS FOLIAGE. W.L. Barker, N.M. Kaufman, and S.D. Askew; Department of Plant Pathology, Physiology, and Weed Science, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061.

ABSTRACT

In the climatic transition zone, bermudagrass [*Cynodon dactylon* (L.) Pers.] fairways are typically overseeded with perennial ryegrass (*Lolium perenne* L.). However, turfgrass management can be difficult during transition back to a bermudagrass monoculture in the spring. To speed transition and avoid competition between perennial ryegrass and post-dormant bermudagrass, herbicides are often used to control perennial ryegrass. Field studies have shown that rimsulfuron can move laterally or "track" and injure neighboring cool-season grasses, therefore, persistence and stability of rimsulfuron on turf foliage was assessed. Our objectives were to determine amounts of water extractable rimsulfuron remaining on perennial ryegrass and annual bluegrass (*Poa annua* L.) foliage over time. Two trials were conducted in a completely randomized design. Treatments were arranged in a split plot design with harvest times as main plots and plant species as subplots (either perennial ryegrass or annual bluegrass). Each treatment was replicated three times per trial. Perennial ryegrass and annual bluegrass were chosen because rimsulfuron is commonly used to control them in areas adjacent to sensitive creeping bentgrass (*Agrostis stolonifera* L.) putting greens. Plants were harvested from the field, separated to two tillers, planted in 50 ml 0.25-strength Hoagland's solution, and allowed to acclimate in a growth chamber at 18.5/12.5 C day/night temperature and 50/80% day/night relative humidity for one week. Lighting was maintained for the 14-hour day period at 110 μmols photons/m^2/second of photosynthetically active radiation. After acclimation, the first and second fully-expanded leaves on each tiller were treated with [pyrimidine-2-^{14}C}-rimsulfuron and misted each night to simulate dew. Plants were harvested at 0.06, 12, 24, 48, 72, and 96 hours after treatment. Plants were clipped at ground level, rinsed with water, rinsed with methanol, and combusted in a biological oxidizer. An aliquot of each rinse was removed and radioactivity was determined using a liquid scintillation spectrometer. Water rinses were subjected to thin layer chromatography (TLC) to determine the fraction of stable rimsulfuron over time. Methanol rinses were not subjected to thin layer chromatography due to insufficient radioactivity counts. Utilizing water rinse data from chromatograms it was determined 50% of the applied rimsulfuron was water extractable after 24 hours. At 96 hours after treatment, 40% of applied rimsulfuron was water extractable. A substantial amount of stable rimsulfuron persists on turf foliage for up to 4 days. These data concur with several reports by Virginia golf course superintendents and additional field research conducted at Virginia Tech that rimsulfuron may be dislodged from wet turfgrass and tracked onto sensitive creeping bentgrass. These results indicate that turfgrass treated with rimsulfuron should be irrigated to rinse chemical residue from foliage before mowing in an effort to prevent lateral relocation and injury of sensitive species.

MOLECULAR MECHANISM UNDERLYING RESISTANCE TO DICLOFOP IN RYEGRASS (*LOLIUM MULTIFLORUM*). S.N. Rajguru, R. Bevitori, N.R. Burgos and R.E. Talbert; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville.

ABSTRACT

Acetyl-coenzyme A carboxylase (ACCase) is a biotinylated enzyme that catalyzes the carboxylation of acetyl-CoA to produce malonyl-CoA. The chloroplastic ACCase isoform catalyzes the first step in fatty acid biosynthesis and is the target of two chemically distinct classes of inhibitors, aryloxyphenoxypropionates (AOPPs) and cyclohexanediones (CHDs). These chemicals prevent the carboxyl-transferase (CT) subunit of the ACCase enzyme from completing the transfer of the carboxyl group to acetyl-CoA. Widespread use of these herbicides has given rise to resistant biotypes of many grass weeds. Several studies in various grass species have implicated mutation of target site as the mechanism of resistance. This study was conducted to identify mutations associated with the diclofop-resistant ryegrass biotypes

A partial gene sequence encoding the CT domain of the multidomain, chloroplastic ACCase was sequenced in four individuals drawn from three populations of diclofop-resistant *L. multiflorum* biotypes. Oligonucleotide primers were synthesized based on highly conserved regions of the ACCase amino acid sequence of wheat (*Triticum aestivum*) and corn (*Zea mays*) to partially amplify the CT region. Four sets of overlapping fragments encoding partial ryegrass ACCase was generated. These fragments coded for a total of 573 amino acids. Some neutral mutations in the ACCase nucleotide sequence were observed between resistant and susceptible ryegrass biotypes, however, no resistant plants contained an Ile-1,781-Leu substitution, previously shown to confer resistance to CHDs in *A. myosuroides*. It is very likely that mutation in these populations lies downstream in the CT region.

Based on gene sequences published for *A. myosuroides*, we designed two gene specific nested primer pairs to PCR clone a sequence of 1082 base pairs from the downstream region of the CT domain. In initial PCR runs we included four individuals from one resistant population of *L. multiflorum*. Sequences obtained from the four individuals revealed six point mutations resulting in an alteration of the amino acid sequences at positions 5920, 5969, 6190, 6277, 6317, and 6779. These mutations were consistent among all individuals. The contribution of these mutations to the resistant phenotype is currently under investigation.

[a]This project was funded by the Arkansas Rice Research Promotion Board and BASF

GROWTH CHARACTERISTICS OF ITALIAN, RIGID, POISON, AND PERENNIAL RYEGRASS. M.T. Bararpour, L.R. Oliver, and N.R. Burgos; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville.

ABSTRACT

Weeds must be properly identified at the seedling stage in order to select the most effective herbicides. Italian ryegrass (*Lolium multiflorum*), which has evolved resistance to diclofop, is the number one weed problem in Arkansas wheat. Field studies were conducted in 2002 and 2003 at the Agricultural Experiment Station, Fayetteville, to determine morphological differences among *Lolium sp.:* Italian, rigid (*Lolium rigidum*), poison (*Lolium temulentum*), and perennial (*Lolium perenne*). Greenhouse seedlings (20 days old) transplanted 1.5 m apart in the field on November 12 (2001) and 22 (2002). The experimental design was a randomized complete block with ten replications. During the growing season, plant height, plant growth habit, plant color, and node color were recorded. At maturity, plant height and number of tillers and spikes were recorded. Two spikes from each plant were collected to measure spike and spikelet length, awn length, number of spikelets/spike, number of seed/spikelet, number of seed/spike, and number of seed/plant.

At the seedling stage poison ryegrass can be distinguished by a larger diameter main stem (2 to 3 times than the others) and droopy leaves with a wider leaf blade, and at maturity, poison ryegrass had the lowest number of tillers (43), spikes (32), seed/spikelet (6), and seed/plant (3,340); thick seed (7 to 8 mm) with long awns (12 mm); and glumes (21mm) longer than spikelet (15 mm) compared to the others. Perennial ryegrass was also easy to distinguish due to prostrate growth habit, a greenish node, short and narrow leaf blade, small seed (<5 mm) with no awn, and glume (11 mm) shorter than spikelet (14 mm). Perennial ryegrass had 129 tillers, 71 spikes, 20 spikelet/spike, 8 seed/spikelet, and 11,360 seed/plant and flowered 3 weeks later than the other species. Italian ryegrass (Arkansas diclofop-resistant ryegrass) had erect growth habit, greenish color, green node, glume (10 mm) shorter than spikelet (21 mm), and medium seed size (5 to 7 mm) with 1- to 3- mm awns. Italian ryegrass had the highest number of tillers (173), spikes (149), spikelet/spike (25), and seed/plant (44, 700). Rigid ryegrass had prostrate growth habit with the leaf blade as wide as Italian ryegrass , but two to three times wider than perennial ryegrass and two times narrower than poison ryegrass. Glume (13 mm) was shorter than spikelet (16 mm). Seed was 5 to 7 mm long with no awn. Rigid ryegrass had 81 tillers, 72 spike, 14 spikelet/spike, 7 seed/spikelet, and 7, 056 seed/plant.

In general, at the seedling stage (1 to 2 weeks old) poison ryegrass, with a larger diameter main stem and droopy leaves with a wider leaf blade, and perennial ryegrass, with short and very narrow leaf blade, can be distinguished from Italian or rigid ryegrass, which have leaf blades wider than perennial but narrower than poison ryegrass. Although it is difficult to distinguish Italian ryegrass from rigid ryegrass at this stage of the growth, it is easy to distinguish them at the reproductive stage. At maturity, Italian ryegrass and poison ryegrass seed had awns, but perennial and rigid ryegrass seed did not. Poison ryegrass glume was longer than the spikelet, whereas Italian ryegrass glume was shorter than the spikelet. Poison ryegrass awns (> 10 mm) were at least two times longer than Italian ryegrass awns (< 5 mm). Our previous ryegrass population studies showed that morphological variability exists among Arkansas diclofop-resistant ryegrass (Italian ryegrass).

IMPACT OF LATE-SEASON GLYPHOSATE APPLICATIONS ON SEED PRODUCTION OF BARNYARDGRASS (*ECHINOCHLOA CRUS-GALLI*), PITTED MORNINGGLORY (*IPOMOEA LACUNOSA*), AND SICKLEPOD (*SENNA OBTUSIFOLIA*). E.R. Walker and L.R. Oliver; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville.

ABSTRACT

Field studies were conducted in 2000 to 2002 to determine whether glyphosate applications at weed flowering will reduce seed production of a community consisting of barnyardgrass (*Echinochloa crus-galli*), pitted morningglory (*Ipomoea lacunosa*), and sicklepod (*Senna obtusifolia*). The experimental design was a randomized complete block with four replications and a factorial arrangement of treatments consisting of glyphosate rate by application timing. Glyphosate rates included 0.11, 0.21, 0.42, and 0.84 kg ae ha^{-1}, and application timings were at the flowering of barnyardgrass, pitted morningglory, or sicklepod, or 10-day sequential applications initiated by the first flowering of a species in the community and continuing until maturation of all species. Approximately five sequential applications were made to each species each year. Plots were 2.3 by 1.5 m and contained all species planted parallel on individual rows spaced 76.2 cm and traversing the width of the plot. Biomass and seed production data were obtained from a 60-cm sample from the center of each row of each plot.

Although barnyardgrass was the first weed species to flower each year, a single 0.84 kg ha^{-1} glyphosate application, regardless of application timing, was among the most effective treatments, reducing barnyardgrass seed production by 84% when compared to the non-treated check. However, application timing was critical for maximum seed reduction in pitted morningglory, requiring one 0.84 kg ha^{-1} glyphosate application at pitted morningglory flowering to reduce seed production in the species by 97%. Sicklepod was highly susceptible to glyphosate during flowering and required only 0.21 kg ha^{-1}glyphosate, regardless of timing, to obtain a 98% reduction in sicklepod seed. For a weed community consisting of barnyardgrass, pitted morningglory, and sicklepod, one application of 0.84 kg ae ha^{-1} glyphosate initiated by pitted morningglory flowering will most effectively and practically reduce seed production from 84 to 98% of all species.

CHARACTERIZATION OF THE MECHANISM OF GLYPHOSATE RESISTANCE IN HORSEWEED (CONYZA CANADENSIS). G. Heck, R.D. Sammons, G. Bunkers, P. Feng, M. Tran, M. Alibhai, Y. Qi, S. Flasinski, M. Malven and C. Hubmeier, Monsanto Company, St. Louis MO.

ABSTRACT

Conyza canadensis is a winter or summer annual indigenous to North America that is readily dispersed and is now represented in both the New and Old World's in a wide variety of agricultural systems. The appearance of glyphosate resistant horseweed in 2001 in Roundup Ready soybean and cotton has focused a high level of attention on this normally easily controlled weed. Resistance is not due to over-expression of EPSPS or glyphosate metabolism or differences in glyphosate uptake. There are three isozymes of EPSPS in horseweed mutually identical in sensitive and resistance lines. This removes the possibility there is a target site mutation involved in resistance. One isozyme is not fully expressed and is a nonfunctional enzyme or pseudo-gene. The other two functional EPSPS's are very sensitive to glyphosate. Genetic studies show that glyphosate resistance in horseweed is dominant and transmitted by a nuclear gene. The principal measurable difference corresponding to resistant horseweed is decreased translocation of glyphosate from treated leaves with an additional decrease in the production of shikimate in source and sink leaves. Our results are consistent with two potential mechanisms of glyphosate resistance – impaired translocation and reduced EPSPS inhibition, which could have resulted from altered cellular distribution that impaired phloem loading and plastidic import of glyphosate.

SHIKIMIC ACID ACCUMULATION IN CORN (*ZEA MAYS*) FOLLOWING SIMULATED DRIFT RATES OF GLYPHOSATE. N.W. Buehring, J.H. Massey, and D.B. Reynolds. Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

The increased acceptance of transgenic crops and the subsequent increase of glyphosate use throughout the growing season has increased the frequency of glyphosate drift in corn. After a spray drift event in corn, producers are often left with a difficult decision on whether to terminate the crop and replant; or keep the crop in production. Previous research has indicated that visual injury estimates and plant height reductions do not strongly correlate to potential yield losses from sublethal applications of glyphosate in corn. Therefore, other methods for assessing potential yield losses from glyphosate drift events in corn are needed. Glyphosate inhibits 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase in the shikimate pathway which results in accumulation of high levels of shikimic acid. The objectives of this study were to determine the optimum time to sample for shikimic acid accumulation following a sublethal application of glyphosate and to assess the ability of shikimic acid accumulation to predict yield reductions in corn. These studies were conducted at the Plant Science Research Center near Starkville, MS in 2001, 2002, and 2003. The experimental design was a randomized complete block with four replications. Corn 'Pioneer '3167' was planted into four 97-cm rows in 2001 and eight-97 cm rows in 2002 and 2003. Glyphosate rates are as follows: 0.32(1/2X), 0.16(1/4X), 0.04(1/16X), 0.01(1/64X), and 0.00 kg ae/ha. A glyphosate formulation which did not contain surfactant was used. Thus, a nonionic surfactant was added to all treatments at 1% (v/v) which were applied to corn at the V6 to V8 growth stage at a delivery volume of 48 L/ha. Corn whorls were randomly collected from each plot at 0, 1, 3, 5, 7, and 14 days after application (DAA). Shikimic acid concentration and visual injury were assessed at each collection interval. Corn whorls were ground using a food processor. To extract the shikimic acid, 1.0 N HCl was added at ratio of 5 mL to 1 g of plant tissue and allowed to digest for 72 (2001) or 24 h (2002 and 2003). Laboratory studies indicated no difference between a 24 or 72 h extraction time period for corn, therefore, the extraction time period was reduced in 2002 and 2003. The extract was diluted at 2:3 ratio with acetonitrile. The diluted extract (1 ml) was used for analysis with high performance liquid chromatography (HPLC) using a wavelength of 215 nm. Shikimic acid concentration was recorded on an oven-dry weight basis (µg shikimic acid/g dry plant tissue).

Shikimic acid accumulation, as a result of glyphosate at 0.32 and 0.16 kg/ha, was transient over the collection times. Shikimic acid accumulated to higher concentrations 3, 5, and 7 DAA with glyphosate at 0.32 and 0.16 kg/ha. Visual injury symptoms were detected with glyphosate at 0.32 and 0.16 kg/ha at 3 DAA and increased through 14 DAA. Shikimic acid accumulation at 3, 5, and 7 DAA did not strongly correlate (r^2=0.83 to 0.85) to potential yield losses from a sublethal application of glyphosate. Visual injury ratings 14 DAA were a better predictor of potential yield losses (r^2=0.93) than shikimic acid accumulation at any of the sample collection periods.

Shikimic acid accumulation could serve as a potential method to indicate if a glyphosate drift event had occurred. However, plant tissue samples would need to be collected between 3 and 7 days after a drift event. If a glyphosate drift event occurred in corn without prior knowledge, shikimic acid accumulation may not serve as an effective method because visual injury symptoms were most evident at 14 DAA for glyphosate at 0.32 and 0.16 kg/ha. By 14 DAA, shikimic acid decreased to background levels equivalent to that found in the untreated control. Also, shikimic acid accumulation would not be a good predictor of potential yield losses due to poor correlations.

DOES ROW WIDTH INFLUENCE THE CRITICAL PERIOD FOR WEED CONTROL IN FIELD CORN? J.K. Norsworthy; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC.

ABSTRACT

Field studies were conducted near Blackville, SC, in 2002 and 2003, and near Pendleton, SC, in 2003, to compare the critical period for weed control in narrow- (48 cm) and wide-row (97 cm) corn. A series of treatments of increasing duration of weed interference and length of weed-free period were imposed within each row spacing. Diversity and density of the weed spectrum were greater both years at Blackville than at Pendleton. Weed interference duration and weed-free period curves were similar between row widths for each of the three site years. Averaged over row width, the critical period for weed control was longer at Blackville, beginning 5 to 9 days after corn emergence (DAE) (1 to 2-lf stage) and ending 45 to 53 DAE (8 to 10-lf stage). At Pendleton, the critical period for weed control was only 4 days, beginning 21 (5-lf stage) and ending 25 DAE (5- to 6-lf stage). Light interception by corn at Blackville at the end of the critical period for weed control was stable across years, ranging from 77 to 78%, but light interception was only 31% at Pendleton at the end of the critical period for weed control, implying the weed density or weed spectrum may be more of a determinate of the critical period for weed control than canopy formation. Light interception was similar between row widths throughout the growing season, which resulted in similar late-season weed biomass between row widths. The CPWC and crop competitiveness with late-emerging weeds appears to be similar between wide- and narrow-row corn when canopy formation does not differ between row widths. Therefore, other strategies such as increasing the population of narrow-row corn and use of a hybrid better suited for narrow rows are likely needed to provide narrow row widths a competitive advantage over wider rows.

HYPERSPECTRAL REMOTE SENSING ANALYSIS TECHNIQUES FOR WEED CLASSIFICATION. C.J. Gray, D.R. Shaw, and D.M. Dodds; Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

A field experiment was implemented in 2002 and 2003 to differentiate six common Mississippi weeds, soybean [*Glycine max* (L.) Merr.], and soil using hand-held hyperspectral radiometry. The weed species chosen were hemp sesbania [*Sesbania exaltata* (Raf.) Rybd. ex. A. W. Hill], prickly sida (*Sida spinosa* L.), sicklepod [*Senna obtusifolia* (L.) Irwin and Barnaby], smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.], palmleaf morningglory (*Ipomoea wrightii* Gray), and pitted morningglory (*Ipomoea lacunosa* L.). Weed species were planted to densities reflecting 50, 100, and 200% of published yield loss thresholds. After approximately 60 days after emergence four hyperspectral reflectance readings were randomly acquired for each plot. Subsequent readings were collected approximately two weeks thereafter, which resulted in five total acquisition dates. All acquisition dates were pooled for each year, and also combined over both years.

The hyperspectral reflectance data were collected at wavelengths from 350 to 2500 nm in 1.4-nm increments between 350 and 1000 nm and 1.0-nm increments between 1050 and 2500 nm. Three bands were then produced which corresponded to the green (545-555 nm), red (670-680 nm) and near infrared (NIR) (835-845 nm) portions of the electromagnetic spectrum. In addition two other bands were also produced, TM4 (760-900 nm) and TM5 (1550-1750 nm), to represent the band widths typically used with satellite imagery. These bands were then used to create seven vegetation indices. These indices were then subjected to stepwise discriminant analysis and principal component analysis, which were then tested by linear discriminant analysis. The reflectance readings were also subjected to maximum-likelihood best spectral band combination analysis using a maximum-likelihood classification method. In addition, the ten best spectral bands chosen by best spectral band combination analysis and the created vegetation indices were subjected to stepwise discriminant and principal component analysis.

Classification accuracies were greater within years than when pooled across years. Analyzing the three classifications alone, best spectral band combination out-performed discriminant analysis followed by principal component analysis. When observing the classification capabilities of the vegetation indices in combination with the ten best spectral bands, discriminant analysis resulted in higher classification accuracies than principal component analysis. The addition of the ten best spectral bands to the vegetation indices increased species differentiation more than using the vegetation indices alone when employing discriminant analysis techniques. Soybean classification accuracies were 79 and 72% for 2002 and 2003, respectively, when using discriminant analysis techniques incorporating the combination of vegetation indices and best spectral bands. Employing the same analysis techniques, soybean classification decreased to 55% when pooled over years. Weed species classifications were greatest when using best spectral band combination analysis. Weed species classification ranged from 91 to 100% for 2002 and 2003 with the exception of sicklepod classification reaching only 59% for 2002. When pooled over years, weed species classification ranged from 81 to 93%. Soil classifications were 100% for all analysis techniques except best spectral band combination analysis, which ranged from 72 to 76%. Results from these experiments using the analysis techniques described would suggest not using principal component analysis when attempting to discriminate similar species.

SECTION VIII. EDUCATIONAL ASPECTS OF WEED CONTROL

FIELD SCHOOLS IN PLANT PEST MANAGEMENT: WEED SCIENCE AS AN INTEGRAL COMPONENT OF AN IPM COURSE. W.W. Witt, Department of Agronomy, University of Kentucky, Lexington.

ABSTRACT

The number of students with farm backgrounds has decreased over the past few years as the number of farms declined. As a result, many students in plant science disciplines have little, if any, background in crop production or pest management. The number of students with 'hands on' experience in pest management is particularly small. One means of addressing this issue is to have a course in which students get practical experience in crop production and pest management under field conditions. This approach challenges instructors and students alike because the ideal time for such a course is during the summer months when students, and frequently, instructors are not on campus. Another challenge is finding a suitable location for such a course; most researchers are not keen on having ten or more students walking through research plots. At the University of Kentucky, the course "PLS 531, Field Schools in Plant Pest Management" was developed in 2000 to provide experience under field conditions. It is a two-credit course open to undergraduate and graduate students and emphasizes integrated pest management strategies in corn, soybean, wheat and forages. The key to the success of this course was the establishment of a teaching field that was devoted entirely to this course. A ten-acre field on a UK Agricultural Experiment Station near Lexington was procured and designed to accommodate corn, soybean, and wheat planted in rotations or under continuous monoculture. This arrangement allows for comparison of continuous cropping and rotations on pest populations at various times during the year. The course meets two days in May and two days in August. The May field school emphasizes early season pest problems in corn, soybean and forages and late season pest problems in wheat. The August field school emphasizes late season pest problems in corn, soybean and forages. The availability of the teaching field allows the instructors to send students into the field to monitor pest populations, which frequently is a destructive sampling procedure for insects and diseases. The course emphasizes the correct techniques for pest monitoring in crops with wide row spacing (corn, soybean), narrow row spacing (soybean, wheat) and broadcast spacing (alfalfa, pastures). The teaching field is managed by the Weed Science group and I coordinate the teaching in the field schools. The great majority of teaching at the field schools is by extension specialists in Weed Science, Entomology and Plant Pathology—eight faculty members participate in teaching these field schools. This course is offered in the fall semester, but students participate in the field schools in the summer preceding enrollment in the fall semester. The course meets one time a week during the first half of the fall semester and I discuss the principles of integrated pest management and give writing assignments. Each student must make a fifteen-minute presentation on some aspect of integrated pest management taught during the field schools. This course receives excellent evaluations from the students. The course was taught for the fourth year in 2003 and enrollment has varied from 8 to 11 students.

BROMUS SPP. CONTROL IN THE SOUTHERN GREAT PLAINS WHEAT PRODUCTION REGION. J.P. Kelley, T.A. Baughman, C.R. Medlin, and T.F. Peeper. University of Arkansas Cooperative Extension Service, Little Rock. Texas A&M Research and Extension Center, Vernon. Oklahoma State University, Stillwater.

ABSTRACT

Cheat (*Bromus secalinus*), rescuegrass (*Bromus catharticus*), and downy brome (*Bromus tectorum*) are winter annual grass weeds that can be troublesome in the Southern Great Plains wheat production region. Several herbicides are currently labeled or soon to be labeled for control of such weeds. The purpose of this presentation is to provide an overview of herbicide options for cheat, rescuegrass, and downy brome control in the Southern Great Plains.

The standard treatments for control or suppression of bromus species for several years has been 0.37 oz ai/a of chlorsulfuron + metsulfuron applied preemergence, 0.3 oz ai/A of chlorsulfuron + metsulfuron + 3 oz ai/A metribuzin applied to 2-3 leaf wheat, or 0.38 lb ai/A of metribuzin applied to well tillered wheat. Results were often variable and factors such as rainfall after application and weed size were most likely responsible for variable results. In 1999, sulfosulfuron was labeled for bromus control in wheat. Cheat control with sulfosulfuron has been excellent, with control generally above 90% and has a wide application window. In contract rescuegrass is more difficult to control and applications to 2 to 3 leaf rescuegrass has provided the greatest level of control. Applications made to rescuegrass larger than 3 leaf has not provided satisfactory control. Downy brome control with sulfosulfuron has been greatest from fall applications and winter to early spring applications will likely provide suppression. Clearfield wheat is now available in the Southern Great Plains. Imazamox used with Clearfield wheat has provided good to excellent control of cheat, rescuegrass, and downy brome. Control with Imazamox from fall applications tends to provide greater control than late winter applications. MKH 6561 (propoxycarbazone-sodium), an experimental sulfonylurea herbicide has shown excellent control of cheat over a wide application window. Rescuegrass and downy brome control are more difficult to control with MKH 6561 and early fall applications tend to provide more satisfactory control.

ITALIAN RYEGRASS (*Lolium multiflorum* Lam.) CONTROL IN THE SOUTHERN GREAT PLAINS WHEAT PRODUCTION REGION. C.R. Medlin, J.P. Kelley, T.A. Baughman, and T.F. Peeper. Oklahoma State University, Stillwater. University of Arkansas Cooperative Extension, Little Rock. Texas A&M Research and Extension Center, Vernon, TX.

ABSTRACT

Italian ryegrass (*Lolium multiflorum* Lam.) is a competitive winter annual grass that has invaded the major wheat growing regions of Arkansas, Oklahoma, and Texas. Italian ryegrass germinates in the fall along with the fall seeded wheat crop, grows vegetatively throughout the winter months, until it begins its reproductive growth in the spring, then sets seed along with the wheat crop in the early summer.

Current selective herbicides for controlling Italian ryegrass in the wheat crop have limitations. Chlorsulfuron + metsulfuron (in a 5:1 prepackaged mixture) is labeled for preemergence control of Italian ryegrass, but has limitations in its use due to the lack of timely activating rainfalls in much of the wheat growing region of the Southern Great Plains. Diclofop effectively controls Italian ryegrass when applied postemergent, but is not widely used due to its full-season grazing restriction that prevents cattle from grazing forage produced after application. Imazamox applied to imidazolinone-tolerant wheat cultivars can effectively manage Italian ryegrass, however current variety characteristics limit their production to the extreme western regions of the Southern Great Plains, far west of current Italian ryegrass problem areas.

Experiments were established in the late 1990's and early 2000's throughout Oklahoma and Texas to evaluate the control of Italian ryegrass with diclofop, flucarbazone-sodium, imazamox, mesosulfuron-methyl, propoxycarbazone-sodium, and early postemergence applications of chlorsulfuron + metsulfuron. Diclofop controlled Italian ryegrass from 89 to 99% regardless of location. Flucarbazone-sodium controlled Italian ryegrass from 79 to 95%, while mesosulfuron-methyl controlled the weed from 74 to 100%. Propoxycarbazone-sodium controlled the weed less than 75% regardless of location. Imazamox controlled ryegrass from 80 to 99%. Preemergence applications of chlorsulfuron + metsulfuron were inconsistent in their control of ryegrass, but when applied early postemergence, to 1-2 leaf ryegrass, control ranged from 75 to 99%.

WILD OAT CONTROL IN THE SOUTHERN GREAT PLAINS WHEAT PRODUCTION REGION. T.A. Baughman, C.R. Medlin, J.P. Kelley, and T.F. Peeper; Texas A&M Research and Extension Center, Vernon; Oklahoma State University, Stillwater; and University of Arkansas Cooperative Extension Service, Little Rock.

ABSTRACT

Estimates have indicated that wild oat (Avena spp.) reduces grain production worldwide by as much as 12 million tons. It is one of the most common and troublesome weeds in Southwest Oklahoma and North Texas wheat production. Wild oat has been extensively studied as a weed problem throughout the United States. However, due to the unique environment that occurs in the Southern Great Plains information development from other areas of the United States does not correlate with production in the Southern Great Plains. A large percentage of the wheat in this region is grazed by cattle and wheat yields are often lower than those in other regions of the United States. Therefore, herbicides that have grazing restrictions or that are extremely expensive do not necessarily provide an option in the Southern Great Plains Wheat Production Region. In additions the production season is quite long for winter wheat (up to 9 months), and often multiple flushes of wild oat will occur during the growing season. Herbicides investigated in the Southern Great Plains include Achieve (tralkoxydim), Assert (imazamethabenz), Avenge (difenzoquat), Beyond (imazamox), Discover (clodinafop), Everest (flucarbazone), Hoelon (diclofop), Maverick (sulfosulfuron), Olympus (propoxycarbazone), Osprey (mesosulfuron), and Puma/Silverado (fenoxaprop). Wild oat control was inconsistent with Achieve, Avenge, Everest, Olympus, and Maverick. Both Assert and Hoelon provided effective control of wild oat but both have grazing restrictions which limit there utility in this region. Puma/Silverado provided good control of wild oat but provides no residual control for subsequent weed flushes. Discover provided excellent control of large wild oat but is not labelled in the Southern Great Plains growing region. Beyond provide good activity on wild oat, but residual is somewhat limited and a Clearfield (imidazolinone tolerant) wheat must be planted. Osprey appears to be a potential option for wild control, but currently does not have a label, and data is limited at this time.

SUCCESSFUL INTEGRATION OF BIOTECHNOLOGY INTO A PLANT PHYSIOLOGY COURSE USING WEED SCIENCE PRINCIPLES. C.L. Brommer, Dept. of Pharmacology, Emory University, Atlanta, GA.

ABSTRACT

Laboratory courses in plant physiology are difficult to develop. This is especially true when the student audience is not accustomed to coursework in the plant sciences or in biotechnology. The discipline of weed science offers an outstanding background to help foster biotechnology education within plant physiology. One third of the laboratory sections at Clark Atlanta University were altered from a traditional series of laboratory exercises to more problem based learning. Biotechnology principles and practice were infused into these sections using a weed science perspective. Course assessment came from student surveys at the beginning of the course, upon completion of the course, as well as assignment grades. Traditional and weed science based sections were compared. All data was analyzed for statistical differences over the single semester of this study. Student comments were also used as a means of assessment of course outcomes. Students gave the weed science labs 4.5 out of a scale of 5, with 5 being most favourable. Traditional labs received a 3.0 score. For the question, "This lab made me want to continue study in plant physiology/biology" students gave the traditional labs 2.5 and the weed science labs 4.5. Weed science labs scored equal too or higher then each of the traditional labs in relation to student opinions and information retention. Grades from the different sections were also compared. Students scored 9% ± 2 higher in weed science labs then in traditional labs. This could be low due to a higher number of traditional labs then those based on weed science. Student comments were mostly favourable in conjunction with the weed science labs. The only major complaint, which was recorded more then once, was that the labs were not organized as well as the traditional labs and they were not long enough to work through all of the material. The use of weed science principles and techniques to help educate plant physiology lab students is worthy of future research and refinement. This research was part of Fellowships in Research and Science Teaching (FIRST) a three-year post-doctoral experience integrating diversity to train young scientists in research and teaching. Supported in part by a grant from the NIH, NIGMS(MORE division) GM00680-01A1.

WEEDS OF THE U.S. AND CANADA DVD-ROM VERSION 3.0 UPDATE. M.S. DeFelice and C.T. Bryson; Pioneer Hi-Bred International, Johnston, IA 50131 and USDA-ARS Southern Weed Science Research Unit, Stoneville, MS 38776.

ABSTRACT

The next version of the Southern Weed Science Society's interactive weed identification software (Version 3.0) is nearing completion and should be available by August of 2004. The program provides lessons and exercises on the principles of weed and plant identification and a database of photographs and descriptions of over 420 weed species common to the continental United States, Canada, and Alaska. The software program targets colleges and universities, high schools, extension, government agencies, horticulturalists, botanists, gardeners, and the agricultural industry to provide a premier reference and teaching tool on plant and weed identification.

Version 3.0 of the software is a major upgrade and overhaul of the entire program. The resolution of the program was increased from 640 x 480 pixels to 1024 by 768 pixels in size. Video color depth requirements were increased from 256 to 16 million (24-bit) colors. This required rebuilding the entire program including re-editing and importing all 2,200 + photographs, upgrading and re-importing all illustrations, and rebuilding all of the interface elements of the program. Every screen had to be resized and rebuilt. The photographs and illustrations are now much larger, brighter, higher resolution, and have much better color and detail than before. This alone took over two years to complete. Content upgrades include the addition of over 60 new weed species photographed by Arlyn Evans, review and updates to the distribution maps and descriptions for all 420+ weed species as needed, addition of nine new "World of Weeds" articles, and further expansion of the illustrated glossary. A complete database driven key to the plant families and all weed species in the program has been added to the existing grass key. The grass key has also been upgraded to include more search criteria.

Expansion of the program requires that Version 3.0 will be provided on DVD-ROM to accommodate the almost 3 GB of files. The program will require a computer with a Pentium processor, 256 Mb of RAM, DVD-ROM drive, audio card, 1024 x 768 resolution graphics with 24-bit color, and will run on Windows 98 Second Edition, Windows Me, Windows 2000, or Windows XP (versions of Windows that support DVD-ROM drives.) Version 3.0 of the SWSS weed identification software continues to be the premiere reference and teaching tool for weed and plant identification. A hallmark of the software is the depth of information and consistent quality of a full span of growth stage photographs from seed to flower provided for each weed. The interactive tutorial section on plant identification continues to be one of the finest teaching and training tools on plant identification available for students and professionals. Version 3.0 continues the SWSS Weed Identification committee's long commitment to provide the highest quality weed identification resources on the market.

SECTION X. INVASIVE SPECIES

A NEW BOOK ON "NONNATIVE INVASIVE PLANTS OF SOUTHERN FORESTS: A FIELD GUIDE FOR IDENTIFICATION AND CONTROL". J.H. Miller, USDA Forest Service, Southern Research Station, Auburn University, AL.

ABSTRACT

Invasions of nonnative plants into forests of the Southern United States continue to go unchecked and unmonitored. Invasive nonnative plants infest under and beside forest canopies and dominate small forest openings, increasingly eroding forest productivity, hindering forest use and management activities, and degrading diversity and wildlife habitat. Often called nonnative, exotic, nonindigenous, alien, or noxious weeds, they occur as trees, shrubs, vines, grasses, ferns, and forbs. This book provides information on accurate identification and effective control of the 33 nonnative plants and groups that are currently invading the forests of the 13 Southern States, showing both growing and dormant season traits. It lists other nonnative plants of growing concern as well as provides control strategies, and gives selective herbicide application procedures. To request free printed copies of this book email "pubrequest@srs.fs.usda.gov" or call 828-257-4830, and ask for GTR-SRS-62, Revised 2003. Copies can be requested by mail from: Southern Research Station Publications, 200 W.T. Weaver Blvd., P.O. Box 2680, Asheville, NC 28802.

This book can also be viewed and downloaded from three websites for further self-instruction and instruction of others at:
http://www.srs.fs.usda.gov/pubs/viewpub.jsp?index=5424
http://www.srs.fs.usda.gov/fia/manual/exotic_pest_plants.htm
and an HTML format at http://www.invasive.org/weeds/

A set of Power Point presentations is available also for download at http://www.invasive.org/weeds/ppt/program.html. These presentations cover overviews of the problem, integrated vegetation management strategies, and tools; and then provide modules that follow the book on identification and control of the 33 species and groups.

Integrated vegetation management programs are needed to combat invading nonnative plants. Strategies of surveillance and treatment of new arrivals will safeguard lands, and reclamation of existing infestations can be achieved by concerted control measures and reestablishment of native vegetation.

EMERGENCE PATTERNS OF TROPICAL SPIDERWORT (*COMMELINA BENGHALENSIS*) IN COTTON. T.M. Webster USDA-ARS, Tifton, GA; A.S. Culpepper, T.L. Grey, and J.T. Flanders, University of Georgia, Tifton; and M.G. Burton and A.C. York, North Carolina State University, Raleigh.

ABSTRACT

Tropical spiderwort is a Federally noxious, exotic, invasive weed that has rapidly become one of the most troublesome weeds in Georgia. As recent as 1998, tropical spiderwort was not considered among the most significant cotton weeds, while it is currently the most troublesome cotton weed where it occurs. Contributing to the significance of tropical spiderwort, is its relative tolerance to glyphosate. With 90% of the Georgia cotton acreage planted with Roundup-Ready varieties, tropical spiderwort poses a serious threat to cotton production in Georgia and throughout the Cotton-Belt. Preliminary studies indicate that optimal temperatures for tropical spiderwort growth are between 86 and 95 F, with a base temperature for growing degree-day accumulation of 68 F (same as cotton). Studies were conducted to: 1) determine the length of soil-residual control of tropical spiderwort that can be expected from several common herbicides used in cotton and 2) evaluate the emergence patterns of tropical spiderwort in relation to environmental cues.

Studies were conducted in Georgia and North Carolina. Cotton (DP 555B/RR) was planted 30 April 2003 and 7 May 2003 at two sites near Cairo, Grady County, Georgia in 2003. Herbicides were applied with a CO_2-pressurized backpack sprayer equipped with flat fan nozzles calibrated to deliver 140 L/ha at 4.8 km/hr. Treatments included a nontreated control, *S*-metolachlor at 1.1 kg ai/ha and 1.6 kg/ha, flumioxazin at 0.36 kg ai/ha and 0.71 kg/ha, pyrithiobac at 0.048 kg ai/ha, diuron at 1.1 kg ai/ha, prometryn at 1.1 kg ai/ha, clomazone at 0.8 kg ai/ha, norflurazon at 1.6 kg ai/h, fluometuron at 1.1 kg ai/ha, and norflurazon at 1.1 kg/ha + fluometuron at 1.1 kg/ha. Plots were 7.6 m long and 4 rows wide (rows space 0.76 m apart), and treatments arranged in a RCBD with 4 replications. A similar study to monitor tropical spiderwort emergence was initiated 30 April 2003 in North Carolina, but no crop was planted. In Georgia, the number of newly emerged tropical spiderwort plants was quantified between the first and second row of each plot using four-0.25 m^2 quadrats. In North Carolina, the entire plot was monitored for emergence due to the small tropical spiderwort population. After tropical spiderwort seedling populations were quantified, the areas were hand-hoed to remove all weeds. The process was repeated each week between planting and cotton canopy closure in middle July in Georgia and through November in North Carolina. Environmental parameter measured included soil temperature, rainfall, and soil moisture. The Georgia sites used for this study had very high populations of tropical spiderwort, a total of 454 and 1,762 tropical spiderwort/m^2 emerged over the course of the season. The North Carolina site averaged 15 tropical spiderwort/m^2, but sampled nearly 8000 plants over the course of the season.

Only five herbicide treatments (both *S*-metolachlor, both flumioxazin, and prometryn) reduced tropical spiderwort emergence relative to the nontreated control. *S*-metolachlor was the most successful treatment for suppressing spiderwort emergence, reducing emerged spiderwort seedlings to <50% of the nontreated control. Flumioxazin was the next best treatment, reducing spiderwort emergence to <69% of the nontreated control. Prometryn (88%) was the only other herbicide that had less than the nontreated control (100%), all other treatments ranged from 103 to 125% of the nontreated control.

Being a sprawling, low-growing plant, we suspect that tropical spiderwort emergence will be suppressed once cotton canopy closure occurs (personal observation). Overall reduction in tropical spiderwort population will require an integrated management strategy, including growing a competitive crop and using tools that will delay weed emergence until the crop forms a canopy. Therefore, the influence of each of these herbicides in delaying a particular level of tropical spiderwort emergence was evaluated. The number of growing degree days (GDD) at which 20% of the season-long tropical spiderwort in the nontreated control emerged (91 and 352 tropical spiderwort seedlings/m^2 at the two locations, respectively) is referred to as the E_{20}.

In the nontreated control, E_{20} occurred at the 4.7-leaf stage in cotton. By comparison, *S*-metolachlor applied at 1.1 and 1.6 kg/ha delayed E_{20} by greater than 4 cotton-leaf stages, to the 8.9-leaf and 10.5-leaf stages, respectively. Similarly, flumioxazin delayed E_{20} by a full cotton-leaf stage, to the 5.8 leaf stage. All other treatments had E_{20} values similar to the nontreated control.

In Georgia, there was a sigmoidal relationship between tropical spiderwort emergence and GDD (T_b=20C) (R^2=0.98). During the first month of the growing season tropical spiderwort emergence was relatively small; approximately 20% of the season's total tropical spiderwort emergence occurred during the first month, while cotton grew to nearly the 5-leaf stage. However, of the total tropical spiderwort population to emerge over the course of the season, 64% emerged between June 4 and June 24. In North Carolina, tropical spiderwort emerged throughout the entire season, as the area was not limited by the shade of a crop canopy. Though tropical spiderwort emergence patterns were quite dissimilar between North Carolina and Georgia, the estimated number of growing degree-days for median germination (E_{50}) was 330 GDD in North Carolina and 350 GDD in Georgia.

TROPICAL SPIDERWORT IN NORTH CAROLINA: A CASE FOR CONTAINMENT OR ERADICATION? M.G. Burton and A.C. York; Department of Crop Science, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

In the fall of 2001 the federal noxious weed tropical spiderwort (*Commelina benghalensis*) was positively identified in <2 ha of a research field at the Center for Environmental Farming Systems (Cherry Research Farm) in Wayne County, NC. Heightened awareness and increased scouting efforts identified several other populations in conventional, organic, grazing areas, and agroforestry research and production fields in 2002. Intensive surveys conducted in 2003 identified a total of 45 ha that have various levels of tropical spiderwort infestation. No other infestation sites are known in NC. Because tropical spiderwort distribution has increased explosively in other states (most notably Georgia, where infestations originally believed to be isolated to a few thousand hectares in a few counties in 1998 grew to an estimated 70,000 ha affected in 43 GA counties in 2003), university scientists, farm and state department of agriculture administrators, and commodity groups have expressed great concern for the containment or eradication of this weed from NC.

Under what circumstances does a state decide to quarantine or eradicate an invasive weed? As an herbicide tolerant weed, tropical spiderwort represents one of many taxa that could have devastating effects on agriculture, ecosystem integrity, or cause other economic or human injury. Biological factors of consideration for a given agricultural site include:

Effectiveness of alternative weed controls
Phenological capabilities
Degree of competition or interference
Dispersal mechanisms/Phytosanitary control

In the case of tropical spiderwort, few effective cotton herbicides exist. Alternative mechanical control methods are believed to spread propagules (stems, rhizomes, and seeds), and survival of cut stem pieces on the soil surface or partially buried can exceed 50%. In North Carolina, tropical spiderwort emergence ranged from the first week of May through the end of October – leaving a season-long window of opportunity for germination and growth in open canopies such as cornfields (during drying and after harvest), or cotton. Season long dense canopies, such as those provided by narrow-row soybean are believed to strongly reduce germination. Under optimal growth conditions in controlled environments, tropical spiderwort flowered and produced dehiscing fruit in 45 d. Time from flowering to fruit dehiscence was only 14 d. Dispersal by equipment is believed to be the chief means of movement. Tillage, mowing and harvesting operations can move plant parts and seeds (or plant parts containing seeds) between fields. Plant material clinging to cotton harvesting equipment may be a principal means of movement and new field contamination. Seed movement by wind and water (e.g. erosion, flooding, hurricanes, etc) are likely. Phytosanitary procedures associated with organic production fields (equipment is only used in organic areas or is washed prior to use) are believed to have thus far prevented their infestation. However, the lack of wash stations or "wash in" / "wash out" policies at most research farms leaves them susceptible to the introduction of tropical species.

THE EFFECTS OF IMAZAPYR RESIDUE ON SELECTIVE REVEGETATION AFTER INITIAL COGONGRASS CONTROL. M.C. Barron, G.E. MacDonald, B.J. Brecke, and D.G. Shilling; Department of Agronomy, University of Florida, Gainesville, FL, 32611; West Florida Research and Education Center, Jay, FL, 32565; Mid-Florida Research and Education Center, Apopka, FL, 32703.

ABSTRACT

Cogongrass [Imperata cylindrica (L.) Beauv.], a rhizomatous perennial grass, is a serious pest in many areas and situations, covering over 500 million acres throughout the world. Cogongrass has and continues to spread rapidly throughout the southeastern U.S., covering several thousand acres in Florida, Mississippi, and Alabama. Current control strategies often involve burning and herbicide application, often with little or no long-term impact. This weedy species has an extensive rhizome system that allows for persistent regrowth and spread. Desirable native species are threatened by cogongrass because of their inability to compete directly with the weed. However, it may be possible to suppress cogongrass regrowth by introducing native plants after initial chemical control measures have been employed. Therefore, the objective of this research was to monitor cogongrass re-infestation and native plant recruitment in cogongrass treated areas.

Two large cogongrass-infested areas (minimum of 5 acres each) were equally divided into 4 (2000) or 8 (2001) replications. These were treated in the fall of each year following a late summer burn, with imazapyr at 0.75 lbs-ai/A or glyphosate at 3.0 lbs-ai/A. In the area treated in 2000, 25 random soil samples (4-inch diameter, 8-inch depth) were taken from each replication 3 years following initial treatment. Each soil sample was divided into three categories based on proximity to cogongrass: 1) no cogongrass within 2 feet, 2) cogongrass within 2 feet, and 3) cogongrass present. In addition, the presence of native species was noted for each sample. Data was analyzed using ANOVA and means separated using Fisher's LSD procedure at $p<0.05$. For either herbicide treatment, there was no significant difference in overall cogongrass control or the density of the 3 most common native species – dogfennel (*Eupatorium capillifolium*), broomsedge (*Andropogon virginicus*), and saltbush (*Baccharis halimifolia.*) Both glyphosate and imazapyr treatments had approximately half of all samples not within 2 feet of cogongrass (52 and 56%, respectively.) Of these samples, less than 2% contained rhizomes, with dry weights less than 0.20 g. Samples taken from either herbicide treatment were within 2 feet of cogongrass plants 38% of the time. Approximately half (45% glyphosate, 49% imazapyr) of the samples contained rhizomes with dry weights of 0.9 g and 0.38 g for glyphosate and imazapyr. Only 9 and 6% of glyphosate and imazapyr samples, respectively, were classified as being within a cogongrass patch. All of these samples contained rhizomes, with average weights of 2.2 g and 2.0 g, respectively. This data suggests that the continued growth and spread of cogongrass after treatment in 2000 was due to spread from patches remaining from initial control rather than dormant rhizomes. The area treated in fall 2001 was planted in slash pine in early December 2003. Visual evaluations of cogongrass control and pine injury were taken one month after planting. There was 37% or 88% cogongrass control in glyphosate or imazapyr treated areas, respectively. There was no visible injury to the pines in either treatment.

EVALUATION OF SEED DEVELOPMENT OF COGONGRASS [*Imperata cylindrica* (L.) Beauv.] USING PLANT GROWTH REGULATORS. K.D. Burnell, J.D. Byrd, Jr., P.D. Meints, and B.S. Peyton. Mississippi State University, MS 39762.

ABSTRACT

Cogongrass [*Imperata cylindrica* (L.) Beauv.] is a rhizomatous, perennial, grass introduced into the United States in the early 1900's accidentally and intentionally from tropical and subtropical areas of the eastern hemisphere. It is considered a weed in 73 different countries in 35 different crops as different as tomatoes and coconuts and covers several thousand ha in the southern U.S., and worldwide over 500 million ha. Consequently, it is considered the world's seventh worst weed. Cogongrass spreads by rhizomes and seed. Reducing the spread of seeds of cogongrass with plant growth regulators would be an important step in the fight to stop the spread of cogongrass.

For this reason, two field studies were conducted during 2003 at two locations in Hurley and Oswalt (southern) Mississippi to evaluate efficacy of plant growth regulators (PGR) applied at various phenological stages in reducing seedhead production and seed germination. A factorial arrangement was used with stage of application as one factor and chemical treatment as the other in either a 4 by 6 structure for test 1 or a 4 by 5 structure for test 2. Treatments were arranged in RCB with three replications and plots size was 2.4 by 6.1 m, respectively. Applications were based on Haun's scale of phenological development and stages consisted of dormant (March 11th), dormant to joint (March 21th), joint to boot (March 28th), boot to seedhead emergence (April 11th), and seedhead emergence to anthesis (April 17th), respectively. All treatments were applied using a CO_2 pressurized backpack 4-nozzle boom sprayer delivering 187 L/ha at 138 kPA to foliage ranging from 75 to 100 cm tall. Treatments for test 1 included Primo 1EC (trinexapac-ethyl) at 6.4 L/ha, Oust 75DG (sulfometuron methyl) at 0.10 kg ai/ha, Plateau 2AS (ammonium salt of imazapic) and Select 2EC (clethodim) both at 0.28 kg ai/ha + 0.25% V/V (NIS) with Plateau and + 1% V/V COC with Select, glyphosate in the form of Roundup Pro 4L (isopropylamine salt) at 0.42 and 0.84 kg ae/ha, and an untreated check. Applications for test 1 were made at dormant to joint, joint to boot, boot to seedhead emergence, and seedhead emergence to anthesis, respectively. Treatments for test 2 included Arsenal 2AS (imazapyr) and Plateau at 0.28 kg ai/ha + 0.25% V/V (NIS), Select at 0.14 kg ai/ha + 1% V/V COC, glyphosate at 0.42 and 0.84 kg ae/ha, and an untreated check. Applications for test 2 were made at dormancy, joint to boot, boot to seedhead emergence, and seedhead emergence to anthesis, respectively. Seedhead reduction was based on 0-100% scale, with 0 representing no seedhead reduction and 100 representing total seedhead reduction and ratings were taken weekly from April 25th, through May 15th. Seedheads were collected May 1, 7, and 15th for standard germination, percent fill, and seedhead length measurement. No germination tests could be competed due to numerous seed borne diseases. Analysis of variance was conducted using PROC MIXED, with mean separation using Fisher's Protected LSD at a significance level of 0.05.

Results for test 1 indicated that when averaged over application timings, seedhead production was reduced 88% by both glyphosate rates or 93% by both (0.28 kg ai/ha) imazapic and clethodim, while trinexapac-ethyl and sulfometuron methyl reduced seedhead production 72 and 76%, respectively. Both glyphosate rates, imazapic and clethodim all provided between 97 to 100% seedhead reduction when applied at joint to boot or boot to seedhead emergence. In addition, clethodim at 0.28 kg ai/ha + 1% V/V COC provided 97% seedhead reduction when applied at joint stage, while imazapic provided 95% seedhead reduction when applied at seedhead emergence to anthesis. Applications at joint to boot or boot to emergence provide the highest level of seedhead reduction at about 95% for either timing when averaged over all chemicals. Results for test 2 indicated, when averaged over application timings for seedhead production, no treatment provided above 80% seedhead reduction. Both glyphosate rates achieved about 75% seedhead reduction, while imazapic and imazapyr reduced seedhead production by 64 and 62%, respectively. Clethodim at 0.14 kg ai/ha + 1% V/V COC did not provide above 65% seedhead reduction regardless of application time, and suggested that the 0.14 kg ai/ha rate was not adequate. Applications to dormant cogongrass were optimal with

imazapyr, glyphosate(s), and imazapic all providing between 84 to 97%. No other chemical applied at any other timing provided above 80% control.

Data from these studies suggest that 1) clethodim rate of 0.14 kg ai/ha + 1% V/V COC is not adequate for seed head reduction, 2) imazapic (0.28 kg ai/ha + 0.25% NIS), glyphosate (at 0.42 and 0.84 kg ae/ha), and clethodim at 0.28 kg ai/ha + 1% V/V COC reduce seedhead production equally well when applied between jointing seedhead emergence, 3) applying imazapic (0.28 kg ai/ha + 0.25% NIS), glyphosate (at 0.42 and 0.84 kg ae/ha), and/or clethodim at 0.28 kg ai/ha + 1% V/V COC from dormancy to boot stage to seedhead emergence will provided acceptable levels of seedhead reduction for cogongrass.

ADAPTATION AND BIOLOGY OF SERICEA LESPEDEZA. R.L. Farris, D.S. Murray, M.P. Anderson, and P. Yerramsetty. Department of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK 74078.

ABSTRACT

Sericea lespedeza (Lespedeza cuneata) is a very aggressive invasive species and an increasing problem in Oklahoma and many other states due to it's ability to out-compete native vegetation. Sericea lespedeza's natural spread into new areas of the country is enhanced by the fact it is still grown as a forage species and for commercial seed production. Sericea lespedeza is a summer perennial legume with typically seed yields of 230 to 1140 kg/ha and is not only able to reproduce from seed but vegetatively from perennial crown bud regrowth. Control with herbicides has varied and it is hypothesized that sericea lespedeza may vary broadly from region to region in the U.S. and this, in part, may account for the differing control results. One objective of this experiment was to determine if DNA amplification fingerprinting (DAF) with polyacrylamide gel electrophoresis (PAGE) is a useful technique for the detection of genetic variation of sericea lespedeza obtained from Oklahoma, other U.S. states, and a China source. The other objective was to determine if the genetic relationships could explain the regional variation in herbicide control results. DNA amplification fingerprinting with polyacrylamide gel electrophoresis was used to investigate the genetic variation of sericea lespedeza from Oklahoma, other U.S. states, and a China source. Sericea lespedeza seed representing various states and genetically improved accessions were obtained from various commercial seed companies, the U.S.D.A Plant Genetic Resource Conservation Unit, and hand collections. These were grown under greenhouse conditions to obtain leaf material for DNA extraction. Four DAF primers were used in polymerase chain reaction (PCR) in order to amplify the DNA. Bands on the PAGE gel were visualized by SYBR 1 Gold staining and the four primers amplification patterns were combined to produce a dendrogram. Two unique accessions and fifteen related accessions of sericea lespedeza were observed with this method. Three distinct groups were identified from the fifteen related sericea lespedeza accessions. They were as follows: five were collected in or near Oklahoma, four accessions are in a genetically improved group, and six are in a group of accessions collected from different states. These groupings are not absolute; therefore there are both subtle differences and similarities among these groupings. DNA amplification fingerprinting (DAF) with polyacrylamide gel electrophoresis (PAGE) is a useful technique for the detection of genetic variation of sericea lespedeza. These results may provide possible reasons for differing responses to control strategies, growth, or developmental characteristics of sericea lespedeza.

SECTION XI. APPLICATION TECHNOLOGY

COMPATIBILITY OF CLETHODIM AND SETHOXYDIM FORMULATIONS WITH OTHER AGRICHEMCIALS. D. Jordan and S. Hans, Department of Crop science, North Carolina State University, Raleigh.

ABSTRACT

Efficacy of three formulations of clethodim (Select 2EC, Arrow 2EC, V-10139 1.6EC) and two formulations of sethoxydim (Poast 1EC, Poast Plus 1.5EC) were compared in various experiments either alone or with several agrichemcials generally applied to peanut. Agrichemicals were applied in 20 gallons water per acre using hollow cone nozzles. Crop oil concentrate at 1.0% (v/v) was included with all treatments. Visual estimates of percent annual grass control were determined 2 to 4 weeks after application. In one set of experiments, imazapic (Cadre), acifluorfen plus bentazon (Storm), Chlorothalonil (Bravo Weather Stik), and pyraclostrobin (Headline) reduced control of large crabgrass and broadleaf signalgrass by Select 2EC, Arrow 2EC, and V-10139 1.6EC similarly regardless of application rate (0.094 and 0.125 lb ai/acre of clethodim). Tebuconazole (Folicur) did not affect control by clethodim regardless of rate or formulated product. In a separate experiment, large crabgrass control by all formulations of clethodim and sethoxydim was reduced by Headline; the magnitude of reduction was greater for sethoxydim formulation than for clethodim formulations.

HERBICIDE DRIFT DETECTION USING REMOTE SENSING. N.W. Buehring, D.B. Reynolds, L.T. Barber, and J.C. Sanders. Mississippi State University, Mississippi State, MS.

ABSTRACT

In the past few years, problems with herbicide drift have increased. After a spray drift event occurs, producers are often faced with the difficult decision of whether to terminate the crop and replant or keep the crop in production. Previous research indicates that visual injury estimates and plant height reductions do not strongly correlate to yield losses from sublethal applications of non-target herbicides in cotton (*Gossypium hirsutum*). The objective of this research was to investigate the possibility of using multi-spectral images for detecting and monitoring herbicide spray drift in cotton. This experiment was conducted at the Black Belt Branch Experiment Station in Brooksville, MS. A field (4.7 hectares) was planted with cotton 'Stoneville 4691B' on May 1, 2002. The field was then sub-divided into 0.07 hectare grids. At the pin-head growth stage, a simulated drift event from bromoxynil was imposed across the field. Applications were made at high concentrations on one corner of the field and applied at decreasing rates to form a concentration gradient across the field. Bromoxynil rates of 0.28, 0.14, 0.07, 0.04, 0.02, or 0.00 kg ai/ha were assigned to individual grids. Nine days after application, a multi-spectral image was taken of the entire field and visual injury ratings were taken at the center of each grid. Before harvesting, percent open bolls was recorded for each grid cell. Areas having a high number of unopened bolls were indicative of delayed maturity due to herbicide injury. Seed cotton yield was taken from 24 m^2 at the center of each grid. The image was analyzed by three different methods: unsupervised classification (computer decision model), supervised classification (using training areas), and normalized difference vegetative index (NDVI). Injury ratings, percent open bolls, and yield from the grid centers were interpolated across the field using ArcMap (inverse distance weighted, power = 4, nearest neighbor = 4).

Unsupervised and supervised classification resulted in an overall accuracy of 73 and 69% for classifying bromoxynil rate. An unsupervised classification method resulted in accuracies of 39 to 79% for classifying bromoxynil rates of 0.02 to 0.28 kg ai/ha. This method resulted in a 94% accuracy of identifying untreated areas. A supervised classification method resulted in accuracies of 38 to 82% for classifying bromoxynil rates of 0.02 to 0.28 kg ai/ha. This method resulted in a 95% accuracy of identifying untreated areas. NDVI also provided a good indication of injury across the field. Higher rates of bromoxynil corresponded to higher visible injury ratings, lower percent bolls open, and lower seed cotton yield.

The supervised or unsupervised classification method resulted in a 94 to 95% accuracy of identifying the untreated area. Errors in classification were most often associated with trying to differentiate rates rather than identifying areas where a drift event had occurred. Differentiation among rates was not as good because it appears that the effect of the herbicides on reflectance was similar, regardless of rates. This would indicate that there is a great potential for using multi-spectral images to identify herbicide drift. Further research will be needed to determine the correlation between reflectance and potential yield losses.

DIFFERENTIATION OF WEED AND CROP SPECIES UTILIZING VEGETATIVE INDICES AND BEST SPECTRAL BANDS. L.T. Barber, D.B. Reynolds, J.C. Sanders, N.W. Buehring, M.T. Kirkpatrick and J.J. Walton. Mississippi State University, Mississippi State, MS.

ABSTRACT

Site-specific crop management is becoming increasingly popular. Growers are beginning to utilize crop reflectance information from aerial imagery to schedule plant growth regulator and defoliant applications in cotton. By managing cotton on a site- by- site basis, growers can reduce chemical costs and decrease the number of trips across the field. Currently, aerial platforms that provide imagery do not have the proper resolution or band width to correctly identify and separate weed species from the crop. The purpose of this study was to identify the best spectral bands and/or vegetation indices to correctly identify and separate weed and crop species.

Experiments were conducted at the Plant Science Research Center at Starkville MS, to evaluate the use of plant reflectance data to differentiate crop and weed species. The experiments were designed as a randomized complete block with 4 replications and repeated two years. Velvetleaf (*Abutilon theophrasti)*, redroot pigweed (*Amaranthus retroflexus*), johnsongrass (*Sorghum halepense*), broadleaf signalgrass (*Brachiaria platyphylla*), cotton (*Gossypium hirsutum*), and corn (*Zea mays*) were planted in 16 m^2 plots. Planted species were maintained free of other species and hyperspectral data were taken on two week intervals with an Analytical Spectral Device. Spectral data were taken from 350 to 2500 nanometers (nm) and the best band combinations were selected by HyperSpec, a program developed by Mississippi State University engineers. The best spectral bands for classification were selected by HyperSpec through supervised classification methods using a Best Spectral Band feature extraction and a nearest neighbor classifier. The top ten bands (710, 714, 716, 717, 720, 769, 772, 774, 1732, and 1741 nm) selected by HyperSpec were analyzed further in SAS and reduced to 8 spectral bands. These bands, along with vegetation indices, were further analyzed through stepwise and linear discriminate analysis. The vegetation indices were calculated from discrete bandwiths corresponding with available airborne sensors. Bands selected were: Blue 440 to 460 nm; Green 540 to 560 nm; Red 640 to 660 nm; and Near Infrared 840 to 860 nm. The following vegetation indices were computed: Normalized difference vegetation index (NDVI); Green normalized difference vegetation index (NDVIg); Global Environmental Monitoring Index (GEMI); Near Infrared (NIR); Ratio Vegetation Index (RVI); Anthocyanin Reflectance Index (ARI); Plant Sensing Reflectance Index (PSRI); Visibile Atmospherically Resistant Index (VARI); Chlorophyll Fluorescence Ratio (CF_685); and Chlorophyll Fluorescence Ratio (CF_735).

The computed indices and band widths were evaluated with a linear discriminant analysis technique, to categorize the dependent variable utilizing cross-validation procedures. Classifications from the 8 best spectral bands and 10 vegetation indices were compared collectively and separately. The highest classification of broadleaf signalgrass, johnsongrass, corn, cotton, pigweed and velvetleaf at 3 weeks after plant emergence (WAE) was accomplished by combining the 8 best spectral bands and the 10 vegetation indices which resulted in 85, 86, 97, 94, 97 and 93% respectively, in 2002. While the 8 best spectral bands alone provided decreased classification of 60, 75, 86, 85, 75, and 69% respectively. In 2003 the results were similar in that a combination of both indices and best spectral bands provided the highest classification accuracies (92, 83, 88, 100, 97, and 100%, respectively) and a similar decrease was noted when the 8 best spectral bands or vegetation indices were analyzed separately. Classification accuracies were unchanged by 5 WAE with the exception of corn, which decreased in classification to 83% in 2002. Spectral profiles were also grouped over both years (2002 and 2003) and 3 sampling timings (3, 5 and 7 WAE). The results indicate an overall decrease in classification; however, the combination of vegetative indices and 8 spectral bands maintained the highest species classification of 74, 75, 60, 90, 84 and 85% of broadleaf signalgrass, johnsongrass, corn, cotton, pigweed and velvetleaf, respectively. These data indicate that best spectral bands for plant species classification can be identified and reduced to a viable number to determine ranges needed on multispectral or hyperspectral aerial platforms. These ranges

could further be developed into vegetation indices to aid in weed and crop species classification and differentiation.

AERIAL IMAGERY FOR SITE-SPECIFIC HERBICIDE APPLICATIONS IN SOYBEAN.

J.W. Easley, D.R. Shaw, and C.J. Gray. Department of Plant and Soil Sciences, Mississippi State, MS 39762.

ABSTRACT

Production practices employed in agriculture must be cost-effective and user-friendly. As costs associated with production rise, more economical methods of production are being evaluated. An example is site-specific technology. Site-specific applications of pesticides have been successful using current technology but can be difficult to implement. Data acquisition is the primary hindrance for this technology. The collection of data for a site-specific application is a very labor intensive, time consuming, and expensive process. As a result, producers are looking for additional data collection methods which give accurate economical data that can be used to make a site-specific application. Remotely sensed aerial imagery is one possibility for data collection concerning locations of specific weed populations.

Research was conducted on multiple soybean fields in eastern Mississippi in 2002 and 2003. Data were collected by overlaying a 0.25-ha grid on each field, and sampling at the center of the grid. At each sample location, weed counts were recorded on all weeds present in a 10-m^2 area. Additionally, weed and crop size, and field conditions were recorded. Aerial imagery of each field was also obtained, within 5 days of sampling. The imagery contained 0.5-m multispectral data collected in the green, red, and near-infrared regions of the electromagnetic spectrum. ERDAS Imagine, ArcGIS, and SSToolbox were used to process the imagery for the generation of prescription spray maps. Supervised and unsupervised classifications, as well as NDVI's, were used to build prescription maps. These prescription maps were then compared to the grid-sampled data, and actual herbicide recommendations to determine the prescription map's accuracy.

Aerial imagery was successfully used to detect weeds and build site-specific prescription maps. Classification accuracies for distinguishing weeds from soybean ranged from 63 to 90% over the two years. Additionally, prescription spray maps generated for the fields showed areas equal to 53 and 52% of the fields required no herbicide spray in 2002 and 2003, respectively. Therefore, it appears that aerial imagery is a viable tool to be used to help locate areas of weed infestation within production fields.

SPECIES DIFFERENTIATION USING HYPERSPECTRAL REMOTE SENSING

D.M. Dodds, D.R. Shaw, L.T. Barber, J.W. Barnett, N.W. Buehring, K.D. Burnell, C.J. Gray, K.C. Hutto, F.S. Kelley, C.T. Leon, C.H. Koger, D.B. Mask, W.G. Powell, J.C. Sanders, and M.L. Tagert; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State.

ABSTRACT

Extensive previous research has shown that weeds are not uniformly distributed across a field, but are aggregated into patches. However, producers generally make broadcast weed control applications to all areas of an infested field, resulting in excess herbicide use and cost to the producer. Site-specific herbicide applications have the potential to save producers money by reducing input costs, decreasing time in the field, and lowering the amount of pesticide released into the environment. The goal of this research is to incorporate remote sensing technologies into production agriculture in order to develop an on-the-go, site-specific sprayer.

Hyperspectral data previously collected at MSU was located and compiled for this study. Hyperspectral measurements were collected from 350-2500 nm in the electromagnetic spectrum using a hand-held spectroradiometer on more than 50 species located throughout Mississippi. Feature extraction techniques using customized software (Hyperspec) recently developed at MSU, as well as traditional statistical methods, were employed for species differentiation.

Hyperspec selected eight spectral wavelengths ranging from 994 to 1046 nm in the near infrared region of the electromagnetic spectrum as the most important for species differentiation in this dataset. Overall classification accuracy using the Hyperspec program was 42%. Hyperspec was successful at classifying hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. ex A.W.Hill.] 95%, kudzu [*Pueraria lobata* (Willd.) Ohwi] 75%, and dubbs soil 86% of the time. However, classification accuracies were generally inadequate. Poor classification accuracy makes it difficult to use broad scale reflectance values for species identification. Remote sensing systems may need to be trained to look for certain weed species within a given crop. Results of this research indicate that classification parameters need to be further refined in order to implement this technology.

SECTION XII. SOIL AND ENVIRONMENTAL ASPECTS OF WEED SCIENCE

SOIL MOBILITY OF FOUR PESTICIDES IN ACTIVELY GROWING AND DORMANT BERMUDAGRASS VS FALLOW SYSTEMS. H.D. Cummings, F.H. Yelverton, J.B. Weber, and R.B. Leidy; Crop Science Department, North Carolina State University, Raleigh, NC 27695-7620.

ABSTRACT

Regulatory issues of pesticides based on the downward movement of pesticides in traditional agricultural systems may not be appropriate for turf systems. In turf, pesticides are rarely applied to bare soil, and a lower fraction of pesticides reaches soil as a portion is intercepted by the turf canopy. Some pesticides are absorbed and metabolized by turf. The thatch layer contains high levels of organic matter which can bind pesticides. The thatch layer also contains diverse microbial populations which degrade pesticides. If the fate of pesticides in turf were better understood, management plans that preserve their use may be implemented. Thus, the objective was to compare the downward movement of pesticides in a turf system to movement in a fallow system in times of rapid growth and dormancy.

At the Sandhills Research Station in NC, 580 m^2 was fumigated with methyl bromide in May 2001. The native soil in this area has a high sand content (92% sand) which is conducive to leaching experiments. In a split-plot design, two replications of soil column lysimeters 15 cm in diameter and 91 cm long were driven into fallow soil and established 'Tifway' bermudagrass. Imazaquin, prodiamine, pronamide, and simazine were applied during times of rapid growth and dormancy at 0.56, 0.56, 1.7, and 2.2 kg ai/ha, respectively, in July and November 2001 and 2002. In November 2001 and 2002 and April 2002 and 2003 (120 days after application), the lysimeters were removed and divided into the following depth increments: 0-2, 2-4, 4-8, 8-15, 15-30, 30-45, 45-60, 60-91 cm. The residues were extracted and analyzed for parent material by gas chromatography.

The fate of pesticides is determined by their persistence and soil binding affinity. In general, more movement and greater concentrations were reported in winter for both systems. Pesticides tended to stay in the thatch layer (0-4 cm) in the turf system and distribute more uniformly in the 0-15 cm region in the fallow system. However, prodiamine was detected consistently in the 0-4 cm region in summer and winter 2001 and 2002 in both systems. Concentrations in the bermudagrass system may be greater in winter than summer because the bermudagrass is dormant and not absorbing and metabolizing pesticides. In addition, pesticides may be immobilized by the organic matter in turf and not available to microorganisms. Although greater concentrations were reported for some pesticides in turf in winter, there was never greater movement in the bermudagrass system except for a minor amount (9 ppb) of prodiamine in summer 2002. None of the pesticides were detected below 30 cm in either system. The results of this research indicate that pesticides are less likely to move downwardly in the bermudagrass system in summer. In winter, there may be greater concentration in turf, but not more movement. Thus, regulatory issues of pesticides used in turf should be developed using pesticide fate in turf data.

EFFECTS OF GLYPHOSATE ON SYMBIOTIC NITROGEN FIXATION AND YIELD IN GLYPHOSATE-RESISTANT SOYBEAN. R.M. Zablotowicz and K.N. Reddy. USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS 38776.

ABSTRACT

Glyphosate-resistant (GR) soybean [*Glycine max* (L.) Merr.] expressing an insensitive 5-enolpyruvylshikimic acid-3-phosphate synthase (EPSPS) gene has revolutionized weed control in soybean production. GR soybean acreage in the U.S. has steadily increased from 2% of the U.S. soybean acreage in 1996 to 81% in 2003. The soybean nitrogen fixing symbiont, *Bradyrhizobium japonicum*, possesses a glyphosate-sensitive EPSPS enzyme and upon exposure to glyphosate accumulates shikimic acid and hydroxybenzoic acids such as protocatechuic acid (PCA), accompanied with *B. japonicum* growth inhibition and death at high concentrations. This field study continues our laboratories risk assessment of GR soybean examining effects of glyphosate on nitrogen fixation and yield of GR soybean under weed-free conditions.

A 2-yr field study was conducted during 2002-2003 on a Dundee silt clay loam at Stoneville, MS. The experiment was conducted in a randomized complete block design with four replications. Five treatments were glyphosate at 0.84, 1.68, 2.52 + 2.52 and 0.84 + 0.84 kg ae/ha and hand weeded, weed-free plot as a control. Experimental units consisted of 4 rows of soybean spaced 102 cm apart and 12.2 m long. Roundup Ready soybean (AG 4702RR) was planted on April 19, 2002 and April 21, 2003. Glyphosate was applied at 4 WAP (2-3 trifoliate leaf (TF) stage) and 6 WAP (6-7 TF stage). Soybean was flood-irrigated once in 2002 and twice in 2003, following the second glyphosate application. Soybean plants were harvested at seven and five sampling dates in 2002 and 2003 respectively, between 4 and 8 WAP, and roots were assessed for nitrogenase activity (acetylene reduction assay, ARA), respiration and nodulation. Shoot and root biomass were determined at the final vegetative sample and foliar nitrogen content (9-10 TF stage) determined using a CNS analyzer. Soybean was harvested from all 4 rows and yield adjusted to 13% moisture and nitrogen content of soybean seed determined.

Little consistent effect of glyphosate was observed on either nitrogenase activity or root respiration. In 2002, all glyphosate treatments had ARA significantly lower than the control only at 21 days after the first glyphosate application. Root respiration and ARA observed in 2002 were about a third of that in 2003, attributed to water deficit following glyphosate application in 2002. All glyphosate treatments reduced foliar nitrogen content by 26 to 42% in 2002, while three glyphosate treatments reduced foliar nitrogen content by 9 to 14% in 2003. The greatest reduction in foliar N was when glyphosate was applied at the highest rate. Soybean yield compared to untreated control was reduced by 11% by two applications of 2.52 kg ae/ha glyphosate in 2002, but no effect of treatment on seed yield was observed in 2003. Total soybean grain nitrogen harvested was reduced by 32 and 17% compared to untreated soybean respectively, when 2.54 kg ae/ha glyphosate was applied in 2002 and 2003. Soybean seed yield averaged 3369 and 4075 kg/ha in 2002 and 2003, respectively and soybean seed nitrogen content averaged 5.5% and 7.2% in 2002 and 2003, respectively. These studies indicate that nitrogen fixation or assimilation in GR soybean was consistently reduced by high glyphosate applications compared to untreated control under weed-free conditions and the greatest reductions were observed when soil moisture deficit occurred following glyphosate application.

ADSORPTION-DESORPTION AND MINERALIZATION OF ATRAZINE AND ATRAZINE METABOLITES AS RELATED TO MICROBIOLOGICAL AND CHEMICAL CHARACTERISTICS OF VEGETATED FILTER STRIPS AND CULTIVATED SOIL. L.J. Krutz[1], T.J. Gentry[2], S.A. Senseman[1], M.C. Dozier[3], D.W. Hoffman[4], and D.P. Tierney[5]. (1) Department of Soil and Crop Sciences, Texas Agricultural Experiment Station, Texas A&M University System, 2474 TAMU, College Station, TX, (2) Environmental Science Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6038; (3) Department of Soil and Crop Sciences, Texas Cooperative Extension, Texas A&M University System, College Station, TX, (4) Blackland Research Center, Texas Agricultural Experiment Station, Texas A&M University System, Temple TX, (5) Human & Environmental Safety Department, Syngenta Crop Protection, Greensboro, NC.

ABSTRACT

Sorption and mineralization of atrazine and atrazine metabolites have not been evaluated in vegetated filter strip soil (VFS). However, these data are required to determine the effectiveness of vegetated filter strips at reducing the subsequent transport of atrazine and atrazine metabolites to surface and groundwater. Therefore, the objective of this experiment was to compare the sorption and mineralization of atrazine, desethylatrazine (DEA), deisopropylatrazine (DIA), and hydroxyatrazine (HA) between a cultivated Houston Black clay (CS) and an adjacent 12-year-old VFS established in a mixed stand of bermudagrass [*Cynodon dactylon* (l.) Pers.] and buffalograss [*Buchloe dactyloides* (Nutt. Engelm)]. The evaluated chemical and physical properties of the VFS and CS were similar with the exception of a 1.7-fold increase in the organic carbon content of the VFS. Microbial activity, numbers of gram-negative bacteria and total fungi were higher in VFS. Sorption coefficients for atrazine and HA were at least 48% higher in VFS compared to CS. Conversely, sorption coefficients for DEA and DIA were not different between soils. These data indicate that the higher organic carbon content in VFS will likely retard the transport of atrazine and HA to surface and ground water; however, the mobility of DEA and DIA will be similar between soils. Evolution of $^{14}CO_2$ from uniformly ring-labeled atrazine, DEA, and HA was at least 69% higher in CS compared to VFS. Mineralization of uniformly ring-labeled DIA was not statistically different between soils. Enhanced mineralization of atrazine, DEA, and HA in CS was attributed to an enhanced degrader population potentially resulting from 12-years of atrazine application. Thus, under the conditions of this experiment, our data demonstrate that the persistence of atrazine and atrazine metabolites may be longer in VFS compared to adjacent CS.

RICE RESPONSE TO CLOMAZONE AS INFLUENCED BY SOIL TYPE AND PLANTING DATE. J.H. O'Barr, G.N. McCauley, J.M. Chandler; Soil & Crop Sciences Department, Texas A&M University, College Station, TX.

ABSTRACT

Preemergence weed control in rice is an important component of a successful weed control program in rice (*Oryza sativa*). Grasses such as barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] and broadleaf signalgrass [*Brachiaria platyphylla* (Griseb.) Nash] are two of the most predominate species in Texas rice production systems. Clomazone, a carotenoid biosynthesis inhibitor, is a low cost and effective preemergence herbicide that effectively controls these species. However, clomazone has the potential to cause significant rice injury under various edaphic and environmental conditions.

The objectives of this research were to better understand rice response to clomazone as influenced by soil type, clomazone rate, and planting date. Field studies were conducted in 2002-2003 in a silty clay loam soil near Beaumont, and fine sandy loam soils near Eagle Lake and Ganado, Texas. Four rates of clomazone were applied at 0.2, 0.3, 0.4 and 0.5 lbs active ingredient/A at three planting dates March, April, and May 15 at each location. Season long visual injury ratings and yield were collected. The type and duration of injury differed with each of the planting dates. Bleaching duration was greatest with March plantings with bleaching visible for 40 DAT. The intensity and duration of injury was least with the April plantings. May plantings resulted with high injury with stand reductions up to 20% at Eagle Lake. This injury was short lived in the surviving rice. Rice injury increased with clomazone rate as expected. Injury was greater on fine sandy loam soils. No significant differences in yields were noted at each planting date, however delaying planting to May caused a significant reduction in yield. Our data suggests that injury can be minimized for a fine sandy loam soil in Texas by planting in mid March at a rate of 0.3 to 0.4 lbs ai/A clomazone. For silty clay loam soils, planting in April, and applying 0.5 lbs ai/A clomazone would provide the least injury.

SECTION XIII. POSTERS

TOLERANCE OF GLYPHOSATE RESISTANT ALFALFA TO SEQUENTIAL APPLICATIONS OF ROUNDUP WEATHERMAX™. R.M. Hayes and P.B. Brawley, University of Tennessee, Jackson, and R.F. Montgomery, Monsanto, Union City, TN.

ABSTRACT

Approximately 24 million acres of alfalfa is grown in the United States. Production of alfalfa in the southeastern US could increase significantly with more effective and more economical weed management. Roundup Ready® alfalfa was first developed in 1997. Early greenhouse proof of concept testing proved tolerance to Roundup herbicide. Before commercialization, tolerance to glyphosate under field conditions must be demonstrated in adapted varieties that exhibit equal or improved feed value.

The objectives of this study were to determine the cumulative impact of sequential dosages of glyphosate on Roundup Ready® alfalfa stand, quality and yield. Treatments consisted of sequential applications of glyphosate (Roundup WeatherMax™) at various rates. Treatments were applied prior to each cutting/harvest. Application dates and alfalfa stages were Apr 22 (3-4 trifoliate), Jun 10 (10 inch regrowth), Jul 16 (11 inch regrowth) and Aug 15 (10-11 inch regrowth). Glyphosate was applied in 10 gpa at 0, 0.75, 1.13, 1.5, 2.25, and 3.0 lb ae/A before each cutting (Table 1). The combinations of rates and timing of applications provided seasonal cumulative rates of 0, 1.5, 3.0, 4.5, 6.0, 7.5, 9.0, 10.5, and 12 lb/A. Plots were harvested on May 23, Jun 30, Aug 1 and Sep 2, 2003. Each treatment was replicated three times in a randomized complete block design. Individual plots were 6.33 feet by 20 feet in length. Plots were trimmed to a length of 15 ft before harvest. The center 2.5 ft by 15 ft of each plot was cut with a Kinco™ sickle mower. The alfalfa was hand-raked and immediately weighed, providing fresh weight (FW). A 2.2 lb subsample was dried for 72 hr in a forced-air drier at 60 C and weighed. The percent dry matter (DM) was calculated by dividing the dry weight of the subsample by FW of sample. This percentage was then multiplied by the FW to determine lb DM/plot, and then multiplied by 1161.6 to convert the yield to lb DM/A. A 0.44 lb sample of the dried alfalfa was analyzed for quality, crude protein % and relative feed value (100 = DM intake of full-bloom alfalfa).

Data collected included alfalfa ground cover (stand) prior to initial treatment, chlorosis, necrosis, and height reduction at 7 and 14 days after treatment (DAT) and yield, lb DM/A. Alfalfa yield was adjusted for the variation in initial stand density. Data were analyzed using the MIXED procedure SAS version 8.2 (SAS Institute, 1997). In the analysis of cumulative rate effect, LS means was used to adjust for unequal replication of treatments. Single degree of freedom contrasts were used ($p<0.05$) to determine differences among dry matter yield for glyphosate treatments.

Alfalfa height was not reduced nor was there any visible difference in plant necrosis from any glyphosate rate or application timing. Chlorosis did not appear on plants until after the 3rd glyphosate application. Plants treated with the highest glyphosate rate (3 lb ae/A) exhibited some chlorosis at 7 DAT. By 14 DAT, plants had recovered to normal color. The ANOVA for yield indicated significant treatment, cutting and stand effects. No interaction between treatments and cuttings was observed, thus data was pooled across cuttings and stand was used as a covariate. The first and third cutting averaged 2,595 and 2,411 lb DM/A, while the second and fourth cuttings were 1,141 and 1258 lb DM/A, respectively. Yields among glyphosate treatments ranged from 1,605 to 2,268 lb DM/cutting/A. There were yield differences due to glyphosate treatments, but the differences were not always consistent with increasing rates. Yields from treatments with glyphosate applied before the first and third cuttings tended to be higher thank yields from plots receiving glyphosate prior to all four cuttings.

Alfalfa quality as determined by crude protein and relative feed value (RFV) did not differ with treatment, nor was there an interaction between cutting and treatment. Most treatments had a quality standard of 'Prime (RFV >150). The quality differences among cuttings likely reflect maturity differences at the time of each harvest. The cumulative rate effect was examined and found to be not significant (P =0.10). This indicates exceptional tolerance of this Roundup Ready® alfalfa to Roundup Weather Max™. While some transient chlorosis was observed at the highest rates, DM yield was not impacted. Based on this initial evaluation, we infer that this RR alfalfa line will tolerate glyphosate at rates of up to four times greater than normally used (0.75 lb ae/A) for weed control prior to each cutting. Glyphosate treatments did not adversely impact alfalfa quality as determined by crude protein and relative feed value. Treatments will be repeated during 2004 and the cumulative impact of treatment on stand longevity and future yield will be determined.

CROP TOLERANCE AND WEED MANAGEMENT IN ROUNDUP READY ALFALFA.

Z.H. Braden, J.W. Keeling, L.L. Lyon, and P.A. Dotray. Texas Agricultural Experiment Station, and Texas Tech University, Lubbock, TX.

ABSTRACT

The development of transgenic crops such as Roundup Ready cotton, soybeans, and canola have allowed producers to manage a broad spectrum of weeds with glyphosate. The absence of tillage during the life of an alfalfa stand may allow the invasion of tough to control annual and perennial weeds, which can degrade the value and yield of the forage. To broaden the spectrum of weed control in alfalfa, research has been conducted to develop an alfalfa variety tolerant to glyphosate. The objectives of this experiment were: to determine crop safety and yield of glyphosate-tolerant alfalfa as affected by sequential glyphosate applications and to compare the efficacy of glyphosate in a glyphosate-tolerant alfalfa weed control system to a conventional alfalfa weed control system.

The tolerance experiment was located at the Texas Agricultural Experiment Station near Lubbock on an Acuff clay loam soil. The plots were 6.67 x 50 ft and were arranged in a randomized complete block design with a factorial arrangement. The test consisted of three replications. Benefin was applied at 2.0 lb ai/A preplant incorporated (PPI) was applied to the test area. Glyphosate application timings included: 0.75 lb ae/A at the 3-4 trifoliate followed by (fb) 1.5 lb ae/A at 10, 50, or 90% regrowth after the first cutting fb 1.5 lb ae/A at all combinations of these same regrowth stages after subsequent cuttings. All herbicide applications were made at 10 GPA. Plots were harvested using a flail shredder on June 30, July 28, August 25, and October 9.

The weed control experiment was located at the Texas Agricultural Experiment Station near Plainview on an Olton clay loam soil. The trial was a randomized complete block design that was replicated four times. Plots, 6.7 x 50 ft, were planted on April 4. The glyphosate-tolerant system consisted of: benefin at 2.0 lb ai/A PPI fb a glyphosate application at 1.5 lb ae/A at the 3-4 trifoliate fb glyphosate at 1.5 lb ae/A postemergence (PT-2). The conventional system consisted of: benefin at 2.0 lb ai/A PPI fb an application of imazethapyr + COC + AMS at 0.063 lb ae/ A + 1.0 % V/V + 15 lb/100 gal at the 3-4 trifoliate fb 2,4-DB + NIS at 0.50 lb ae/A + 0.25% V/V PT-2. Plots were harvested June 27, July 28, and August 26.

In these trials, excellent tolerance was observed in glyphosate-tolerant alfalfa to sequential applications of glyphosate. Up to 5.25 lb ae/A of glyphosate was applied at various regrowth timings and no adverse affects on alfalfa yield were observed. Total alfalfa yield (4 cuttings) from all treatments were not different from untreated plots. In the weed control experiment, no alfalfa injury was observed from any glyphosate application compared to applications made in a conventional weed control system. Alfalfa dry weight from the first cutting in the glyphosate-tolerant system (1563 lb/A) was greater than in the conventional system (1275 lb/A), but no differences were seen at any other cutting or when the season dry weight totals were compared. Weed dry weights were slightly higher in the glyphosate-tolerant system at each cutting, but season total dry weights were not different. Benefin applied PPI combined with two in-season glyphosate applications controlled all weeds.

TOLERANCE OF ACCENTUATED RATES OF TRIFLOXYSULFURON BY YOUNG CITRUS AND WEED CONTROL EFFICACY. M. Singh and S. Singh, University of Florida-IFAS, Citrus Research and Education Center, Lake Alfred, FL 33850.

ABSTRACT

Trifloxysulfuron-sodium, an ALS inhibitor herbicide evaluated for cotton and sugarcane had temporary setback to crop, though treated plants recovered after 3-6 weeks with no reduction in yield. Higher rates of trifloxysulfuron are required for effective weed control in citrus, but the information on crop safety is lacking, particularly with young citrus trees. Keeping this in view, field experiments were conducted during 2002 and 2003 in sandy loam soil with 2-3 year old seedlings of citrus plants. Trifloxysulfuron rate of 21, 42 and 63 g, 31.5 followed by 31.5 g after 4 weeks and 21 g applied thrice at 4 weeks intervals were compared with bromacil 3360, 4480 g, glyphosate 840, 1680 g and tank mixture of trifloxysulfuron with glyphosate (21+840 g) and trifloxysulfuron with norflurazon and simazine (21+2800+2400 g/ha). An untreated control was maintained for comparisons. There were 4 replications for each treatment arranged in a randomized block design in a plot size of 3.3 by 23 m with 5 trees per plot. The field was infested mainly with Brazil pusley, Texas panicum, common ragweed, nightshade, purple nutsedge, globe sedge, carpetweed and slender amaranth. Brazil pusley and Texas panicum were most dominant during the second year. Herbicides were applied by tractor mounted boom sprayer fitted with 80015 Teejet nozzles delivering 190 L/ha volume at 152 kPa pressure. A non-ionic surfactant (0.25% v/v) was used with all treatments of trifloxysulfuron. Crop phytotoxicity and weed mortality was recorded at 2- week intervals up to 10 weeks after spraying.

No phytotoxicity on young citrus trees was observed with accentuated rates of 63g/ha of trifloxysulfuron applied once, twice or in three split applications at 4 weeks intervals. Trifloxysulfuron was not effective against Brazil pusley at either rate of application. Highest control of Brazil pusley was recorded with bromacil (>90%) which was significantly higher than glyphosate alone at 1.68 kg/ha or tank mix applications with trifloxysulfuron. Similar results were observed with Texas panicum, though increased mortality was observed when trifloxysulfuron was tank mixed with glyphosate at 21+840g compared with glyphosate at 840g/ha. Trifloxysulfuron provided effective control of nutsedge and was significantly better than glyphosate at 1.68 kg/ha. All the treatments provided greater than 95% control of carpetweed. Trifloxysulfuron at 21 g/ha was less effective against common ragweed; control increased with higher rates or repeat applications. All the treatments inflicted more than 70 % mortality to nightshade and slender amaranth, later was found more sensitive.

EFFICACY OF ALONE AND SEQUENTIAL APPLICATION OF DIURON AND SIMAZINE ON SOME VINES AND BROADLEAF WEEDS. S. Singh, S. Singh and M. Singh; University of Florida-IFAS, Citrus Research and Education Center, Lake Alfred, FL 33850.

ABSTRACT

Weed management in citrus cost almost 25% of the total production cost in Florida. The problem is further aggravated with the shift in weed flora due to continuous use of glyphosate. Partial control of several vines and broadleaf weeds by glyphosate is causing concern to Florida citrus growers. Herbicide like bromacil which is effective against several weed species is withdrawn from use on sandy soils due to leaching problems. Under the prevailing situation a sequential or tank mix application of herbicides is required to provide effective weed management. Field and greenhouse experiments were conducted to evaluate weed control by diuron and simazine when used alone or as a follow up with glyphosate. Diuron and simazine at 0, 2, 4, 6 and 8 kg/ha were applied with 4 replications in metal trays for greenhouse study. Balsam apple, Brazil pusley, milkweed vine and Spanish needles were included in this study. Field studies were carried out with PRE herbicides, diuron at 3.6 kg/ha applied alone or tank mixed with simazine at 3.6 or norflurazon at 2.7 kg/ha. Repeat applications of tank mix of diuron, simazine or norflurazon were made after 60 d and compared with repeat of glyphosate at 1.68 kg ae/ha (50 or 110 d) and glyphosate twice followed by diuron or simazine plus norflurazon. The field was infested with natural population of several vines, grass and broadleaf weeds. Herbicides were applied by a tractor mounted boom sprayer delivering 190 L/ha volume at 152 kPa pressure. All the herbicides were applied 3 weeks after glyphosate application.

Persistence of diuron and simazine under glasshouse conditions inhibited germination and growth of several vines and broadleaf weeds for 90 d; higher rates of these herbicides were required to inhibit germination for up to 180 d. Glyphosate alone was not able to provide effective control after 7 weeks of treatment, but sequential application with diuron plus simazine or diuron plus norflurazon provided effective control up to 150 d. Weed control in diuron alone treatment was reduced to 75% after 90 d, but follow up treatment of diuron plus simazine or diuron plus norflurazon provided more than 90% control of weeds. A clean up with glyphosate followed by tank mix application of diuron plus simazine or norflurazon could provide season long weed control under the ridge soil conditions.

COMPARISON OF HERBICIDE SYSTEMS IN ROUNDUP READY AND CONVENTIONAL CORN. R.R. Dobbs[1], N.W. Buehring[1], M.W. Shankle[2], T.F. Garrett[2], and M.P. Harrison[1]. Mississippi State University, [1]North Mississippi Research and Extension Center, Verona, MS 38879, [2]Pontotoc Ridge Flatwoods Experiment Station, Pontotoc, MS 38863.

ABSTRACT

A study was conducted in 2003 to evaluate the effects of preemergence (PRE), PRE plus postemergence (POST), and POST only herbicide systems on broadleaf signalgrass control in no-tillage Roundup Ready and conventional corn.

Herbicide systems included a tank-mixture of 1.8 qt/A Bicep II Magnum (atrazine + *S*-metolachlor) plus 0.6 qt/A Atrazine (atrazine) PRE; 0.9 qt/A Bicep II Magnum plus 0.3 qt/A Atrazine PRE followed by (fb) 16 oz/A Roundup WEATHERMAX (glyphosate) POST (3 inch weeds, 8 inch corn); a tank-mixture of 1.5 qt/A Atrazine plus 21.4 oz/A Roundup WEATHERMAX POST (3 inch weeds, 8 inch corn); a tank-mixture of 1.5 qt/A Atrazine plus 21.4 oz/A Roundup WEATHERMAX POST fb 16 oz/A Roundup WEATHERMAX POST (4 inch weeds, 26 inch corn); 21.4 oz/A Roundup WEATHERMAX POST (3 inch weeds, 8 inch corn); 21.4 oz/A Roundup WEATHERMAX POST (3 inch weeds, 8 inch corn) fb 16 oz/A Roundup WEATHERMAX POST (4 inch weeds, 26 inch corn); 1.3 pt/A Cinch ATZ (atrazine + *S*-metolachlor) PRE fb a tank-mixture of 14 oz wt/A Steadfast ATZ (nicosulfuron + metsulfuron + atrazine), 1.39 lb/A Atrazine (atrazine) 90 DF, 2 lb/A ammonium sulfate, and 1 % v/v crop oil concentrate (COC) POST (3 inch weeds, 8 inch corn); 0.8 pt/A Cinch (*S*-metolachlor) PRE fb a tank-mixture of 14 oz wt/A Steadfast ATZ, 1.39 lb/A Atrazine 90 DF, 2 lb/A ammonium sulfate, and 1 % v/v COC POST (3 inch weeds, 8 inch corn); a tank-mixture of 14 oz wt/A Steadfast ATZ, 1.39 lb/A Atrazine 90 DF, 2 lb/A ammonium sulfate, and 1 % v/v COC POST (3 inch weeds, 8 inch corn); 1.8 qt/A Bicep II Magnum plus 0.6 qt/A Atrazine PRE fb a tank-mixture of 0.66 oz wt/A Accent plus 1 % v/v COC POST(4 inch weeds, 20 inch corn).

All systems which included a POST application of Roundup WEATHERMAX, controlled broadleaf signalgrass at least 96% at 46 DAP, and 99% at 60 DAP. Residual herbicides applied PRE (Atrazine 4SC, Bicep II Magnum) and followed by Roundup WEATHERMAX POST 39 DAP, or Atrazine 4SC applied as a tank mix with Roundup WEATHERMAX POST 39 DAP, did not improve weed control compared to two POST applications of Roundup WEATHERMAX, but were greater than PRE alone systems. The addition of a PRE application of Cinch or Cinch ATZ to the POST treatments of 14 oz wt/A Steadfast ATZ plus 1.39 lb/A Atrazine 90DF did not improve broadleaf signalgrass control compared to the POST application of Steadfast ATZ at 14 oz wt/A plus 1.39 lb/A Atrazine 90DF 39 DAP.

The untreated checks and the 1.8 qt/A Bicep II Magnum plus 0.6 qt/A Atrazine 4SC applied to Dekalb 6971 RR/YG, yielded less than all other treatments. Grain yield was 142.5 bu/A for a single application of 21.4 oz/A Roundup WEATHERMAX 39 DAP. The addition of a residual herbicide or sequential Roundup WEATHERMAX treatments did not increase yield. Preliminary research with good growing conditions indicated that broadleaf signalgrass control and grain yield with a single application of Steadfast ATZ plus Atrazine 90DF (39 DAP), or a single application of Roundup WEATHERMAX (39 DAP), or sequential applications of Roundup WEATHERMAX (39 and 64 DAP) can be equivalent to a conventional PRE followed by POST herbicide system in Roundup Ready® corn production.

EFFECT OF POSTEMERGENCE APPLICATION TIMING ON CROP SAFETY OF NICOSULFURON PLUS RIMSULFURON MIXTURES IN CORN. H.A. Flanigan, E.P. Castner, R.E. Etheridge and D.W. Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Field studies were established in corn to assess crop response from applications of Steadfast (nicosulfuron + rimsulfuron) and various tank mixtures when applied to two, four and six leaf collar corn. To reduce the impact of environment at the time of herbicide application, planting dates were varied so a single application timing could be used. Crop response at seven days after treatment with Steadfast was comparable to Steadfast tank mixtures with atrazine, mesotrione or dicamba. Minimal differences in crop response were seen from applications made to various corn growth stages. Plant health at the time of herbicide application was the greatest determining factor in crop response.

EFFICACY AND CROP SAFETY OF POSTEMERGENCE APPLICATIONS OF NICOSULFURON PLUS RIMSULFURON AND MESOTRIONE PLUS METOLCACHLOR MIXTURES IN CORN. M.F. Holm, D.D. Ganske, S.K. Rick and D.W. Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Field studies were conducted in corn (Zea mays L.) to determine the effect of tank mixes of Steadfast and Camix or Lumax on crop safety and efficacy on several grass and broadleaf weed species. Tank mix applications were made utilizing either a non-ionic surfactant or non-ionic surfactant plus AMS or 28% nitrogen. Results from weed free trials show no significant crop response across treatments on corn up to 5 inch in height regardless of the additives utilized. In additional trials when applications were made at two different corn heights, crop response ratings were similar to weed free trials and did not vary between application timings. The addition of Camix or Lumax to Steadfast gave excellent control to a broad spectrum of broadleaf grass weed species when applied at labeled weed heights.

HERBICIDE PROGRAMS FOR GLYPHOSATE TOLERANT CORN. J.L. Lloyd, R.M. Edmund, C.M. Mayo, and D.W. Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Studies were conducted at 17 locations in 2003 comparing herbicide systems in glyphosate tolerant corn. Glyphosate applied alone early post emergence was compared to tank mixtures of glyphosate and rimsulfuron and to tank mixtures containing glyphosate and metolachlor and glyphosate, metolachlor and atrazine. A standard tank mix of Steadfast (nicosulfuron + rimsulfuron), Callisto (mesotrione) and atrazine was included. Key weeds included giant foxtail, yellow foxtail, fall panicum, ivyleaf morningglory, and tall waterhemp. For season long weed control it was necessary to add a residual product to the glyphosate for control of both grass and broadleaf weed species. Rimsulfuron provided good residual control of many grass and small-seeded broadleaf species and improved the control of the glyphosate on several broadleaf species. For most weed and grass species the tank mix of Steadfast, Callisto and atrazine provided equal or superior season long control compared to treatments including glyphosate

APPLICATION TIMINGS AND RATES IN ROUNDUP READY FLEX COTTON. B.L. Joy, J.W. Keeling, J.D. Everitt, and P.A. Dotray. Texas Agricultural Experiment Station, Lubbock, TX.

ABSTRACT

Roundup Ready cotton varieties are widely planted on the Texas High Plains, with effective control of a wide range of annual and perennial weeds achieved with glyphosate. With the current Roundup Ready technologies, postemergence over-the-top (POST) applications must be made prior to the 5-leaf cotton growth stage. Wet or windy conditions may make it difficult to treat large acreages during this application window. The use of Roundup Ready Flex varieties will widen the window of application and allow POST applications to be made beyond the 5-leaf cotton growth stage with the additional benefit of higher glyphosate rates, which could improve control of more difficult to control weeds.

Field experiments were conducted in 2003 at the Texas Agricultural Experiment Station near Lubbock to evaluate rates and timings of glyphosate for optimum control of Palmer amaranth (*Amaranthus palmeri* S. Wats), devil's-claw (*Proboscidea louisianica* (Mill.) Thellung), ivyleaf morningglory (*Ipomoea hederacea* (L.) Jacq.), and silverleaf nightshade (*Solanum elaeagnifolium* Cav.). Glyphosate was applied at rates ranging from 0.75 to 1.5 lb ae/A. Treatments based on cotton growth stage were compared to as-needed (ASN) treatments based on weed population and size. Trifluralin at 0.75 lb ai/A was applied preplant incorporated to all trial areas.

Palmer amaranth, devil's-claw, and silverleaf nightshade was controlled at least 90% with POST treatments based on cotton growth stage or ASN applications. For these weeds, effective control was achieved with 0.75 lb ae/A treatments, with no benefit from higher glyphosate rates. The most effective ivyleaf morningglory control was achieved with four POST applications applied ASN beginning at the 2-leaf cotton growth stage, with the last treatment applied at the 20-leaf cotton growth stage. When applied at the 1.5 lb ae/A rate, three POST applications provided similar control by delaying the first application. Initial observations indicate that timely applications of glyphosate are better than increased rates.

SHARPPOD MORNINGGLORY (*IPOMOEA CORDATOTRILOBA* DENNSTEDT) GROWTH AND INTERFERENCE WITH COTTON (*GOSSYPIUM HIRSUTUM* L.). G.L. Steele and J.M. Chandler, Texas Agricultural Experiment Station, College Station, TX 77843-2474.

ABSTRACT

Sharppod morningglory is a perennial vine that is becoming increasingly prevalent as a weed in Texas row crops. Field research was conducted near College Station in 2002 and 2003 to evaluate the effects of sharppod morningglory density on cotton yield, harvest efficiency, lint quality, and lint value. Treatments consisted of sharppod morningglory densities of 0, 2, 4, 6, and 8 plants $10m^{-1}$ transplanted at the cotyledon stage, directly beside the cotton seed furrow. The experiment was designed as a randomized complete block, and treatments were replicated 4 times. Plots were maintained weed-free through hand hoeing, and yield was determined by mechanically picking row two of three transplanted rows. Row four of each 10m plot served as a weed-free buffer. Fiber quality was assessed at the International Textile Center in Lubbock, TX. Lint value was calculated from a three-year average of loan rate premiums and discounts. Greenhouse experiments were conducted to examine the comparative growth of sharppod and ivyleaf morningglory. Ivyleaf and sharppod morningglory seed were planted in containers and grown up to 8 wk after emergence. Five plants of each species were sampled weekly and plant parts separated into leaves, stems, and roots. Plant parts were dried at 32C for 72h to determine aboveground biomass and root dryweights. All data were subjected to analysis of variance, and regression analysis was used to describe the relationships between density and yield, grade discount, and lint value reduction. Ivyleaf and sharppod morningglory aboveground biomass and root weights were regressed with sampling time.

The only significant reduction in lint yield occurred with 8 plants $10m^{-1}$ in 2002. Similarly, sharppod morningglory density had no effect on harvest efficiency in 2002 and 2003. The combined effects of color grade, staple length, and leaf content contributed to lint value reductions. Loan discount points from these parameters increased with sharppod morningglory density according to the equation: $y = 1554.7 – 43.9x + 141.7x^2$ ($R^2 = 0.68$). In 2002 each sharppod morningglory plant $10m^{-1}$ reduced lint value by \$134.80 ha^{-1}. Lower yields in 2003 resulted in more moderate value reductions. As in the previous year, value reductions from the untreated increased linearly, with a \$64.90 ha^{-1} reduction for every sharppod morningglory $10m^{-1}$. The minor effects of sharppod morningglory interference on lint yield can be explained in part by its perennial growth habit. Greenhouse experiments revealed that aboveground biomass of ivyleaf morningglory increases faster and to a greater extent from 1 to 5wk after emergence, while sharppod morningglory exceeds ivyleaf morningglory in production of root tissue beginning 3wk after emergence. This suggests that the competitive ability of sharppod morningglory could be affected by the preferential allocation of resources for root growth during the first months of the growing season. In conclusion, sharppod morningglory interferes with cotton production by reducing lint quality, which translates into decreased economic value. Minor effects on cotton yield can be attributed to the allocation of resources for root production instead of aboveground growth in the first months after emergence.

THE EFFECT OF 2,4-D DRIFT RATES ON COTTON GROWTH AND YIELD. A.S. Sciumbato, S.A. Senseman, G.L. Steele and J.M. Chandler; Texas Agricultural Experiment Station, Texas A&M University, College Station, TX 77843-2474.

ABSTRACT

Field studies correlating early-season 2,4-D injury on cotton to lint yield were carried out at the Texas A&M University Field Laboratory near College Station, Texas during 2001, 2002 and 2003. Five reduced rates of 2,4-D were applied to cotton plants in the 4- to 6- leaf stage. Injury was recorded 14 days after treatment (DAT) using a rating scale designed to quantify plant injury typical of phenoxy herbicides on cotton leaves and stems. Yield results from each year were regressed with herbicide injury so that the season-long effects of exposing young cotton plants to 2,4-D could be observed.

Plots receiving as much as 5.3×10^{-4} kg 2,4-D ha^{-1} displayed no significant yield reduction. It was determined that yield loss may not occur in injured cotton exhibiting symptoms as severe as leaf-margin malformation and leaf chlorosis coupled with stems or petioles bending as much as 45°. High correlations between early-season plant injury and cotton yield, particularly during 2002 and 2003 ($R^2 = 0.82$ and 0.80, respectively), suggest the possibility of predicting yield losses after early-season 2,4-D injury. These data indicate that although cotton may exhibit severe leaf and stem malformations, a subsequent loss of yield is not certain. However, additional research is needed to validate this prediction method as well as investigate the effects of other auxin-like herbicides applied at different stages of cotton growth.

DELAYED EARLY POST EMERGENCE APPLICATIONS INFLUENCE ON COTTON WEED CONTROL AND YIELD. M.P. Harrison, N.W. Buehring, and R.R. Dobbs; Mississippi State University; North Mississippi Research and Extension Center, Verona, MS 38879.

ABSTRACT

A study was conducted in 2003 to evaluate delayed early postemergence herbicide application effect on weed control and yield for Roundup Ready/BT cotton. The study was conducted on a Leeper silty clay loam soil where infestations of sicklepod (*Senna obtusifolia*) were severe with moderate pitted morningglory (*Ipomoea lacunosa*) and light broadleaf signalgrass (*Brachiaria platyphylla*) and large crabgrass (*Digitaria sanguinalis*) infestations.

Roundup WEATHERMAX (glyphosate) treatments were made at 1.0 lb ai/A; Touchdown IQ (glyphosate) treatments were made at 0.75 lb ai/A; Staple (pyrithiobac) postemergence (POT) treatments were made at 1.28 oz ai/A.; Cotoran (fluometuron) preemergence (PRE) application was made at 1.0 lb ai/A; Dual Magnum (metolachlor) PRE application, and 1 and 4 leaf cotton POT treatments were made at 1.5 lb ai/A; Envoke (trifloxysulfuron) POT and treatments were made at 0.075 oz ai/A; and Suprend (trifloxysulfuron 0.7% ai + prometryn 79.3% ai) post directed broadcast (PD) treatments were made at 1.0 lb ai/A.

The 2003 growing season had above normal rainfall with 10.26, 6.40, 6.48, and 5.63 inches for May, June, August, and September, respectively. The study's mean lint yield was 1041 lb/A and ranged from 262 for the untreated check to 1186 lb/A. All treatments produced higher yield than the untreated check. Treatments with the first herbicide applications delayed until 4 leaf cotton [Touchdown IQ + Dual Magnum applied POT to 4 leaf cotton followed by (Fb) Touchdown IQ PD at 10 leaf cotton; and Touchdown IQ applied POT to 4 leaf cotton Fb Envoke POT at 7 leaf cotton fb Touchdown IQ PD at 10 leaf cotton] resulted in lower morningglory control 53 days after planting (DAP) and lower yield than the highest yield treatments of Cotoran PRE Fb Touchdown IQ POT at 4 leaf cotton and repeated PD at 10 leaf cotton; Dual + Touchdown IQ POT at 1 leaf cotton Fb Envoke POT at 4 leaf cotton Fb Suprend + Touchdown IQ PD at 10 leaf cotton; and Roundup WEATHERMAX applied POT at 1 leaf and repeated POT at 4 leaf and PD at 10 leaf cotton. Envoke applied to 7 leaf cotton caused 10% crop injury 39 DAP with injury less than 5% 53 DAP.

Roundup WEATHERMAX POT at 1 leaf cotton and repeated POT at 4 leaf and PD at 10 leaf cotton; Dual Magnum or Cotoran PRE Fb Touchdown POT at 4 leaf and repeated PD at 10 leaf cotton; Dual Magnum + Touchdown IQ POT at 1 leaf cotton Fb Envoke POT at 4 leaf cotton Fb Touchdown IQ + Suprend PD at 10 leaf cotton; Touchdown IQ POT at 1 leaf cotton Fb Envoke POT at 4 leaf cotton Fb either Touchdown IQ PD or Touchdown IQ + Suprend PD at 10 leaf cotton; and Staple + Roundup POT at 4 leaf cotton Fb Roundup WEATHERMAX PD at 10 leaf cotton provided 83 to 99% sicklepod and mornngglory control at 53 DAP and at harvest with no yield differences. In summary, with the exception of Cotoran PRE or Staple + Roundup POT 4 leaf cotton, delaying the first herbicide (Dual Magnum + Touchdown IQ or Touchdown IQ) application until 4 leaf cotton resulted in reduced morningglory control and yield.

WEED CONTROL, CROP TOLERANCE, AND YIELD WITH TOUCHDOWN, DUAL MAGNUM, CAPAROL, AND ENVOKE WEED MANAGEMENT SYSTEMS. W.J. Everman, I.C. Burke, and J.W. Wilcut[1], D. Miller[2], A. Price[3], C. Koger[4], and D. Porterfield[5]. [1]North Carolina State University; Raleigh, NC, [2]Louisiana State University; St. Joseph, LA, [3]USDA-ARS; Auburn, AL, [4]USDA-ARS-SWRU; Stoneville, MS, [5]Syngenta Crop Protection Inc.; Cary, NC.

ABSTRACT

Experiments were conducted in North Carolina in 2002 and Alabama, Louisiana, Mississippi, and North Carolina in 2003 to evaluate weed control, crop tolerance, and yield potential with a total postemergence (POST) weed management system that included combinations of residual and transgenic herbicides in Roundup-Ready® cotton. The transgenic cotton varieties included Fibermax 989 RR/BG, Deltapine 458 BR, and Stoneville 4793 RR. The experimental design was a randomized complete block with a factorial treatment arrangement of early-postemergence (EPOST), POST, post-directed (PDS), and late post-directed (LAYBY) options with 3 to 4 replications, depending on locations. The EPOST treatments included 1) Touchdown alone at 0.75 lb ae/A or 2) a tank mixture of Touchdown + Dual Magnum at 1.0 lb ai/A. The POST/PDS treatments included 1) No POST, 2) Envoke alone at 0.0048 lb ai/A POST or 3) PDS, 4) Envoke plus MSMA at 2.0 lb ai/A PDS, or 5) Envoke plus Touchdown at 0.75 lb ae/A PDS. The LAYBY treatments included 1) NO LAYBY or 2) Caparol at 1.0 lb ai/A plus MSMA at 2.0 lb ai/A plus Induce at 0.25% v/v. Early season cotton injury and discoloration was minimal (<1%) with all treatments, mid- and late-season injury was <2% except for Envoke POST which injured cotton 9 to 11%. Envoke injury was transitory and not visually apparent at late season evaluations. Cotton injury was minimal with all treatments applied PDS. POST and PDS herbicide applications provided >80% control of sicklepod, smooth amaranth, and entireleaf and pitted morningglory. Envoke POST and PDS applied alone or in combination with Touchdown or MSMA averaged over EPOST and LAYBY treatments increased sicklepod control 25 to 30% points, smooth pigweed control 23% points, entireleaf morninglory, and pitted morningglory 19-30% points compared to EPOST only systems. Envoke PDS/POST provides limited suppression (<7 days) of annual grasses. Touchdown plus Envoke increased control of goosegrass > 20 percentage points, barnyardgrass 30 percentage points, and large crabgrass 20 percentage points. Envoke did not appear to antagonize Touchdown control of these annual grasses. The addition of a LAYBY treatment increased control of all weeds 11 to 21% percentage points. Envoke + Touchdown PDS had the highest yield of 1060 lb/A regardless of EPOST or LAYBY treatment. Cotton lint yield increased 160 to 400 lb/A with the addition of POST/PDS treatments compared to EPOST only systems. The addition of Caparol + MSMA LAYBY increased cotton lint yield by 200 lb/A compared to systems without a LAYBY. These data indicate the spectrum and level of weed control was broader with Envoke in combination with Touchdown PDS than with other POST/PDS treatments. Yield and weed control data indicate a two-pass system will often work, however a three-pass system will always work.

HERBICIDE EVALUATION FOR CONTROL OF HORSEWEED (CONYZA CANADENSIS) IN ARKANSAS. M.R. McClelland, O.C. Sparks, J.L. Barrentine, K.L. Smith, S.G. Matthews, and R.E. Talbert. University of Arkansas, Fayetteville, 72701 and University of Arkansas Extension Service, Blytheville, AR 72316 and Monticello, AR 71656.

ABSTRACT

Suspected glyphosate-resistant horseweed was reported in northeast Arkansas in the early months of 2003. Some plants had survived as many as three applications of glyphosate. Greenhouse screening on these populations confirmed populations resistant to glyphosate rates of 3 to 12 lb ae/A compared to a susceptible population, which was controlled with 0.75 lb/A. Conservation tillage is now used in more than 50% of the cotton acreage in Arkansas, so preplant herbicidal control of horseweed is important. 2,4-D and dicamba are effective options for herbicide-resistant horseweed, but they cannot be used within 3 weeks of planting and provide no significant residual control. More options are needed for control at planting and postemergence.

Field studies were conducted in 2003 at Fayetteville and Osceola, Arkansas. A general herbicide screening experiment on susceptible horseweed was established at Fayetteville on 6- by 15-ft plots. Most, but not all, of the herbicides evaluated could potentially be used in cotton. Horseweed was 10 to 20 inches tall when herbicides were sprayed on June 13 with a backpack sprayer at 15 gpa output volume. The experimental area at Osceola contained resistant horseweed, and plots were 12 by 20 feet. Plants were 2 to 10 inches tall when herbicides were sprayed on May 12. A backpack sprayer at 12 gpa output volume was used. Visual ratings for percent control were subjected to analysis of variance, and means were separated with an LSD at P = 0.05.

In the field screening test at Fayetteville, treatments that controlled horseweed at least 95% 6 weeks after treatment (WAT) were: paraquat (Gramoxone Max) alone or plus diuron (Direx), bromoxynil (Buctril), glufosinate (Ignite), MSMA alone or plus diuron, 2,4-D amine, dicamba (Clarity), glyphosate (Roundup Weathermax), and clopyralid (Stinger). Control with trifloxysulfuron (Envoke), cloransulam (FirstRate), and paraquat plus Canopy (metribuzin + chlorimuron) was 87 to 89%. Activity of dicamba, clopyralid, and cloransulam was very slow (approximately 70% at 3 WAT), and 2,4-D was only slightly faster (78% at 3 WAT). Control was poor (< 20%) with pyrithiobac (Staple), acifluorfen (Blazer), oxyfluorfen (Goal), lactofen (Cobra), fomesafen (Reflex), carfentrazone (Aim), clomazone (Command), flumioxazin (Valor), prometryn (Caparol), fluometuron (Cotoran), and diuron. Environmental conditions for herbicide activity were excellent, and such good control may not be obtained under less favorable conditions. At Osceola , only glyphosate plus 2,4-D controlled horseweed more than 80% 3 WAT. Control with paraquat plus 2,4-D or prometryn was initially above 80% but declined by 3 WAT. Control with MSMA, paraquat plus carfentrazone, glyphosate plus carfentrazone or pyrithiobac, or carfentrazone plus pyrithiobac was also poor by 3 WAT.

Future research will be designed to determine the best herbicide combinations for burndown control of glyphosate-resistant horseweed until cotton planting; to develop herbicide options that can be applied within 3 weeks of planting and postemergence and to determine cotton tolerance; and to screen herbicides such as trifloxysulfuron, pyrithiobac, flumioxazin, oxyfluorfen, and others for potential preemergence control of horseweed.

EVALUATION OF TRIFLOXYSULFURON, PYRITHIOBAC, AND FLUOMETURON WEED MANAGEMENT SYSTEMS IN COTTON. I.C. Burke[1], S.B. Clewis[1], C. Koger[2], D. Miller[3], D. Porterfield[4], A.J. Price[5], and J.W. Wilcut[1]. [1]North Carolina State University, Raleigh, NC 27695; [2]USDA-ARS, Stoneville, MS 38776; [3]Northeast Research Station, St. Joseph, LA 71366; [4]Syngenta Crop Protection, Cary, NC 27513; [5]USDA-ARS, National Soil Dynamics Laboratory, Auburn, AL 36832.

ABSTRACT

Field experiments conducted in 2002 and 2003 at Goldsboro, NC, and in 2003 at Rocky Mount, Lewiston-Woodville, and Kinston, NC; Stoneville, MS; Auburn, AL; and St. Joseph, LA; evaluated the use of pyrithiobac with trifloxysulfuron in conventional cotton. Treatments were a factorial arrangement of preemergence (PRE) by postemergence (POST) by late post-directed herbicide options (LAYBY). PRE herbicide options included pendimethalin (840 g ai/ha), pendimethalin plus pyrithiobac (36 g ai/ha), or pendimethalin plus fluometuron (1,120 g ai/ha). Postemergence treatment options included no herbicide, trifloxysulfuron (5 g ai/ha) EPOST to 5 lf cotton, trifloxysulfuron plus pyrithiobac (36 g/ha) EPOST, or trifloxysulfuron (5 g/ha) EPOST to 5 lf cotton plus trifloxysulfuron (5 g/ha) POST to 7 lf cotton. LAYBY herbicide options included no herbicide or prometryn (1,120 g ai/ha) plus MSMA (2,240 g ai/ha). All EPOST, POST, and LAYBY treatments were applied with a NIS at 0.25% (v/v).

Cotton injury in the form of discoloration was observed 2 wk after EPOST applications that included trifloxysulfuron or trifloxysulfuron plus pyrithiobac to 5 lf cotton at Kinston, NC, Lewiston, NC, and Auburn, AL. Injury was less than 10% in all treatments for which it was observed, transient in nature, and did not affect yields.

Large crabgrass (*Digitaria sanguinalis*) control was greater with pendimethalin plus fluometuron PRE than pendimethalin plus pyrithiobac PRE or pendimethalin alone. Clethodim POST at 240g ai/ha plus 1% COC was required for adequate large crabgrass control. Pendimethalin plus fluometuron PRE and pendimethalin plus pyrithiobac PRE controlled redroot pigweed (*Amaranthus retroflexus*) greater than 72%, while pendimethalin PRE controlled this species 28%. Pendimethalin plus fluometuron PRE controlled common ragweed (*Ambrosia artemisiifolia*) and common lambsquarters (*Chenopodium album*) greater than 80%, while pendimethalin PRE and pendimethalin plus pyrithiobac PRE controlled these species 38% or less. Trifloxysulfuron controlled common lambsquarters, common ragweed, Palmer amaranth (*Amaranthus palmerii*), and redroot pigweed ≥ 80%, regardless of PRE treatment but controlled prickly sida (*Sida spinosa*) and jimsonweed (*Datura stramonium*) ≤ 28%. Pyrithiobac plus trifloxysulfuron EPOST controlled jimsonweed and prickly sida > 72%. Sequential trifloxysulfuron applications controlled ivyleaf morningglory (*Ipomoea lacunosa*), pitted morningglory (*Ipomoea hederacea*), sicklepod (*Senna obtusifolia*), and yellow nutsedge (*Cyperus esculentus*) greater than 82%. There was a main treatment LAYBY effect and the inclusion of a LAYBY treatment increased control of all weeds listed above 9-35 percentage points.

The highest cotton yields required fluometuron PRE or pyrithiobac PRE or EPOST, trifloxysulfuron EPOST, and a LAYBY treatment of prometryn plus MSMA. There was a main treatment effect for LAYBY herbicide treatments with a yield increase of 3-50% for LAYBY containing herbicide systems. Pyrithiobac PRE or applied in mixture with trifloxysulfuron EPOST provided broad spectrum broadleaf weed control for cotton when used in conjunction with soil applied and LAYBY herbicides. The inclusion of multiple herbicide sites-of-action are important for management of herbicide resistance.

GLYPHOSATE-RESISTANT COTTON RESPONSE TO REDUCED RATES OF GLUFOSINATE. D.R. Lee[1], D.K. Miller[1], M.S. Mathews[1], A.M. Stewart[2], and B.R. Leonard[3]; LSU AgCenter, St. Joseph[1], Alexandria[2], and Winnsboro[3], LA.

ABSTRACT

Research was conducted in 2003 at the Northeast Research Station in St. Joseph, La, to evaluate glyphosate-resistant cotton response to reduced rates of Liberty (glufosinate) that may be encountered in drift or sprayer contamination events. Liberty rates of 0.063, 0.084, 0.10, 0.125, 0.146, 0.167, 0.188, 0.21, 0.23, or 0.25 lb ai/A, representing 15, 20, 25, 30, 35, 40, 45, 50, 55, or 60% of a 0.418 lb ai/A (32 oz/A) use rate, were applied to DP 458 BR cotton at the 3 or 6 leaf growth stage. A nontreated control was included for comparison. Applications were made using a CO_2 backpack sprayer at 15 GPA to each 2 row 6.67' x 35' plot. Parameters measured included plant height 30 days after application (DAT) and prior to harvest, plant population 30 DAT, percent first harvest, and seedcotton yield. The nontreated control was used to calculate percent reduction values for all parameters measured except percent first harvest, but was not included in the statistical analysis.

Averaged across growth stage at time of application, height reduction 30 DAT ranged from 19 to 50% and was maximized at the 0.125 lb ai/A rate (38%). Averaged across Liberty rates, greater height reduction was noted with the earlier application timing (53 vs. 22%). Height prior to harvest was reduced no more than 2% for all Liberty rates, while mature height reductions did not differ by growth stage at time of application. At the 3 leaf application, plant population was reduced at least 50% beginning with the 0.10 lb ai/A rate (56%), with higher rates resulting in a population reduction ranging from 78 to 99%. Population reduction for the 3-leaf application was maximized at the 0.167 lb ai/A rate (91%). Reduction at the 6-leaf application timing ranged from 5 to 26%, with little differences noted among Liberty rates. Within each Liberty rate, population reduction was greater at the earlier timing. Percent first harvest ranged from 78 to 92% and 88 to 92% for the 3 and 6 leaf timing, respectively, with only slight differences noted among Liberty rates. At the 3-leaf application, yield reduction ranged from 21 to 82% and was maximized at the 0.146 lb ai/A rate (47%). Yield reduction for the 6-leaf timing ranged from 10 to 29% with no differences noted among Liberty rates. At rates of 0.146 lb ai/A or higher, yield reduction was greater for Liberty application at the earlier timing (47 to 82% vs. 10 to 29%).

In conclusion, Liberty rates as low as 0.063 lb ai/A (4.8 oz/A), or 15% of a 0.418 lb ai/A (32 oz/A) use rate, can result in significant plant population and yield reduction. In general, negative effects from Liberty applied to glyphosate-resistant cotton were more pronounced at the 3-leaf application. As acceptance of both transgenic technologies and likelihood of adjacent production fields increases, all precautions must be taken to avoid Liberty misapplication to glyphosate resistant cotton through spray drift or sprayer contamination to avoid negative consequences.

GLUFOSINATE-RESISTANT COTTON RESPONSE TO REDUCED RATES OF GLYPHOSATE. D.R. Lee[1], D.K. Miller[1], M.S. Mathews[1], A.M. Stewart[2], and B.R. Leonard[3]; LSU AgCenter, St. Joseph[1], Alexandria[2], and Winnsboro[3], LA.

ABSTRACT

Research was conducted in 2003 at the Northeast Research Station in St. Joseph, La, to evaluate glufosinate-resistant cotton response to reduced rates of Roundup Weathermax (glyphosate) that may be encountered in drift or sprayer contamination events. Roundup Weathermax rates of 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, or 0.6 lb ai/A, representing 15, 20, 25, 30, 35, 40, 45, 50, 55, or 60% of a 1.0 lb ai/A (22 oz/A) use rate, were applied to Fibermax LL 981 cotton at the 3 or 6 leaf growth stage. A nontreated control was included for comparison. Applications were made using a CO_2 backpack sprayer at 15 GPA to each 2 row 6.67' x 35' plot. Parameters measured included plant height 30 days after application (DAT) and prior to harvest, percent first harvest, and seedcotton yield. The nontreated control was used to calculate percent reduction values for all parameters measured except percent first harvest, but was not included in the statistical analysis.

At the 3-leaf application timing, height reduction 30 DAT ranged from 36 to 71% and was maximized at the 0.3 lb ai/A rate (61%). At the 6-leaf timing, reduction ranged from 14 to 46% and was maximized at the 0.35 lb ai/A rate (37%). At rates of 0.2 lb ai/A or higher, height reduction following Roundup Weathermax application was greater at the earlier timing (43 to 72% vs. 14 to 46%). Height prior to harvest ranged from a decrease of 22% to an increase of 18%, with few differences noted among Roundup Weathermax rates and application timing. Percent first harvest for the 3 and 6 leaf application timing ranged from 71 to 88% and 77 to 93%, respectively, with few differences noted among Roundup Weathermax rates and no differences noted between application timings. Yield reduction data was extremely variable. At the 3-leaf timing, yield ranged from an increase of 47% to a reduction of 73%. Yield reduction was maximized at the 0.25 lb ai/A rate (32%). At the later application timing, yield ranged from an increase of 2% to a decrease of 45% with no differences noted among Roundup Weathermax rates. Of interest was that at the two lowest rates, significant yield reduction occurred at the later 6-leaf application compared to yield increases at the earlier timing.

In conclusion, yield impact on glufosinate-resistant cotton following Roundup Weathermax application can be quite variable, ranging from an actual increase in yield at lower rates when applied to 3 leaf cotton to greater than a 20% reduction at higher rates. Glufosinate-resistant cotton appeared to be more sensitive, based on yield reduction, at lower rates (<0.25 lb ai/A) when application occurred at the 6 leaf timing compared to the 3 leaf timing while differences among growth stages was less prevalent or nonexistent at higher rates. As acceptance of both transgenic technologies and likelihood of adjacent production fields increases, all precautions must be taken to eliminate misapplication of Roundup Weathermax on glufosinate-resistant cotton through spray drift or sprayer contamination, or deleterious effects may result.

REDUCED INPUT WEED CONTROL IN ROUNDUP READY COTTON. D.K. Miller[1], M.S. Mathews[1], D.R. Lee[1], J.W. Wilcut[2], P.R. Vidrine[3], and S.T. Kelly[4]; LSU AgCenter, St. Joseph[1], Alexandria[3], and Winnsboro[4], LA, and North Carolina State University, Raleigh[2], NC.

ABSTRACT

Research was conducted in 2003 at the Northeast Research Station in St. Joseph, La, and in Lewiston, NC, to evaluate reduced input weed control programs in Roundup Ready cotton. The study consisted of a factorial arrangement of early postemergence (EPOST) treatments applied to 3 to 4 leaf cotton and layby treatments. The EPOST treatments included Touchdown IQ (glyphosate) at 0.75 lb ai/A applied alone or in combination with Dual II Magnum (metolachlor) at 0.95 lb ai/A, Staple (pyrithiobac-sodium) at 0.032 lb ai/A or Envoke (trifloxysulfuron-sodium) at 0.0048 lb ai/A, and no EPOST treatment. The layby treatments included Caparol (prometryne) at 1.0 lb ai/A or Valor (flumioxazin) at 0.063 lb ai/A in combination with MSMA at 2.0 lb ai/A, and no layby treatment. Applications were made to DP 458 BR cotton on a silt loam soil in St. Joseph and to STV 4897 BGRR cotton on a sandy loam soil in Lewiston. Weed species evaluated at St. Joseph included redroot pigweed (*Amaranthus retroflexus*), hemp sesbania (*Sesbania exaltata*), pitted morningglory (*Ipomoea lacunosa*), entireleaf morningglory (*Ipomoea hederacea*), barnyardgrass (*Echinochloa crus-galli*), large crabgrass (*Digitaria sanguinalis*), broadleaf signalgrass (*Brachiaria platyphylla*), and goosegrass (*Eleusine indica*). In Lewiston, species evaluated included yellow nutsedge (*Cyperus esculentus*), goosegrass, pitted morningglory, entireleaf morningglory, common ragweed (*Ambrosia artemisiifolia*), Palmer amaranth (*Amaranthus palmeri*), and large crabgrass. Parameters measured included visual weed control late season at both locations and seedcotton yield in St. Joseph and lint yield in Lewiston.

In St. Joseph, both EPOST and layby application were needed to maximize weed control and seedcotton yield. With the exception of hemp sesbania and broadleaf signalgrass, weed control with Touchdown IQ was enhanced with the addition of a residual component at the EPOST application, with the best tank-mix partner varying depending on weed species. With the exception of goosegrass, where Caparol/MSMA performed better (88 vs. 81%), differences in weed control were not observed between layby programs. Averaged across layby treatments, addition of a residual component to Touchdown IQ significantly increased yield over the herbicide applied alone (952 to 1343 lb/A vs. 470 lb/A), with Staple providing the greatest benefit (1343 lb/A). Averaged across EPOST treatments, layby programs resulted in equivalent seedcotton yield (1007 lb/A vs. 852 lb/A). In North Carolina, results were similar with full compliment programs needed to maximize weed control and yield and residual benefits varying by weed species. Addition of a residual herbicide to Touchdown IQ, however, did not result in a yield increase over the herbicide applied alone (581 to 592 lb/A vs. 590 lb/A) when averaged across layby treatments. Averaged across EPOST programs, yield was similar for layby programs evaluated (599 lb/A vs. 598 lb/A).

In conclusion, in a reduced input Roundup Ready weed control program, both EPOST and layby applications are needed for maximum weed control and yield. Residual herbicides benefited weed control at both locations and yield in Louisiana when included with Touchdown IQ as an EPOST program. Caparol or Valor is equally effective for maintaining season-long weed control and maximizing yield with MSMA in a layby program.

WEED CONTROL PROGRAMS IN ROUNDUP READY FLEX COTTON. D.K. Miller, M.S. Mathews, and D.R. Lee; LSU AgCenter, St. Joseph, LA.

ABSTRACT

Research was conducted in 2003 at the Northeast Research Station in St. Joseph, La, to evaluate weed control programs in Roundup Ready Flex cotton. Treatments evaluated included the following: Roundup Weathermax (glyphosate) at 0.75 lb ae/A applied to 1 to 2 or 3 to 4 leaf cotton followed by (fb) the same rate applied to 2 to 3 inch weeds; Roundup Weathermax at 1.125 or 1.5 lb ae/A applied to 3 to 4 leaf cotton fb the same rates applied to 3 to 5 inch weeds; Roundup Weathermax at 1.125 or 1.5 lb ae/A applied to 5 to 8 leaf cotton fb the same rates applied to 3 to 5 inch weeds; Roundup Weathermax at 0.75 lb ae/A applied to 1 to 2 leaf cotton fb the same rate co-applied with Envoke (trifloxysulfuron-sodium) at 0.007 lb ai/A or Staple (pyrithiobac-sodium) at 0.096 lb ai/A applied to 7 to 10 lf cotton as a salvage treatment; and a full season pest management program consisting of Roundup Weathermax at 0.75 lb ae/A co-applied with the following: Orthene (acephate) at 0.5 lb ai/A to 1 to 2 leaf cotton, Centric (thiamethoxam) at 0.05 lb ai/A to 5 to 8 leaf cotton, Orthene at 0.5 lb ai/A plus Pix (mepiquat chloride) at 0.016 lb ai/A to 7 to 10 leaf cotton, and Tracer (spinosad) at 0.064 lb ai/A to 12 to 14 leaf cotton. Plot size was 4 rows 13.33' x 30'. Cotton was a non-BT variety and all plots were intensively managed for insect pests season long. The Roundup Weathermax plus insecticide or insecticide plus Pix full season program application timings were based on simulated need for insecticide/Pix application at various growth stages (no insect counts or weed or crop size triggers) to assess co-application compatibility on crop tolerance and weed control with a season-long program. Weed species evaluated included pitted morningglory (*Ipomoea lacunosa*), barnyardgrass (*Echinochloa crus-galli*), and hemp sesbania (*Sesbania exaltata*). Parameters measured included visual weed control late-season and prior to harvest and seedcotton yield.

With the exception of the Roundup Weathermax/Staple salvage treatment (79%), all treatments resulted in 84 to 90% control of pitted morningglory late-season. All treatments resulted in equivalent barnyardgrass control ranging from 90 to 95%. With the exception of Roundup Weathermax only programs consisting of an initial application at 1 to 2 leaf cotton followed by application to 2 to 3 inch weeds (76%) or initial application at 5 to 8 leaf cotton followed by application to 3 to 5 inch weeds at rates of 1.125 lb ae/A (70%), all treatments resulted in similar hemp sesbania control of 80 to 90%. All treatments resulted in excellent season-long control of pitted morningglory (84 to 91%) and barnyardgrass (91 to 95%). Hemp sesbania control ranged from 74 to 95%. Seedcotton yield for the season long Roundup Weathermax/insecticide program averaged 2326 lb/A, which was equivalent to RoundupWeathermax only programs with an initial application timing to 1 to 2 or 3 to 4 leaf cotton (2071 to 2346 lb/A), and greater than Weathermax programs with initial applications to 5 to 8 leaf cotton (1867 and 1647 lb/A) and the salvage treatments (1773 to 1664 lb/A).

In conclusion, insecticides Orthene, Centric, Tracer and growth regulator Pix resulted in no negative effects on crop tolerance or weed control when co-applied with Roundup Weathermax. Roundup Weathermax programs consisting of an early-season application at 1 to 2 or 3 to 4 leaf cotton followed by a sequential application to 2 to 5 inch weeds maximized yield when compared to a multiple application, season-long Roundup Weathermax program. Delaying initial Roundup Weathermax application to 5 to 8 leaf cotton or allowing weed escapes in a salvage situation for the sequential application to become too large can limit maximum yield potential due to prolonged weed competition.

BROADLEAF WEED AND EARLY SEASON INSECT CONTROL WITH ENVOKE AND INSECTICIDE CO-APPLICATIONS. M.S. Mathews[1], D.K. Miller[1], D.R. Lee[1], J.W. Wilcut[2], E. Burris[1], and R.G. Downer[3]; LSU AgCenter, St. Joseph[1] and Baton Rouge[3], LA, and North Carolina State University, Raleigh, NC[2].

ABSTRACT

Research was conducted in 2002 at the Northeast Research Station in St. Joseph, La, and at 4 locations in North Carolina in 2003 to evaluate the influence of co-application of various insecticides and Envoke (trifloxysulfuron-sodium) on broadleaf weed and early season insect control. The insect control study, consisting of 2 experiments conducted in 2002, included the insecticides Orthene (acephate) at 0.33 lb ai/A, Vydate (oxamyl) at 0.33 lb ai/A, Karate Z (lambda-cyhalothrin) at 0.03 lb ai/A, Intruder (acetamiprid) at 0.04 lb ai/A, Centric (thiamethoxam) at 0.04 lb ai/A, Phaser (endosulfan) at 0.33 lb ai/A, Steward (indoxacarb) at 0.11 lb ai/A, Denim (emamectin benzoate) at 0.01 lb ai/A, Intrepid (methoxyfenozide) at 0.06 lb ai/A, Tracer (spinosad) at 0.067 lb ai/A or S-1812 (pyridalyl) at 0.1 lb ai/A applied alone or co-applied with Envoke at 0.007 lb ai/A. Nonionic surfactant was not included with any co-application. Application was made to each 4 row, 13.33' x 40' plot at heavy thrips infestation levels. At 4 days after application (DAT), adult thrips and larvae were counted from 10 randomly selected terminals. The weed control study, conducted in 2003, included Envoke applied alone at 0.0047 lb ai/A or co-applied with the previously mentioned insecticides at the rates indicated. Application was made to each 6' x 20' natural weed population using a CO_2 backpack sprayer. Nonionic surfactant was included with all treatments. Visual assessment of weed control was conducted 14 DAT. Weeds evaluated at each location included sicklepod (*Senna obstusifolia*), pitted morningglory (*Ipomoea lacunosa*), Palmer amaranth (*Amaranthus palmeri*), smooth pigweed (*Amaranthus albidus*), and common lambsquarters (*Chenopodium album*) at Goldsboro; pitted morningglory, tall morningglory (*Ipomoea purpurea*), smooth pigweed, Palmer amaranth, sicklepod, and common lambsquarters at Kinston; smooth pigweed, Palmer amaranth, common lambsquarters, entireleaf morningglory (*Ipomoea hederacea*), and tall morningglory at Rocky Mount, and jimsonweed (*Datura stramonium*), prickly sida (*Sida spinosa*), Ivyleaf morningglory (*Ipomoea hederacea*), and pitted morningglory at Clayton. Weed size at application was as follows: sicklepod (cotyledon to 3 leaf), Palmer amaranth (2 to 16 leaf), common lambsquarters (8 to 20 leaf), entireleaf morningglory (cotyledon to 5 leaf), tall morningglory (cotyledon to 4 leaf), smooth pigweed (5 to 18 leaf), jimsonweed (cotyledon to 4 leaf), prickly sida (cotyledon to 4 leaf), ivyleaf morningglory (cotyledon to 3 leaf), and pitted morningglory (cotyledon to 4 leaf). Pairwise comparisons with insecticides alone and each Envoke/insecticide co-application for the insect study and with Envoke alone and the co-applications for the weed control study were conducted at the 0.05 level of significance. A nontreated control was included in the insect study to determine a percent thrips reduction for all treatments and also in the weed control study for visual rating reference, but was not included in the statistical analysis.

In the first experiment, adult thrips number reduction for each insecticide was negatively affected with the addition of Envoke for only the insecticide Steward (61 vs. 23%). Adult thrips number reduction in the second experiment and thrips larvae reduction averaged across both experiments was unaffected by Envoke addition when compared to each insecticide applied alone. Sicklepod, Palmer amaranth, common lambsquarters, entireleaf morningglory, tall morningglory, smooth pigweed, jimsonweed, prickly sida, ivyleaf morningglory, and pitted morningglory control with Envoke applied alone was 95, 73 to 87, 93 to 97, 95, 97 to 98, 82 to 97, 23, 24, 97, and 96 to 97%, respectively over all locations. With few exceptions, Palmer amaranth, smooth pigweed, common lambsquarters, jimsonweed, and prickly sida control was significantly reduced when Envoke was co-applied with all insecticides evaluated compared to the herbicide applied alone. Control of sicklepod and all morningglory species with Envoke was not affected by co-application with insecticides.

In conclusion, Palmer amaranth, smooth pigweed, common lambsquarters, jimsonweed, and prickly sida control with Envoke can be reduced when the herbicide is co-applied with insecticides evaluated in this study. Control of sicklepod and morningglory species evaluated is unaffected. Envoke co-applied with insecticides evaluated does not appear to have a negative impact on thrips control.

UTILIZATION OF SPECTRAL BANDS AND VEGETATION INDICES IN MONITORING THE SEASONAL GROWTH AND DEVELOPMENT OF COTTON. J.C. Sanders, D.B. Reynolds, L.T. Barber, L.M. Bruce, and C.G. O'Hara; Mississippi State University, Mississippi State, MS.

ABSTRACT

The growth and development of cotton is indeterminant in nature, thus requiring termination of the crop at optimal maturity. Cotton maturity can vary temporarily and spatially due to environmental and cultural factors, thus allowing for the utilization of site-specific crop management. Remotely sensed spectral data is one such tool that can be used to monitor the growth and development of cotton, and implemented into site-specific crop management techniques. Spectral bands and vegetation indices are two aspects of remotely sensed spectral data that have been used to evaluate the growth and development of crops, including cotton. With the capability to temporally and spatially monitor the growth and development of cotton, the crop can be more economically and efficiently managed.

Research was conducted to evaluate spectral reflectance data for monitoring the growth and development of cotton. Field studies were established in each year from 2000 to 2002 at the R.R. Foil Plant Science Research Center near Starkville, MS to correlate remote sensing data to cotton maturity. The experimental area received irrigation in amounts necessary to maintain moisture conditions conducive for proper plant growth and development. The studies were conducted in a randomized complete block design with four replications. Plots were 7.7 m wide and 12.2 m long, including eight rows with 0.97m row spacing. Four sites, consisting of two row meters each, were established within each plot and permanently marked, additionally the location of each site was recorded using a global positioning system (GPS) with 1-m accuracy. Hyperspectral measurements from a handheld spectroradiometer were collected at 14 to 21 day increments in early and mid-season. As maturity was approached in late-season, measurements were collected at 7 to 10 day increments or as weather conditions permitted. Two measurements were taken at each site with a 25-degree bare-fiber field of view at a height of 46 cm above the target. The hyperspectral reflectance range was from 350 to 2500 nm. The handheld measurements were analyzed using various procedures in customized software and SAS. Aerial images of the experimental area were collected in 2002 throughout the entire growing season from an aircraft platform with 1-m spatial resolution. Crop growth and development monitoring was achieved through NDVI calculations from appropriate aerial surveys via two ArcGIS software products, ArcView® and ArcInfo®.

Differential growth and developmental stages of cotton were found distinguishable by spectral attributes. Regardless of analytical technique, classification accuracies were no less than 96% for differentiating developmental stages of cotton. High accuracies were obtained with linear discriminant models with no less than 96% correct classification. Discriminant models for multiple vegetation indices provided classification accuracies of no less than 81%. These classification procedures suggest that differing growth and developmental stages of cotton, including those at maturity, can be separated through the use of spectral data. Vegetation indices were found to have a non-linear relationship with growth and development of cotton, through second order polynomial regression.

WEED MANAGEMENT IN LIBERTY LINK AND ROUNDUP READY FLEX COTTON.

J.J. Walton, D.B. Reynolds, N.W. Buehring, and M.T. Kirkpatrick. Mississippi State University, Mississippi State MS.

ABSTRACT

The need for a wider topical application window in transgenic cotton has facilitated the development of Roundup Ready Flex and Liberty Link Cotton. The Roundup Ready Flex system allows foliar applications of glyphosate (Roundup WeatherMax) through the 12th node, and the Liberty Link system allows for foliar applications of glufosinate (Ignite) up to 70 days prior to harvest. The objective of this research was to compare the efficacy of current Roundup Ready systems to potential weed control programs in both the Roundup Ready Flex and Liberty Link systems.

Field trials were conducted to evaluate the Roundup Ready Flex programs at the Black Belt Experiment Station in Brooksville, MS, the North Mississippi Research and Extension Center in Verona, MS, and the Plant Science Research Center in Starkville, MS. An experiment with Liberty Link cotton was also conducted at the Brooksville location. The experimental design for all experiments was a randomized complete block design with four replications. Plot size was 13 by 40 ft. Foliar applications of glyphosate at 0.75, 1.125, and 1.5 lb ae/A were applied on 1 to 3, 3 to 4, 5 to 8, and 10 to 12 leaf cotton as well as on 2 to 3" and 3 to 5" weeds. Foliar applications of glufosinate were applied at 0.41 lbs ai/A at the 4 leaf stage followed by a sequential application at the 6 leaf stage in cotton. An untreated check was included in the treatments for comparison. In both weed control systems, visual ratings were observed on pitted morningglory (*Ipomoea lacunosa*), sicklepod (*Senna obtusifolia*), hemp sesbania (*Sesbania exaltata*), and annual grasses (*Digitaria sanguinalis*, *Bracharia platyphylla*, and *Eleusine indica*). Ratings were recorded 7 days after treatment (DAT) within the application period and 7, 14, 21, & 28 days-after-final application.

In the Roundup Ready Flex system, pitted morningglory control ranged from 91 to 97% at 7 days after application of the layby treatments. Treatments receiving only glyphosate at layby exhibited 91 to 92% control compared to treatments that included the use of 0.5 lb ai/A diuron which resulted in 97 to 98% control. By 14 DAT, control did not differ among treatments and ranged from 92 to 95%. Sicklepod control 7 DAT was slightly better with treatments containing diuron but all treatments provided 93 to 98% control. By 28 DAT control did not differ among treatments and ranged from 90 to 94%. Hemp sesbania control 14 and 28 DAT ranged from 96 to 99% and did not differ among treatments. Control of the annual grass complex did not differ among rates or rating interval and was at least 99% for all treatments. No cotton injury was observed from any treatment combination.

In the Liberty Link system, pitted morningglory, sicklepod, and hemp sesbania control did not differ among treatments or evaluation interval, and ranged from 95 to 99%. Large crabgrass control did vary among treatments. Seven days after the early postemergence application, all treatments provided 95 to 97% control. By 14 DAT, control in treatments that did not include a residual ranged from 69 to 76% as compared to treatments that included 1.5 lbs ai/A of fluometuron as a preemergence treatment, which provided 87 to 92% control. Following the second topical application, control did not differ among treatments; however, by 28 DAT only treatments containing fluometuron or treatments that consisted of three topical applications of glufosinate provided greater than 90% control. Barnyardgrass control was slightly less than for crabgrass, yet the trends were similar. By 14 DAT of the first topical application, treatments that did not contain a residual provided 73 to 76% control as compared to 89 to 92% with treatments that had 1.5 lbs ai/A of fluometuron applied preemergence. No crop injury was observed with any treatment combination.

BROADLEAF WEED CONTROL WITH GLUFOSINATE AS INFLUENCED BY INSECTICIDE CO-APPLICATION. M.S. Mathews[1], D.K. Miller[1], E. Burris[1], B.R. Leonard[2], and R. G. Downer[3]; LSU AgCenter, St. Joseph[1], Winnsboro[2], and Baton Rouge[3], LA.

ABSTRACT

Research was conducted in 2003 at the Northeast Research Station in St. Joseph, La to evaluate broadleaf weed control with Liberty (glufosinate) as influenced by co-application with various insecticides. Hemp sesbania (*Sesbania exaltata*), redroot pigweed (*Amaranthus retroflexus*), pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), and sicklepod (*Senna obtusifolia*) seed were planted outdoors in trade gallon nursery containers in a peat moss/silt loam soil mix (1:1) and thinned to one plant per pot following germination. Liberty was applied at the 3 to 4 or 7 to 8 leaf growth stage alone at 0.418 lb ai/A or co-applied with the following insecticides: Bidrin (dicrotophos) at 0.4 lb ai/A, Orthene (acephate) at 0.75 lb ai/A, Centric (thiamethoxam) at 0.047 lb ai/A, Intruder (acetamiprid) at 0.03 lb ai/A, Trimax (imidacloprid) at 0.047 lb ai/A, Capture (bifenthrin) at 0.06 lb ai/A, Karate Z (lambda-cyhalothrin) at 0.04 lb ai/A, Baythroid (cyfluthrin) at 0.04 lb ai/A, Steward (indoxacarb) at 0.11 lb ai/A, Tracer (spinosad) at 0.075 lb ai/A, Denim (emamectin benzoate) at 0.015 lb ai/A, or Intrepid (methoxyfenozide) at 0.125 lb ai/A. A nontreated control was included for comparison. Applications were made using a CO_2 back-pack sprayer at 15 GPA. Visual weed control assessments were conducted 7 and 14 days after application (DAT). Above ground fresh weight was also recorded at the later rating interval. Fresh weight determinations were converted to a percent reduction from nontreated control plants. Pairwise comparisons with Liberty alone and each Liberty/insecticide co-application were conducted at the 0.05 level of significance. Nontreated control plants were used for visual rating reference and fresh weight reduction calculations, but were not included in the statistical analysis.

Only growth stage effect was significant with respect to parameters measured for hemp sesbania and redroot pigweed (control 7 DAT and fresh weight reduction), prickly sida (control 14 DAT and fresh weight reduction), and pitted morningglory and sicklepod (all parameters). Averaged across all treatments, control and fresh weight reduction for these parameters was greater for application at the 3 to 4 leaf stage than at the 7 to 8 leaf stage. Treatment and growth stage effects were not noted for hemp sesbania and redroot pigweed control 14 DAT. A significant treatment by growth stage interaction was noted for prickly sida control 7 DAT. Insecticide co-application did not reduce control with Liberty at either growth stage. Insecticides Bidrin, Tracer, and Intrepid did, however, increase prickly sida control 7 DAT with Liberty applied at the 7 to 8 leaf growth stage (79 vs. 65%). When applied at the earlier timing, Liberty alone provided 95, 100, 99, 99, and 94% control of hemp sesbania, redroot pigweed, pitted morningglory, prickly sida, and sicklepod, respectively, 7 DAT. At 14 DAT, control was 100% for all weeds treated at the 3 to 4 leaf timing. At the later timing, control of theses respective weeds with Liberty alone 7 DAT was 80, 83, 76, 65, and 63%, while at 14 DAT control was 100, 100, 91, 71, and 76%.

In conclusion, Liberty provided greater control of the broadleaf weeds evaluated in this study when applied at the 3 to 4 leaf growth stage compared with 7 to 8 leaf application. Also, insecticides evaluated in this study did not reduce visual control or fresh weight reduction of hemp sesbania, redroot pigweed, pitted morningglory, prickly sida, or sicklepod when co-applied with Liberty.

RESPONSE OF COTTON CULTIVARS TO SIMULATED GLUFOSINATE DRIFT.

C.C. Craig, L.E. Steckel, R.M. Hayes, and P.B. Brawley. University of Tennessee, Jackson, TN 38301.

ABSTRACT

Glufosinate (Ignite) has been labeled for use in Tennessee for burndown, hooded applications and for overtop applications to glufosinate resistant cotton. Currently, greater than 95% of the cotton grown in Tennessee is glyphosate-resistant. However, recent discovery of glyphosate resistant horseweed (*Conyza canadensis*) has forced producers to search for alternative means of weed control. Glufosinate promises to be a viable control option for weeds that are glyphosate resistant and difficult to control. Since use of glufosinate will probably increase, a field study was initiated at the West Tennessee Experiment Station in 2003 to evaluate the effect of simulated glufosinate drift to glyphosate resistant cotton. The objectives of this study were to study the effect of simulated glufosinate drift on the growth, earliness and yield of glyphosate-resistant cotton and to determine if glufosinate drift injury will vary among cultivars of differing maturity.

Three, glyphosate-resistant, *Bt* cultivars; an early-maturing cultivar PM 1218 BG/RR, a medium-maturing cultivar FM 960 BR and a late-maturing cultivar DP 555 BG/RR were planted without tillage in late April, 2003. Simulated drift rates of 10, 5 and 1% of the recommended use rate of 32 oz acre^{-1} were applied at two stages of cotton growth (5-6 node and 8-10 node). These two growth stages were chosen because they signify two growth stages at which drift injury may occur. Drift was simulated by applying the various rates via TX-4 hollow cone nozzles calibrated to deliver a total volume of 5 gallons acre^{-1}. Visual injury ratings were taken at 7 and 18 days after treatment (DAT). Cotton was harvested twice for seedcotton yield and to determine percent first harvest, a measure of earliness. Data were subjected to analysis of variance using SAS (v.8) PROC GLM and means were separated using Fisher's Protected LSD (p=0.05).

Visual ratings of plots at 7 DAT showed the highest injury response to the 10% drift rate and injury was greatest in PM 1218 BG/RR. However, visual injury was negligible at 18 DAT for all varieties. Percent first harvest was significantly reduced by all application rates to DP 555 BG/RR at both application timings and at the 10% rate made at the 8-10 node timing to FM 960 BR. Percent first harvest was unaffected in the early-maturing, PM 1218 BG/RR at any rate or application timing. However, seedcotton yield of all cultivars was significantly reduced at both application timings at the 10% drift rate. Results from one year of data suggest that glufosinate drift can delay boll opening, particularly in medium- and full-season cultivars. In addition, glufosinate drift in excess of 10% of the applied rate can reduce yields of cultivars of all maturities.

IMPACT OF BIOTECHNOLOGY-DERIVED HERBICIDE-TOLERANT CROPS ON THE SOUTHERN REGION OF THE UNITED STATES. S. Sankula and L. Gianessi, National Center for Food and Agricultural Policy, Washington, DC.

ABSTRACT

Of the four currently planted biotechnology-derived herbicide-tolerant (HT) crops (soybean, corn, cotton, and canola) in the US, soybean, corn, and cotton are the major crops in the southern region. Overall adoption of HT crops in the southern United States has been higher than the national average. While the national adoption of biotechnology-derived herbicide-tolerant soybean, corn, and cotton was 68, 8, and 74% in 2001, the southern region of the United States planted herbicide-tolerant soybean, corn, and cotton on 69, 9, and 84% of the respective crop acreage in 2002.

A study was conducted in 2001 to evaluate the impacts of biotechnology-derived crops on US agriculture. Impacts were assessed for four categories: changes in crop yields, crop production costs, crop value, and pesticide use.

Comparative analysis of weed management programs in conventional versus glyphosate-tolerant soybean suggested that alternative herbicide programs that would provide weed control equivalent to that of gyphosate would require 3 herbicide active ingredients and 1.39 lb ai/A at a cost of $32.80. On the other hand, weed management in glyphosate-tolerant soybean reduced the number of herbicide active ingredients by 67%, herbicide use by 23%, and weed control costs by 53%. Thus, the net impact of the adoption of herbicide-tolerant soybean in the NE United States has been lowered production costs and increased simplicity and flexibility in weed management.

The adoption of biotechnology-derived HT corn in the southern region of the United States has largely been driven by improved control of troublesome weeds such as burcucumer (*Sicyos angulatus*), yellow nutsedge (*Cyperus esculentus*), Johnsongrass (*Sorghum halapense*), and Bermudagrass (*Cynodon dactylon*). The adoption of herbicide-tolerant corn has replaced or reduced the soil-applied preemergence treatments or substituted the previously used POST applications with either glyphosate or glufosinate. These substitutions have resulted in $4.73 million in savings on herbicide costs with an associated reduction of 0.47 million pounds of herbicide use.

Weed management has become simpler since the introduction of HT cotton. Growers have experienced significant reductions in the number of herbicide active ingredients, herbicide applications, tillage trips, manual weeding operations and overall herbicide use. Net impact of HT cotton has been $107 million in grower cost savings, in spite of the added expenses of technology fees and seed premiums

Herbicide-tolerant crops have facilitated the adoption of conservation tillage practices, no tillage in particular, across the United States. No-till acreage of soybean, corn, and cotton was increased by 100, 25, and 300%, respectively, in the Southern region of US in 2002 compared to 1994. Herbicide-tolerant crops enables all the environmental benefits that no-tillage offers (such as reduction in soil erosion, runoff and global warming potential, improved organic matter conservation, decreased production costs due to fuel and labor savings), as their use is compatible with no-tillage production practices.

The combined impact of herbicide-tolerant soybean, corn, and cotton on the southern region of United States is a saving of $242.5 million in grower costs and 11.7 million lb. reduction in herbicide use. Herbicide-tolerant corn acreage is projected to increase in the coming years in view of its cost effectiveness and increasing availability of herbicide-tolerance trait in high-yielding varieties.

DEEP TILLAGE AND GLYPHOSATE REDUCED REDVINE AND TRUMPETCREEPER POPULATIONS IN ROUNDUP READY SOYBEAN. K.N. Reddy. USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS 38776.

ABSTRACT

Redvine [*Brunnichia ovata* (Walt.) Shinners] and trumpetcreeper [*Campsis radicans* (L.) Seem. ex Bureau] are deciduous perennial woody vines distributed extensively in the Mississippi Delta. These vines have an extensive, deep-rooted system, which enables them to spread and survive environmental extremes. They are among the 10 most troublesome weeds in row crops of the mid-southern U.S. As herbicides alone cannot provide complete control of these vines, additional management tactics are needed. This study examines integration of deep tillage and glyphosate for management of redvine and trumpetcreeper in Roundup Ready soybean.

A 3-yr field study was conducted during 2000-2002 on a Dundee silty clay loam at Stoneville, MS. The experiment was conducted in a split-split plot arrangement of treatments in a randomized complete block design with tillage as main plot, preplant application of glyphosate as subplot, and in-crop glyphosate postemergence (POST) as sub-subplot with four replications. Each sub-subplot consisted of 4 rows of soybean spaced 102 cm apart and 19.8 m long. Main plot treatments were deep (45 cm depth; twice) and shallow conventional (15 cm depth) tillage in the fall of previous year. Subplot treatments were preplant application of glyphosate at 2.52 kg ae/ha 2 wk before planting soybean and no glyphosate. Sub-subplot treatments were glyphosate early POST (EPOST) at 1.26 kg ae/ha, glyphosate EPOST at 1.26 kg ae/ha followed by glyphosate late POST (LPOST) at 0.84 kg ae/ha, and a no herbicide control. Roundup Ready soybean (DP5806RR in 2000; DP4690RR in 2001; AG4702RR in 2002) was planted in May each year. Flumetsulam plus metolachlor were applied at planting to entire experimental area to control all other weeds. EPOST and LPOST treatments were applied at 4 and 6 weeks after planting soybean, respectively. Redvine and trumpetcreeper counts and dry weights were recorded from two 1-m^2 areas at 4 wk after LPOST. Soybean was harvested from entire plot. Soybean crop failed in 2000 due to late summer drought.

Deep tillage for 1, 2, and 3 years consecutively decreased redvine density by 95, 88, and 97%, respectively, compared with shallow tillage, but deep tillage had no effect on trumpetcreeper density. Glyphosate applied preplant reduced trumpetcreeper density (25 to 44%), but not redvine compared with no glyphosate in all three years. Glyphosate EPOST alone (45 to 67%) or followed by LPOST (59 to 83%) reduced density of trumpetcreeper but not redvine compared with no herbicide. However, dry biomass of redvine was reduced with glyphosate in-crop POST compared with no herbicide. Soybean yields were higher with deep tillage vs. shallow tillage, glyphosate preplant application vs. no glyphosate, and glyphosate EPOST alone or followed by glyphosate LPOST vs. no herbicide. These results show that deep tillage even for one year could effectively reduce redvine density. Glyphosate preplant, EPOST, and EPOST followed by LPOST applications could greatly reduce trumpetcreeper density and suppress growth of redvine in Roundup Ready soybean.

GLYPHOSATE EFFICACY AS INFLUENCED BY TIME OF DAY APPLICATIONS.

L.L. Lyon, J.D. Everitt, and J.W. Keeling, Texas Agricultural Experiment Station, Lubbock, TX.

ABSTRACT

Roundup Ready cotton has been widely planted on the Texas Southern High Plains since its introduction in 1997. Producers use glyphosate to effectively control a broad spectrum of weed species across the 50 to 60% of Roundup Ready cotton planted in the area. Typical weather conditions during the growing season include high temperatures and low relative humidities. However, daily temperatures can fluctuate as much as 30˚ from early morning to mid-day and daily humidity can vary from as much as 80% to as low as 5 to 10% over the course of a day. Concerns about the effectiveness of glyphosate applied mid-day have surfaced recently, so some applicators have considered making glyphosate applications at night to prevent any temperature or humidity interference on weed control. The objective of this study was to determine how diurnal fluctuations in temperature and relative humidity affect Roundup WeatherMax and Touchdown IQ activity on Palmer amaranth (*Amaranthus palmeri*).

Roundup WeatherMax and Touchdown IQ at 0.38 and 0.75 lb ae/A were applied at: 6:00 am, 9:00 am, 12:00 pm, 3:00 pm, 6:00 pm, 9:00 pm, 12:00 am, and 3:00 am. Plots were four rows by 30 feet, replicated three times and arranged in a randomized block design. All treatments were applied broadcast with a tractor-mounted, compressed-air sprayer (equipped with TurboTee 110015 nozzle tips), calibrated to deliver 10 GPA at 3 MPH and 30 to 35 psi.

Palmer amaranth size ranged from 6- to 30-inches, and weed pressure was intense and uniform in the trial area both years. This size weed and pressure is not typical of normal applications, but the purpose of this study was to put the herbicide into a challenging situation to determine if the time of day of the application affected herbicide efficacy. In 2002, temperatures ranged from 68 to 95 °F and relative humidity ranged from 30 to 88% during the day the treatments were applied, while in 2003, temperatures from 67 to 96 °F and relative humidity from 16 to 67% were recorded.

In 2002, the 0.75 lb ae/A rate of either Roundup WeatherMax or Touchdown IQ provided >80% control of Palmer amaranth, regardless of the time of day of application. However, Palmer amaranth control decreased to 67 to 75% when both glyphosate formulations were applied at the 0.38 lb ae/A rate at 12:00 pm, 3:00 pm, and 6:00 pm. No differences in Palmer amaranth control were observed with glyphosate applied at the 0.38 or 0.75 lb ae/A rates at any time of day, regardless of formulation in 2003, with control >90%. Most treatments were able to "melt" large (up to 30-inch) Palmer amaranth. Based on these data, weather and weed conditions prior to applications may have a greater impact on glyphosate efficacy than the diurnal fluctuations of temperature and humidity.

EFFECTS OF DRIFT CONTROL ADJUVANTS ON EFFICACY AND SPRAY PATTERNS OF ROUNDUP D-PAK™ AND ROUNDUP WEATHER MAX™ APPLIED WITH AIR INDUCTION SPRAY NOZZLES. G.D. Wills[1], J.E. Hanks[2], E.J. Jones[1], and R. E. Mack[3], Delta Research and Extension Center[1] and USDA-ARS[2], Stoneville, MS and Helena Chemical Co.[3], Memphis, TN.

ABSTRACT

Both laboratory and field studies were conducted in 2003 to determine the effect of the drift control adjuvants HM 9752, HM 2005B, and HM 2006 on spray patterns and efficacy of glyphosate as applied without surfactant as Roundup D-Pak® and with surfactant as Roundup Weather Max®. Earlier research has shown that herbicide application is influenced by pattern of spray delivery and by size of spray droplets wherein smaller droplets result in greater drift from the target area. Previous studies using an Insitec Measurement Systems® laser particle analyzer have shown that these drift control adjuvants will reduce droplet size of glyphosate formulations both with and without surfactants as applied with TeeJet® Air Induction 110015VS spray nozzles. The description of these drift reducing adjuvants and the rates applied are shown in Table 1.

In the field study, glyphosate was applied at 0.4 lb ai which is less than the recommended rate of 1 lb ai per acre in order to detect any increase or decrease in efficacy due to the addition of the drift control adjuvants. Mixtures of glyphosate both with and without surfactant were applied with each drift control adjuvant using a tractor-mounted sprayer at 40 psi with eight nozzles spaced 19 inches apart along the boom. Field applications were over-the-top to four rows each of three-trifoliolate-stage non-Roundup Ready® soybeans [*Glycine max* (L.) Merr] 'Pioneer 9594' spaced 38 inches apart, 40 feet long and interspaced with 4- to 6-inch-tall barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], 4- to 6-inch-tall pitted morningglory (*Ipomoea lacunosa* Lag.), and 5- to 7-inch-tall velvetleaf (*Abutilon theophrasti* Medik.). Treatments were replicated four times in a randomized complete block design. Efficacy was determined by visual ratings 2 weeks after treatment (WAT) whereby 0 = no control and 100% = complete kill of shoots. Data were subject to analysis of variance. Means were separated using Fisher's Protected Least Significant Difference (LSD) at P = 0.05.

Spray patterns were determined by using a single nozzle centered in a stationary position at 13 inches above a slanted sheet of corrugated metal. Spray mixtures were applied in 600-ml volumes at 45 psi to the sheet of corrugated metal with troughs spaced 2.5 inches apart and the discharge was collected in 100-ml graduated cylinders. The values for the average milliliter volumes of three replications as collected at each position from left to right were reversed right to left, added together and averaged again for each position to show a symmetrical spray pattern for each mixture. Glyphosate both with and without surfactant was applied at 2 rates, 0.4 lb ai/A which was the same rate as was used in the field efficacy test and 1 lb ai/A which is the recommended rate.

Percent control over all the plant species in the field study at 2 WAT with glyphosate applied with and without surfactant respectively was: with no drift control adjuvants, 91 to 100% and 70 to 91%; with HM 9752 at 9 lb/100 gal, 95 to 100% and 90 to 97%; with HM 2005B at 5 lb/100 gal, 94 to 100% and 89 to 97%; with HM 2005B at 7 lb/100 gal, 95 to 100% and 86 to 96%; with HM 2005B at 9 lb/100 gal, 94 to 99% and 89 to 96%; and with HM 2006 at 9 lb/100 gal, 93 to 96% and 90 to 95%.

The width of the spray patterns of glyphosate without surfactant applied at 0.4 and 1 lb ai/A, respectively, was 30 inches each without drift control agents and 20 inches each with the addition of each type and rate of drift control agent used in this study. With these same spray mixtures, the spray volumes were concentrated toward the edges of the spray patterns.

Spray patterns of glyphosate with surfactant applied at the rates of 0.4 and 1 lb ai/A were 25 to 30 inches wide with glyphosate alone, 20 inches wide with the addition of the drift control agent HM 2005B at 5, 7, and 9 lb/100 gal and 15 inches wide with the addition of the drift control agents HM 2006 and HM 9752 each at 9 lb/100 gal. With these mixtures, the volume of spray was concentrated in the center of the spray pattern with this effect being greater with the 1 lb ai/A than the 0.4 lb ai/A rate of the glyphosate plus surfactant.

Results showed that the drift control adjuvants used in this study applied with glyphosate both with and without surfactant either increased or had no effect on the efficacy of this herbicide. The spray pattern for each glyphosate mixture was adequate to provide uniform applications with the spray nozzles positioned 19 inches apart along the boom.

Table 1. Drift control adjuvants and rates applied.

HM 9752	Proprietary blend of polymeric viscosity modifiers and ammonium sulfate (9 lb/100 gal)
HM 2005B	Proprietary blend of plant nutrients and water soluble organic polymers (5, 7, and 9 lb/100 gal)
HM 2006	Proprietary blend of nonionic water soluble organic polymers and ammonium salts (9 lb/100 gal)

EFFECTS OF DRIFT CONTROL ADJUVANTS ON EFFICACY AND SPRAY PATTERNS OF ROUNDUP D-PAK™ AND ROUNDUP WEATHER MAX™ APPLIED WITH EXTENDED RANGE SPRAY NOZZLES. E.J. Jones[1], J.E. Hanks[2], G.D. Wills[1], and R.E. Mack[3], Delta Research and Extension Center[1] and USDA-ARS[2], Stoneville, MS and Helena Chemical Co.[3], Memphis, TN.

ABSTRACT

Both laboratory and field studies were conducted in 2003 to determine the effect of the drift control adjuvants HM 9752, HM 2005B, and HM 2006 on spray patterns and efficacy of glyphosate as applied without surfactant as Roundup D-Pak® and with surfactant as Roundup Weather Max®. Earlier research has shown that herbicide application is influenced by pattern of spray delivery and by size of spray droplets wherein smaller droplets result in greater drift from the target area. Previous studies using an Insitec Measurement Systems® laser particle analyzer have shown that these drift control adjuvants will reduce droplet size of glyphosate formulations both with and without surfactants as applied with TeeJet® Extended Range 110015VS spray nozzles. The description of these drift reducing adjuvants and the rates applied are shown in Table 1.

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Spray patterns were determined by using a single nozzle centered in a stationary position at 13 inches above a slanted sheet of corrugated metal. Spray mixtures were applied in 600-ml volumes at 45 psi to the sheet of corrugated metal with troughs spaced 2.5 inches apart and the discharge was collected in 100-ml graduated cylinders. The values for the average milliliter volumes of three replications as collected at each position from left to right were reversed right to left, added together and averaged again for each position to show a symmetrical spray pattern for each mixture. Glyphosate both with and without surfactant was applied at 2 rates, 0.4 lb ai/A which was the same rate as was used in the field efficacy test and 1 lb ai/A which is the recommended rate.

Percent control over all the plant species in the field study at 2 WAT with glyphosate applied with and without surfactant respectively was: with no drift control adjuvants, 93 to 100% and 79 to 94%; with HM9752 at 9 lb/100 gal, 95 to 100% and 96 to 100%; with HM 2005B at 5 lb/100 gal, 93 to 99% and 93 to 97%; with HM 2005B at 7 lb/100 gal, 93 to 100% and 89 to 98%; with HM 2005B at 9 lb/100 gal, 95 to 100% and 91 to 98%; and with HM 2006 at 9 lb/100 gal, 95 to 100% and 91 to 99%.

The width of the spray patterns with glyphosate applied with or without surfactant at 0.4 and at 1 lb ai/A without the addition of drift control adjuvants was 45 inches and with the addition of each of the drift control adjuvants was 35 to 40 inches.

Results showed that the drift control adjuvants used in this study applied with glyphosate both with and without surfactant either increased or had no effect on the efficacy of this herbicide. The spray pattern for each glyphosate mixture was adequate to provide uniform applications with the spray nozzles positioned 19 inches apart along the boom.

Table 1. Drift control adjuvants and rates applied.

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TRUMPETCREEPER (*CAMPSIS RADICANS*) REGENERATION AS AFFECTED BY TIMING OF SHOOT REMOVAL OF SEEDLING PLANTS. M.W. Marshall and J.D. Green; Department of Agronomy, University of Kentucky, Lexington.

ABSTRACT

Trumpetcreeper, a fast-growing deciduous perennial vine, commonly infests reduced tillage fields across Kentucky. It propagates itself through creeping roots, seeds, and the formation of adventitious roots on leaf axils found along its stems. Typically, plants found in agronomic fields produce vines that remain in a vegetative (do not produce flowers and seed) state and frequently die back to the original plant. However, plants located near undisturbed areas, such as fencerows, resemble a shrub with woody stems that are capable of producing flowers and seeds. Seed transfer, via wind and/or other dispersal mechanisms, represents a vehicle of entry for trumpetcreeper into agronomic fields. Therefore, an integration of trumpetcreeper seedling development into its perennial form is critical in developing an overall management strategy. The objectives of this study were to quantify early growth and development of trumpetcreeper seedlings and to quantify trumpetcreeper seedling shoot regrowth following a discrete time period after shoot removal. In the greenhouse, seeds were germinated between moistened layers of paper towels placed in a growing tray with a clear plastic hood. Approximately 14 days after germination, seedling trumpetcreeper were transplanted at the cotyledon stage to 7.5 by 15 cm pots containing 1000 g of 2:1:1 soil mix (Pro-Mix, Soil, and Sand). At 10, 20, 30, 40, 50, and 60 days after transplanting (DAT), shoots were clipped at the soil level. Experimental design was a randomized complete block with 5 replications and 6 clipping dates. The experiment was repeated four times (runs). At each time interval, vine length, number of compound leaves per vine, number of plantlets initiated per vine, and shoot dry weight data were collected. A plantlet is defined as a stem axil that produces an adventitious root where it touches the ground. To quantify shoot regeneration, each clipped plant was given 30 days from its initial clipping date to produce new shoots. Data collected were vine length, shoot dry weight, and root dry weight. Growth data were fitted against time using quadratic regression models for each parameter. Shoot regeneration growth data were analyzed using ANOVA and means separated using Fisher's protected LSD. Vine length, shoot dry weight, number of plantlets initiated per vine, and number of leaves per vine at time of initial clipping were pooled across runs because there was no significant interaction between time and runs. Vine length, shoot dry weight, and number of plantlets initiated per vine increased significantly 20, 30, and 30 DAT, respectively. In addition, number of compound leaves per vine increased significantly over time. Vine length, shoot dry weight, and root dry weight data were pooled across the four runs because there was no significant interaction between runs and time. A majority of clipped trumpetcreeper seedlings, beginning at 30 DAT, produced new shoots (>52% attained perennating capability) at a relatively low root dry weight (0.07 g). In addition, vine length, shoot dry weight, and root dry weight increased rapidly when clipped beyond 40 DAT. This indicates that a critical root biomass threshold must be exceeded before trumpetcreeper is able to produce new shoots from perennating organs (roots). In conclusion, trumpetcreeper seedlings entered their rapid growth rate phase approximately 30 to 40 DAT as shown by rapid increases in shoot length, shoot dry weight, and compound leaves per vine. Number of plantlets initiated per vine increased dramatically 40 DAT indicating that this form of vegetative reproduction is very important for its propagation in agronomic fields. A majority of clipped trumpetcreeper seedlings, 30 DAT, attained perennating capability indicating that the seedling is able to rapidly store reserves in its root system very early in development.

GLYPHOSATE EFFICACY AS AFFECTED BY WATER HARDNESS IN TENNESSEE.

T.C. Mueller, C.L. Main, M.A. Thompson, and R.M. Hayes; Department of Plant Sciences, University of Tennessee, Knoxville.

ABSTRACT

Reports of reduction in glyphoste efficacy when mixed with hard water are well documented. Glyphosate, an effective chelator of ions in solution, is affected by naturally occurring ions in carrier water. Calcium, iron, zinc, aluminum, and magnesium cations generally antagonize glyphosate activity. Diammonium sulfate (AMS) has been used to successfully over come calcium antagonism. A better understanding of the ion concentration that causes antagonism could reduce glyphosate performance complaints. Furthermore, this understanding could lead to more accurate recommendations for rates of AMS to use with varying ion species and concentrations in hard water

Much of the previous research on glyphosate antagonism utilized sub-lethal rates, and different plant species. The specific goals of this project were to determine what concentration of calcium or magnesium ion reduces glyphosate activity on difficult to control weed species, to determine the level of cations in a subset of water samples from the state of Tennessee, to determine the effect of different glyphosate salts (IPA, NH_4, or K) on any observed antagonism, and to validate the utility of AMS in reducing the antagonistic affects of these ions in glyphosate solutions.

Typical greenhouse methods were utilized. Plants were grown in 16 oz styrofoam cups in soil-less potting media, and treated when 6 to 10 inches in height using a spray chamber. Commercial herbicide formulations were used. Studies were conducted as a complete factorial arrangement of treatments, including 3 glyphosate formulations (Roundup WeatherMax, K salt; Touchdown , di-ammonium salt; and Roundup UltraMax, IPA salt), 2 glyphosate rates (0.38, 0.75 kg ae/ha), two rates of AMS were added (0 or 2% w:v), 6 water carriers, including Ca^{++} or Mg^{++} added @ 0, 250, 500, 750, 1000 ppm, and a local hard water source. The study was conducted as a completely randomized design with four replications. Weed species examined included yellow nutsedge (*Cyperus esculentus*), broadleaf signalgrass (*Brachiaria platyphylla*), and Palmer pigweed (*Amaranthus palmerii*).

Cation concentrations > 250 ppm of Ca^{++} or Mg^{++} ions reduced glyphosate performance on yellow nutsedge, broadleaf signalgrass, or palmer pigweed. Water samples from Tennessee were < 60 ppm (even though some were from wells within Karst limestone aquifers). There was no effect of different glyphosate salts (IPA, NH_4, or K) on observed antagonism. As expected, the addition of AMS reduced the antagonistic affects of these ions in glyphosate solutions. However, cation levels were too low in water samples collected from most Tennessee wells to warrant the addition of AMS. Potential future research projects include collecting water samples from a wider geographic area, and examining the interaction of cation concentration with carrier volume.

PITTED MORNINGGLORY CONTROL, SURVIVAL, AND SEED PRODUCTION FOLLOWING APPLICATIONS OF GLYPHOSATE AND GLYPHOSATE TANK MIXTURES. [1]D.H. Poston, [2]C.H. Koger, and [3]B.L. Spinks. [1]Delta Research and Extension Center, Stoneville, MS 38776; [2]USDA-ARS Southern Weed Science Research Unit, Stoneville, MS 38776; and [3]Plant and Soil Science Department, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Annual morningglories (*Ipomoea* spp.) have been consistently listed as some of the most common and difficult to control weeds in several crops throughout the southern United States. Before the introduction of glyphosate-resistant soybean, pitted morningglory was listed as the fifth most common weed in Mississippi soybean but did not appear in the top ten list of most difficult to control weed species In a more recent survey conducted in 2001, pitted morningglory was listed as the second most common and difficult to control weed in Mississippi soybean. Therefore, it appears that the emergence of pitted morningglory as a major weed problem in Mississippi soybean has coincided with the widespread adoption of glyphosate-resistant soybean.

Glyphosate often provides inadequate control of pitted morningglory and sequential applications are often required to provide acceptable control in the field. Pitted morningglory plants have been shown to produce 850 thousand to 10 million seed/A. Failure to control this weed with glyphosate only herbicide programs will likely increase the number of pitted morningglory seed in the soil seed bank and create a weed spectrum dominated by pitted morningglory.

Studies were conducted in 2003 at the Delta Research and Extension Center in Stoneville, MS on a Sharkey clay soil to assess the impact of single glyphosate applications, sequential glyphosate applications, and glyphosate tank mixtures on pitted morningglory control, survival, and seed production and to determine the impact of glyphosate rate and weed size on these parameters. Plots were 10 x 10 feet and arranged in a randomized complete block design with a factorial treatment structure (herbicide treatment x weed size). Pitted morningglory was seeded at three different dates to establish size differences and thinned to 6 plants per plot spaced equidistance apart to ensure no plant overlap and complete spray coverage. Pitted morningglory growth stages at time of application were 3- to 5-leaf, 8- to 16-inch vines, and 20- to 30-inch vines. Herbicide treatments were applied July 8, 2003 with a compressed air tractor-mounted sprayer delivering 15 gpa at 32 psi. Visual control rating were taken 1, 2, 4, and 12 wk after treatment and survival was determined 12 wk after treatment by counting the number of living plants that remained out of the 6 original plants. Plants were harvested in the fall just prior to seed dispersal. Plants were dried in the greenhouse for 2 wk and dry weights determined for all samples. Seed were threshed, cleaned, and sub-sampled. Seed number per plot was calculated by counting the number of seed in a sub-sample and extrapolating the total number of seed from the total sample weight.

Pitted morningglory control generally decreased as plant size increased. At 2 WAT, glyphosate at 0.75 lb ae/A provided 90% control of 3 to 5 leaf plants. Control of larger plants did not reach 80%. Glyphosate at 0.94 lb ae/A was required to achieve maximum control of all plant sizes. At 12 WAT, control with all plant sizes evaluated had improved to greater than 90% with 0.94 lb ae/A glyphosate. Glyphosate at 0.94 lb ae/A was required to provide maximum control of vining plants and 0.75 lb ae/A was required to provide maximum control of 3- to 5-leaf plants. Control 12 WAT with the sequential program of 0.75 lb ae/A fb 0.56 lb ae/A was generally similar to the best single application treatments within each growth stage. Tank mixing chlorimuron or cloransulam with 0.56 lb ae/A glyphosate generally did not improve season-long pitted morningglory control compared to 0.56 lb ae/A glyphosate alone. Glyphosate at rates of 0.94 lb ae/A or greater was required to completely kill pitted morningglory plants at the 3 to 5 leaf and 12 to 16 inch vine growth stages. Half of the pitted morningglory plants with 20 to 30 inch vines

at the time of application survived treatment with 1.12 lb ae/A glyphosate. Although plant survived treatment, using 0.94, or 1.12 lb ae/A glyphosate as a single application or a sequential application of 0.75 lb ae/A fb 0.56 lb ae/A essentially eliminated seed production.

RICE INJURY FROM SIMULATED GLYPHOSATE DRIFT. M.E. Kurtz and J.E. Street. Delta Research and Extension Center, Mississippi State University, Stoneville, MS 38776.

ABSTRACT

Field studies were conducted from 1996 to 2000 to determine the effect of glyphosate (isopropyl amine salt) (Roundup Ultra) on rice injury and yield when applied postemergence at 0, 2, 4, and 8 oz product/A to dry-seeded rice in the 3- to 4- L, mid-tiller, panicle initiation, and boot growth stages. Roundup at 4 and 8 oz/A applied at the 3- to 4- L, mid-tiller, and panicle initiation growth stages resulted in the greatest visible injury, and 8 oz/A being more injurious than 4 oz/A. Roundup treatments were the least visibly injurious to rice when applied at the boot stage. Rough rice yield was reduced by Roundup applied at 8 oz/A to rice in the mid-tiller growth stage 3 out of 4 years. When Roundup at 4 oz/A was applied to rice in the panicle initiation stage reduced yields 2 out of 4 years, and 3 out of 4 years when applied at 8 oz/A. Boot stage applications of Roundup at 2, 4, and 8 oz/A reduced yields 2 out of 4, 3 out of 4, and 4 out of 4 years, respectively.

Materials and Methods

Randomized complete block field experiments with four replications were conducted at the Delta Research and Extension Center in 1996, 1998, 1999, and 2000. There were 16 treatments with a factorial treatment structure of 4 growth stages x 4 herbicide rates. Soil type was Sharkey clay (very fine, montmorillonitic, nonacid, thermic Vertic Haplaquept) with a pH of 7.0 and 1.4 % OM. Rice ('Cypress' 1996, 'Lemont' 1998 and 1999, and 'Priscilla' 2000) was dry-seeded at 90 lb/A in drills spaced 8 in apart. Plots were 8 ft in width and 15 ft in length. Roundup rates were 0, 2, 4, 8, 16 and 32 oz product/A. The rates of 16 and 32 oz/A resulted in rice mortality at all growth stages in 1996 and these rates were discontinued.

Results and Discussion

At 8 oz/A Roundup, simulated drift rate onto rice in the mid-tiller, panicle initiation, and boot stages, yields were reduced 3 out of 4, 3 out of 4, and 4 out of 4 years, respectively. Similarly, a drift rate of Roundup at 4 oz/A onto rice in the panicle initiation and boot stages reduced yields 2 out of 4, and 3 out of 4 years, respectively. Even 2 oz/A applied at the boot stage reduced yields 2 out of 4 years. It is also apparent that the most susceptible growth stages associated with yield loss are the panicle initiation and boot stages with the boot stage more susceptible than panicle initiation stage. Though rice yields varied between years, which may be attributed to cultivar response differences, it is clear that a drift rate of 8 oz/A onto rice in the mid-tiller, panicle initiation or boot growth stages will most likely result in significant rice yield reductions.

In general, visible rice injury was not correlated with yield losses except at the high rate of 8 oz/A at the mid-tiller and panicle initiation growth stages. Yield losses were consistently higher with applications at the boot growth stage, yet visible rice injury was the least at this stage. Conversely, visible injury with applications of 4 and 8 oz/A Roundup at the 3- to 4- L stage was high yet there were no consistent yield losses. This indicates a need for some method of measuring injury other than visible foliar injury.

CORRELATING GROUND-TRUTHED WEED MAPS WITH MULTISPECTRAL AERIAL IMAGERY. C.J. Gray, D.R. Shaw, and J.W. Easley; Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

A glyphosate-tolerant soybean [*Glycine max* (L.) Merr.] experiment was initiated in 2002 at the Black Belt Branch Experiment Station near Brooksville, MS. The experiment was designed to determine if ground-truthed weed maps could be correlated to multispectral aerial imagery. The field size was 7.8 ha, in which a 10-m by 10-m grid was imposed on the field using a global positioning system. At each grid location, a 1-m^2 quadrate was used to determine the weed species present. Weed population counts were taken June 4, 2002. The eight most prevalent weed species were large crabgrass [*Digitaria sanguinalis* (L.) Scop.], horsenettle (*Solanum carolinense* L.), broadleaf signalgrass [*Brachiaria platyphylla* (Griseb.) Nash], yellow nutsedge (*Cyperus esculentus* L.), smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.], hophornbeam copperleaf (*Acalypha ostryifolia* Riddell), knotroot foxtail [*Setaria geniculata* (Lam.) Beauv.], and entireleaf morningglory (*Ipomoea hederacea* var. *integruscula* Gray). These weed species and the total weed populations were interpolated by inverse distance weighting to develop weed maps.

Multispectral aerial imagery at 0.5-m resolution containing four spectral bands was collected June 7, 2002. The spectral bands collected were blue (450 nm), green (550 nm), red (650 nm), and near-infrared (NIR) (850 nm). These bands were then used to create six vegetation indices. The indices produced were Ratio Vegetation Index (RVI), Normalized Difference Vegetation Index (NDVI), Difference Vegetation Index (DVI), Normalized Difference Vegetation Index Green (NDVIg), Infrared Percentage Vegetation Index (IPVI) and Soil Adjusted Vegetation Index (SAVI). These six indices, the four spectral bands, and elevation were then correlated to the eight weed species and total weed populations. Correlation analysis was done using both Pearson and Spearman correlation procedures. In addition, stepwise regression analysis was performed on the eight weed species and total weed populations using the vegetation indices, four spectral bands and elevation.

Correlation between variables was either non-significant or relatively low. Spearman correlation tended to produce higher correlations than Pearson. Significant correlations using Pearson ranged from 0.06 to 0.24, while Spearman correlations ranged from 0.07 to 0.36. Broadleaf signalgrass and total weed population correlation was greater then any other weed species. Broadleaf signalgrass correlation to the vegetation indices for Pearson ranged from 0.11 to 0.24 and Spearman was 0.29 for all vegetation indices. Total weed population correlation to the vegetation indices for Pearson and Spearman ranged from 0.07 to 0.14 and 0.22 to 0.23, respectively. No significant correlation was determined for knotroot foxtail using Pearson or Spearman and entireleaf morningglory using Spearman. Stepwise regression analysis results were also very poor. Significant R^2 values ranged from 0.1443 to 0.0084. Low correlations of this magnitude can also be expected due to the size of the weeds at the time of data collection and also the presence of the soybean crop. Weed sizes were from cotyledon to approximately 20 cm tall with the soybean crop being approximately 15 cm tall. The small weed and crop sizes also allowed for greater background soil reflectance, which ultimately gave lower spectral band values when the multispectral image was acquired. These results also suggest only the major weed species present in a production field will be detected using early-season multispectral imagery.

AERIAL IMAGE BASED SITE-SPECIFIC APPLICATIONS OF MEPIQUAT CHLORIDE TO CONTROL IN FIELD VARIABILITY OF COTTON GROWTH. M.T. Kirkpatrick, D.B. Reynolds, L.T. Barber, J.J. Walton, and J.C. Sanders, C.G. O'Hara, and J.L. Willers. Mississippi State University Mississippi State, MS 39762 and USDA, ARS Starkville, MS 39759.

ABSTRACT

Cotton (*Gossypium hirustum* L.) is a perennial plant with indeterminate growth characteristics. In order to maintain efficient cotton production, vegetative growth should be managed. Plant growth regulators such as mepiquat chloride have become an essential part of cotton production as a management tool to modify plant growth. Currently, there is no standardized way to schedule and select rates of mepiquat chloride. Current growth monitoring techniques are very time consuming and require intensive sampling within the field. Although the crop may exhibit considerable spatial variability within a field, these techniques use an average of the samples taken to determine a treatment for the whole field.

The use of remote sensing technologies can involve the spatial monitoring of plant growth within a field. Remote sensing practices have the ability to detect differences between soil and cotton with spectral reflectance (i.e. areas within a field that have poor cotton growth and vigorous cotton growth). With this knowledge it is possible that plant growth regulator applications can be based on these data to make site-specific applications to address spatial variability and increase efficacy. The possible implications to a producer can be more efficient collection of data as well as more intensive sampling in a shorter amount of time.

The study was designed to examine whether NDVI (Normalized Difference Vegetative Index) can accurately depict cotton growth within a cotton field to allow for mepiquat chloride applications to be based on these aerial image data. A study was conducted at the Black Belt Branch Experiment Station in Brooksville, MS to examine the correlation between NDVI and plant growth, and compare aerial image based site-specific application to conventional broadcast application. The results of the study indicated that plant heights can be correlated to their perspective NDVI value within the field (R^2=0.85). The results further indicated that a site-specific application based on NDVI resulted in a 17% reduction in the total amount of mepiquat chloride applied compared to broadcast methods. Although the site-specific application resulted in less total mepiquat chloride and attempted to maximize application in areas of greatest need, seed cotton yield was not affected.

IR-4 PROJECT: UPDATE ON MINOR CROPS HERBICIDE REGISTRATION. M. Arsenovic, F.P. Salzman, D.L. Kunkel, and J.J. Baron; IR-4 Project, Rutgers University, NJ.

ABSTRACT

The IR-4 Project is a publicly funded effort to support the registration of pest control products on minor or specialty crops. The IR-4 Project continues to actively work to provide growers with weed control options despite a climate in which there are fewer herbicides to evaluate. Herbicide petitions submitted to the EPA by IR-4 since October 2002 include: clethodim on flax; ethofumesate on carrot (PNW only) and garden beet; terbacil on watermelon; and paraquat on ginger and the cucurbit vegetable group, metribuzin on garlic, and oxyfluorfen on safflower. Petitions were also submitted for carfentrazone on the root and tuber vegetable; leaves of root and tuber vegetable; bulb; leafy vegetable; *Brassica* leafy vegetable, legume vegetable; foliage of legume vegetables; cucurbit; berry; grass forage, fodder, and hay; and herbs and spices groups. Additional carfentrazone petitions were submitted for hops, various oil seed crops; sugarcane; peanut; and strawberry. Since October 2002 to date, EPA has published in the Federal Register Notices of Filing for: dimethenamid-p on the root and tuber vegetable and bulb vegetable groups; flumioxazin on grape; and sulfentrazone on potato, horseradish, cabbage, lima bean (regional), asparagus, mint, and sunflower. EPA has established tolerances from October 2002 to date for: mesotrione on popcorn, s-metolachlor on sugar beet, grass forage and hay, spinach, sunflower, tomato, carrot, horseradish, rhubarb, Swiss chard, asparagus, and green onion. The EPA also ruled that imazamox is exempt from all tolerances. The status of these and other IR-4 Project studies will be updated.

RESPONSE OF SERICEA LESPEDEZA TO IMIDAZOLINONE HERBICIDES. G. Wehtje and J.A. Mosjidis. Department of Agronomy and Soils, Auburn University, AL 36849.

ABSTRACT

In a greenhouse study imazaethapyr and imazapic were applied at rates ranging from 14 to 85 g/ha to three varieties of Sericea lespedeza and yellow nutsedge. Separate experiments were conducted to evaluate PRE- and POST-applied activity. Imazapic was deemed to have no potential for weed control in Sericea lespedeza since even the minimal rate of 14 g/ha was excessively injurious regardless of application type. In contrast, Sericea lespedeza was generally unaffected by imazethapyr. Therefore, the potential for POST weed control in Sericea lespedeza with imazethapyr was evaluated under field conditions. In this study imazethapyr was applied to mature, but recently-mowed Sericea lespedeza at 0, 71, 142, 213 g/ha. Control of both yellow nutsedge and Chinese lantern was >90% at rates $\geq$ 71 g/ha. Sericea lespedeza forage yield (weeds removed) was not reduced by imazethapyr even at 213 g/ha. Results indicate that imazethapyr has potential for POST-applied, and probably PRE-applied weed control in Sericea lespedeza. And with POST applications; there is a three-fold safety factor between the rate required for weed control and the crop-safe rate.

HERBICIDES FOR WEED CONTROL IN PEARL MILLET. W.K. Vencill, Department of Crop and Soil Sciences, University of Georgia, Athens, GA 30602-7272.

ABSTRACT

Field studies were conducted at the Plant Sciences Farm near Athens, GA to examine tolerance of pearl millet to several new herbicides that have the potential to control annual grass weeds. Amicarbazone applied PRE and POST at 100 g ai/ha, mesotrione applied PRE at 100 g ai/ha and POST at 18 g/ha, sulfosulfuron applied POST with and without a safener (MON 13900) at 36 g ai/ha, and trifloxysulfuron applied POST at 7 g ai/ha caused <15% injury 7 DAT and <10% injury 14 DAT. Carfentrazone applied POST at 18 g ai/ha, clomazone applied PRE at 250 g ai/ha plus disulfoton at 750 g ai/ha, foramsulfuron (with safener mefenapyr) applied POST at 36 g ai/ha, nicosulfuron applied POST at 36 g ai/ha with MON 13900 or naphthalic anhydride, and sethoxydim applied POST at 36 g ai/ha with a safener, cloquintocet caused >90% injury 7 DAT. Pearl millet yields corresponded to crop injury. In a follow-up study, mesotrione was applied POST at 11, 22, and 33 g ai/ha to pearl millet. Pearl millet injury did not exceed 15% 7 DAT and 14 DAT. Sulfosulfuron was applied POST at 32, 64, and 128 g ai/ha to pearl millet. Injury increased linearly with rate from 10 to 45% 7 and 14 DAT.

INFLUENCE OF APPLICATION TIMING AND FUNGICIDE ON SICKLEPOD CONTROL BY 2,4-DB. S. Hans, D. Jordan, J. Spears, D. Monks, J. Wilcut, and A. York; Department of Crop Science, North Carolina State University, Raleigh.

ABSTRACT

It is suspected that seed production by sicklepod, a troublesome weed in North Carolina, may be reduced when 2,4-DB is applied late in the season. Experiments were conducted in Goldsboro, NC in 2002 and 2003 to evaluate control, seed production, and seed germination of sicklepod when 2,4-DB (0.28 kg ai/ha) was applied alone or with chlorothalonil (1.26 kg ai/ha), tebuconazole (0.22 kg ai/ha), or pyraclostrobin (0.16 kg ai/ha) at the sicklepod developmental stages of preflower, early flower, peak flower, pod set, and pod fill. These growth stages were approximately 2 weeks apart, with the preflower timing initiation approximately 6 weeks after sicklepod emergence. Visual estimates of percent sicklepod control were determined two weeks after each application. Sicklepod plants were collected in early October. Dry weights, seed numbers, and pod color were recorded. Percent germination was determined using standard laboratory practices. Sicklepod control was not influenced by fungicides, and was greatest when 2,4-DB was applied prior to sicklepod flowering. Herbicide application at the pod set and pod fill stages of growth were less effective in reducing the quantity and ability to germinate of seed produced.

ABSORPTION, TRANSLOCATION, AND METABOLISM OF ROOT ABSORBED SPARTAN IN PEANUT, PRICKLY SIDA, AND PITTED MORNINGGLORY. J.W. Wilcut, S.B. Clewis, and S.C. Troxler, Department of Crop Science, North Carolina State University, Raleigh, NC 27695-7620.

ABSTRACT

Studies were conducted to evaluate uptake, translocation, and metabolism of root-absorbed ^{14}C-sulfentrazone in peanut, prickly sida, and pitted morningglory. Peanut, prickly sida, and pitted morningglory absorbed 9, 3, and 2% of the applied radioactivity, respectively. All plant species translocated appreciable amounts ($\geq$ 39%) of radioactivity to the leaves. However, 38 and 42% of the absorbed radioactivity remained in the roots of prickly sida and pitted morningglory. All plant species had some capacity to metabolize ^{14}C-sulfentrazone. Peanut had the greatest metabolism with only 16% remaining as ^{14}C-sulfentrazone. Prickly sida and pitted morningglory had 36 and 47% of the radioactivity as ^{14}C-sulfentrazone. Peanut had equivalent levels of metabolites. However, prickly sida and pitted morningglory had greater amounts of metabolite A and metabolite B compared to conjugated metabolites. Tolerance in peanut and prickly sida is mainly due to the ability to metabolize sulfentrazone. Even though peanut absorbed more 14C-sulfentrazone compared to prickly sida and pitted morningglory, differences in root surface area and leaf area between the three species are probably the cause of increased uptake in peanut. Translocation patterns were similar between weed species with nearly equivalent amount of radioactivity being present in both leaves and shoots. However in peanut, the greatest accumulation of radioactivity occurred in the leaves. The greatest metabolism was measured in peanut with progressively less metabolism in prickly sida and pitted morningglory which corresponds to levels of control observed in field experiments. Therefore, our data suggests that metabolism of sulfentrazone is the main basis for tolerance in both peanut and prickly sida. Registration of sulfentrazone (Spartan) in peanut would provide growers with a PRE herbicide option for season-long weed control of several key weeds in the southeastern peanut region.

WEED CONTROL, CROP TOLERANCE, AND YIELD WITH SPARTAN, STRONGARM, AND VALOR HERBICIDE SYSTEMS IN NORTH CAROLINA PEANUTS. S.B. Clewis, W.E. Thomas, and J.W. Wilcut, Department of Crop Science, North Carolina State University, Raleigh, NC 27695-7620.

ABSTRACT

Experiments were conducted at the Upper Coastal Plain Research Station near Rocky Mount and at the Peanut Belt Research Station near Lewiston-Woodville in 2002 and 2003 (5 total sites). The planting dates ranged from May 2 to May 18. Soils were sandy loams typical for the Mid-Atlantic and Southeastern Coastal Plain with soil pH ranging from 5.7 to 6.2. Peanut varieties VA-98R and NCV-11 were planted conventionally in raised beds (standard for the region) with Temik in-furrow at 7 lb product/ac for early season insect control. Weed management options included preemergence (PRE) options of Spartan (sulfentrazone) at 1.25 lb ai/ac plus Dual Magnum (metolachlor) at 1.25 lb ai/ac, Strongarm (diclosulam) at 0.024 lb ai/ac plus Dual Magnum, Valor (flumioxazin) at 0.063 lb ai/ac plus Dual Magnum, and Dual Magnum alone at 1.25 lb ai/ac. The POST options were no POST, Storm (pre-packaged mixture of acifluofen plus bentazon) at 0.75 lb ai/ac plus Butyrac 200 (2,4-DB) at 0.25 lb ai/ac, and Cadre (imazapic) at 0.063 lb ai/ac plus Butyrac 200. All POST treatments included a NIS (Induce) at 0.25% (v/v). All options that received a POST treatment also received an EPOST application of Gramaxone Max (paraquat) at 0.125 lb ai/ac plus Basagran (bentazon) at 0.25 lb ai/ac plus NIS at 0.25 % (v/v). The experimental design was a randomized complete block design with a factorial treatment arrangement of 4 PRE and 3 POST treatments with 3 replications.

Peanut injury was minimal (<5%) with all soil-applied programs. The 2002 growing season was extremely dry in May and June, thus may have reduced injury potential. The 2003 growing season was real wet with only minor injury (<5%) observed. Previous research has shown that Spartan and Valor have more potential for injury than Strongarm in VC peanuts. Spartan, Strongarm, and Valor are of limited value (65-85%) for broadleaf signalgrass [*Brachiaria platyphylla* (Griseb.) Nash.], goosegrass [*Eleusine indica* (L.) Gaertn.], large crabgrass [*Digitaria sanguinalis* (L.) Scop.] and Texas panicum (*Panicum texanum* Buckl.) control. Cadre POST activity on small annual grasses is a benefit in the VC region with 93-98% control. Spartan and Strongarm were the best PRE options with 94% and 92% control respectively, for yellow (*Cyperus esculentus* L.) and purple nutsedge (*Cyperus rotundus* L.) with Valor being least effective at 70%. With adequate moisture, nutsedge control with Strongarm improves throughout the year. Cadre remains the POST standard for nutsedge control with 98% control. Strongarm and Valor were the best PRE option with 100% and 93% respectively, for common ragweed (*Ambrosia artemisiifolia* L.) control while Spartan was the least effective at 65%. Common ragweed infests 75% of the peanut acreage in the VC region. Dual plus Spartan, Strongarm, or Valor PRE options were statistically equivalent (83%, 94%, and 95% respectively) for common lambsquarters (*Chenopodium album* L.) control. Dual plus Spartan, Strongarm, and Valor provided similar levels of entireleaf [*Ipomoea hederacea* (L.) Jacq. var. *integriuscula* Gray], ivyleaf [*Ipomoea hederacea* (L.) Jacq.], pitted (*Ipomoea lacunosa* L.), and tall morningglory [*Ipomoea purpurea* (L.) Roth] control (87%, 86%, and 88% respectively) when compared to Dual alone at 64%. Valor was the best PRE option for control of Palmer amaranth [*Amaranthus palmeri* S. Wats.] at 96%. Strongarm was the best PRE option for control of eclipta (*Eclipta prostrata* L.) at 100%. Cadre was the best POST option for eclipta with 95%. However, Storm and Cadre POST were equivalent for all morningglory species (97% and 99% respectively) and Palmer amaranth control (93% and 97% respectively). Dual plus Strongarm PRE treatments yielded the highest peanut yields at 2850 lb/ac, but were statistically equivalent to Dual plus Valor PRE at 2760 lb/ac. Dual plus Spartan and Valor PRE were equivalent with 2480 and 2760 lb/ac, respectively. All treatments PRE provided better weed control and higher yields than Dual Magnum alone (2130 lb/ac). Cadre was the highest yielding POST options at 2970 lb/ac, but statistically equivalent to Storm POST at 2730 lb/ac when averaged over locations and PRE herbicides. The addition of POST herbicides was beneficial to

peanut yields when compared to systems without POST herbicides (1960 lb/ac). In order to maximize peanut yield potential both, PRE and POST herbicides were required. Rotation restrictions need to be considered when using Cadre, Spartan, and Strongarm [i.e. rotation restrictions are significant for Spartan on cotton (18 months) but not tobacco (0 months)]. Strongarm has an 18 month restriction on corn and tobacco. Cadre has a 9 month restriction on corn, soybean, and tobacco and an 18 month restriction on cotton.

UPTAKE, TRANSLOCATION, AND METABOLISM OF FLUMIOXAZIN IN PEANUT.

R.G. English and W.K. Vencill, Department of Crop and Soil Sciences, University of Georgia, Athens, GA 20602-7272.

ABSTRACT

Greenhouse and laboratory studies were conducted to examine tolerance of peanut to flumioxazin. ^{14}C-flumioxazin was applied to the root, hypocotyls, cotyledon, and leaf tissue of peanut ('Georgia Green) grown in a Tift sand in 500 ml Styrofoam cups cut in half, wrapped in aluminum foil so the ^{14}C-herbicide could be spotted on belowground plant parts without disrupting plant function. The tolerance of peanut to PRE applications of flumioxazin was affected by timing of application and decreased over time with emerging seedlings being relatively sensitive to flumioxazin applications. After 48 h exposure, plants were harvested and split into roots, hypocotyls, cotyledon, and shoot tissue to examine translocation and metabolism of flumioxain. Flumioxazin translocation in peanut was limited mostly to the treated tissue. This could be due to rapid desiccation of tissue that comes into contact with the herbicide.

ADMIXTURE INTERACTIONS OF PREEMERGENCE-APPLIED HERBICIDES USED IN PEANUTS. S.V. Kattapalli, G. Wehtje, and T.L. Grey, Department of Agronomy and Soils, Auburn University, Auburn, AL 36849.

ABSTRACT

In a greenhouse study five soil active herbicides were applied alone and in all possible two-way admixtures. Rates ranges downward from the normal use rate (i.e. 1X) to 0.125 of the 1X rate. Target species was pitted morningglory. Intent was to determine whether any of the admixtures offered superior control, i.e. possible synergisms, that would warrant further investigation in field studies. No clear indications of synergistic combinations have been detected to date. However the flumioxazin + S-metalachlor admixture frequently provided superior ratings.

TOLERANCE AND WEED CONTROL IN PEANUT. K.M. McCormick, P.A. Dotray, T.A. Baughman, J.W. Keeling, and W.J. Grichar. Texas Tech University, Lubbock, TX; Texas Cooperative Extension, Vernon and Lubbock, TX; and Texas Agricultural Experiment Station, Lubbock and Beeville, TX.

ABSTRACT

New soil-applied herbicides have been developed to improve annual broadleaf weed control in peanut. Diclosulam (Strongarm) was introduced in 2000 for preplant incorporated (PPI) and preemergence (PRE) use; however, injury was observed on the Texas High Plains. Label restrictions subsequently limited diclosulam applications to soils with a pH of 7.1 or lower, which excludes the entire peanut region of the Texas High Plains. Flumioxazin (Valor) was introduced in 2001 for PRE weed control, but peanut injury has been reported in Oklahoma, Georgia, and North Carolina. Imazapic (Cadre) applied postemergence-topical (POST) is commonly used to provide broad-spectrum weed control in peanut, but can cause some peanut stunting. The objectives of this research were to examine differential peanut tolerance to flumioxazin PRE, diclosulam POST, and imazapic POST at 1X and 2X label rates in traditional and high O/L peanut varieties. Additional studies examined peanut tolerance to flumioxazin formulations and efficacy on ivyleaf morningglory (*Ipomoea hederacea*).

A randomized block design with split-plot arrangement and three replications was used in one study. The main plot factor was the variety and included Tamrun 96, Tamrun OL01, Tamrun OL02, Florunner, Flavor Runner 458, Tamspan 90, and OLin. The subplot factor included flumioxazin PRE at 0.094 (3 oz) or 0.188 lb ai/A (6 oz), diclosulam early postemergence (EPOST) at 0.016 (0.3 oz) or 0.032 lb ai/A (0.6 oz), imazapic EPOST at 0.063 (1.44 oz) or 0.126 lb ai/A (2.88 oz), and an untreated control. Subplots were 2 rows by 30 feet. In a second study, the design was a randomized complete block with a factorial arrangement and three replications. The first factor was the flumioxazin formulation (Valor 1244, 1092, and 1420), while the other factor was flumioxazin rate (0.094 and 0.188 lb ai/A).

No variety by herbicide treatment interaction was observed in the first study. There was no difference in variety injury early-, mid-, and late-season; however, injury was observed following flumioxazin at 2X and following both rates of imazapic at all observation dates. The only reduction in peanut yield was observed following imazapic at 2X. In the second study, no formulation by rate interaction occurred. There was no difference in weed control at 4 and 8 weeks after treatment (WAT); injury at 2, 4, and 8 WAT and at harvest; and peanut yield between flumioxazin formulations. Flumioxazin at 2X caused higher injury at 4 and 8 WAT and at harvest, and provided better weed control at 8 WAT. Peanut yield following flumioxazin at 2X was reduced compared to the 1X rate and the untreated.

BELL PEPPER YIELD IS AFFECTED BY LIVID AMARANTH DENSITY (*Amaranthus lividus* L.) AND DURATION OF INTERFERENCE. J.P. Morales-Payan and W.M. Stall. Horticultural Sciences Department, University of Florida. Gainesville, FL 32611-0690.

ABSTRACT

Field experiments were conducted in Citra, FL, to determine the effect of livid amaranth (AMALI) on the yield and fruit grade of polyethylene-mulched transplanted bell pepper as a function of AMALI density and time of removal. AMALI densities (0, 2, 6, 10, 12, 14, 16 plants/m^2) were established from seed placed in the pepper transplanting holes. AMALI emerged five days after transplanting the crop and was removed 2, 4, 6, or 12 weeks after emergence (WAE). Increasing AMALI densities from 0 to 10 plants/m^2 resulted in decreasing total marketable yield (TMY), but further density increases did not further reduce TMY. When AMALI was removed 4 WAE, TMY losses were 22% (with 2 AMALI/m^2) to 70% (with 10-16 AMALI/m^2). Yield losses were 30 to 75% (with 2-16 AMALI/m^2) when AMALI was removed ≥6 WAE. As AMALI density increased and/or its removal was delayed, the percentage of large and medium fruits decreased and the percentage of small fruits increased. In weed-free pepper, 50% of the fruits were Fancy. In contrast, 15 and <1% of the fruits were large when 16 AMALI/m^2 was removed 4 and 12 WAE, respectively. If a 5% TMY loss were tolerable, AMALI (2 to 16 plants/m^2) would have to be removed <2 WAE.

EFFECT OF MIXED STANDS OF PURPLE AND YELLOW NUTSEDGES ON BELL PEPPER YIELD. J.P. Morales-Payan and W.M. Stall. Horticultural Sciences Department, University of Florida. Gainesville, FL. 32611-0690.

ABSTRACT

The combined effect of purple nutsedge (*Cyperus rotundus*, CYPRO) and yellow nutsedge (*Cyperus esculentus*, CYPES) on the yield of polyethylene-mulched bell pepper was determined in field experiments in Citra, Florida. Nutsedges emerged 3 days after crop transplanting (DAT) and grew with bell pepper until the end of the season (12 weeks). Nutsedge densities were 0 and 60 tubers/m^2. The CYPRO:CYPES stands were 0:60, 15:45, 30:30, 45:15, and 60:0 (= 0, 25, 50, 75, 100% CYPRO). The percentage of CYPES and CYPRO in the stand affected bell pepper yield by grade (large, medium or small fruits) and marketable yield (MY=large+medium+small fruit yield). Pure stands of CYPRO resulted in 17% MY loss, as compared to weed-free bell pepper. When CYPRO comprised 75% of the nutsedge stand, MY loss was 40%. Stands with 50-100% CYPES resulted in 50% MY loss. As the percentage of CYPES in the stands increase, the yields of large and medium peppers decreased to larger extents than the yield of small peppers. Thus, stands with higher percentages of CYPRO would be expected to result in lower loss of large and medium fruits, and lower MY loss.

TIMING OF FALL FLOODING EFFECTS ON WINTER WEED EMERGENCE IN RICE PRODUCTION SYSTEMS. C.H. Koger, USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS; and J.E. Street and T.W. Walker, Delta Research and Extension Center, Mississippi State University, Stoneville, MS 38776.

ABSTRACT

Flooding is an effective weed management tool commonly utilized in rice production systems, as rice tolerates low oxygen conditions better than most weeds. However, some weed species are capable of surviving flooded conditions. Flooding after rice harvest is a common practice for providing over-wintering waterfowl habitat and degradation of rice straw. Little is known, however, about the effect of post-rice-harvest flood timing and duration on emergence and survival of winter weed species. Identifying a winter flood regime that alleviates winter weed emergence could eliminate the necessity of a pre-plant burndown herbicide application before planting the following rice crop and reduce production costs.

A field study was conducted in 2003-2004 at the USDA-ARS, Southern Weed Science Research Unit farm, Stoneville, MS to investigate the effect of timing and duration of post-rice-harvest flooding and rice straw on emergence and survival of winter weeds. Levees were established in a continuous rice field after rice harvest so that a 10-cm-deep flood could be evaluated in five flood duration treatments. Flooding treatments were flooded October to March, flooded October to January, flooded December to March, flooded December to January, and no-flood. Aboveground rice biomass in adjacent rice field was controlled with glyphosate to serve as a no rice-straw + no flood treatment. Plot size was 4.5 by 6 m. The experimental design was a randomized complete block with six replications. Weeds were counted from one 1-m^2 quadrat per plot 1 d before flooding and 1 and 3 month(s) after flood initiation. In the no flood and no straw plus no flood treatments, weeds were counted by species and removed by hand from one 1-m2 quadrat per plot bi-weekly beginning after rice harvest (15 September). Weed species evaluated were henbit (*Lamium amplexicaule*), annual bluegrass (*Poa annua*), corn buttercup (*Ranunculus arvensis*), and horseweed (*Conyza Canadensis*). Weed counts were summed to present total weed density in each plot.

No weeds had emerged prior to initiation of the first flooding treatment in October. Weed emergence was delayed in the presence of rice straw by ~ 2wk compared with no rice straw. Under non-flooded conditions, weeds emerged consistently in October thru December. October flood timing prohibited weed emergence whereas, more that 12 weeds/m2 were present in December flood plots just prior to initiation of December flood. Flooding emerged weeds in December did not reduce weed densities by 4 wk after flood initiation.

Flooding prior to germination of winter weeds prohibited weed emergence. Flooding after weed emergence was not an effective winter weed management tool, as weeds were not controlled by flooding after their emergence. Flooding prior to weed emergence may be a viable weed management tool by possibly eliminating the necessity of a preplant burndown herbicide application for the upcoming rice crop, while still catering to producers desire to provide habitat for over-wintering habitat for waterfowl.

ACETOLACTATE SYNTHASE (ALS) ACTIVITY IN RED RICE ECOTYPES (*Oryza* spp.) AND IMIDAZOLINONE TOLERANT/RESISTANT RICE CULTIVARS (*Oryza sativa*) IN RESPONSE TO IMAZETHAPYR.

L.A. Avila, CAPES/Brazil and Texas Agricultural Experiment Station, College Station, TX. D.J. Lee, Sunchon National University, Suncheon, Korea. S.A. Senseman, J.M. Chandler, J.T. Cothren, Texas Agr. Exp. Stn., College Station, TX. G.N. McCauley, Texas Agr. Exp. Stn., Eagle Lake, TX.

ABSTRACT

Imazethapyr has been effective in controlling red rice in imidazolinone tolerant rice. However, some red rice ecotypes have shown some tolerance to imazethapyr, including the blackhull TX 4. Two experiments were conducted to determine if three red rice ecotypes including LA 5, MS 5 and TX 4 have acetolactate synthase resistant to imazethapyr. The first experiment was a bioassay to verify the tolerance of the plants to imazethapyr and the second was the ALS activity experiment to verify the tolerance of the extracted ALS enzyme to the herbicide. Three red rice ecotypes (LA 5, MS 5 and TX 4) were compared with a tolerant ('CL-121'), a resistant ('CL-161') and a conventional ('Cypress') rice variety. The bioassay showed that TX 4 and LA 5 were the most tolerant red rice ecotypes. Based on enzymatic activity, the mean I_{50} values were 1.5, 1.1, 1.5, 1.6, 20.8 and 590.6 μM of imazethapyr, respectively for LA 5, MS 5, TX 4, Cypress, CL-121 and CL-161. Based on these values, CL-161 was the most resistant of the plants tested and was 32 times more resistant than CL-121 and approximately 447 times more resistant than the average of the red rice ecotypes and 'Cypress'. Results indicated that CL-161 resistance is probably due to an altered ALS enzyme. The red rice ecotypes did not differ from the Cypress cultivar and showed to be susceptible to imazethapyr when compared with the tolerant CL-121 and the resistant CL-161. This demonstrates that resistance to ALS-inhibiting herbicides has not yet developed in these red rice ecotypes due to changes in enzyme activity. Other mechanisms of resistance could explain the tolerance in TX 4 and LA 5, such as increased herbicide metabolism or differential absorption and translocation.

EFFECT OF GRASSY WEEDS ON STINKBUG POPULATIONS IN FLORIDA RICE.

A.C. Bennett and R.H. Cherry; Everglades Research and Education Center, University of Florida, Belle Glade, FL 33430.

ABSTRACT

Rice has been grown in the Everglades Agricultural Area (EAA) of southern Florida for about 30 years. Due in part to the relatively limited acreage grown in most years (20,000 acres or less), little data is available on insect pests of EAA rice. However, it is generally acknowledged that the rice stinkbug is the most important pest. Two species of rice stinkbug are commonly found in the EAA, *Oebalus pugnax* and *Oebalus ypsilongriseus*. These two species comprised 95% of the rice stinkbugs found in previous studies. Both of these pests cause "pecky rice". Pecky rice is defined by kernels with dark spots that lower the grade of the rice. Weed populations found in rice grown in the EAA generally tend to be low, since crop rotations are generally 3 to 4 years of sugarcane, followed by a single crop of rice. However, low levels of grasses, including fall panicum (*Panicum dichotomiflorum*) and barnyardgrass (*Echinochloa crus-galli*), among others, are often found in rice fields. Previous research in the Mid-South has shown a relationship between the level of grassy weeds found in rice fields and rice stinkbug populations in pre-flowering rice. This relationship has never been studied in the EAA. Our objective was to compare rice stinkbug populations between areas of rice fields infested with grassy weeds and those not infested with grassy weeds prior to rice flowering.

Weedy and non-weedy portions of 4 fields were sampled with sweep nets. Six samples were taken in each area of the field sampled (weedy, non-weedy, roadside), with 50 sweeps taken for each sample. Rice in these fields had not yet initiated flowering, while the grassy weeds present had initiated flowering. Rice stinkbugs found in the samples were identified and counted. Grassy weeds were identified in each sample, and populations were visually estimated. Analysis on populations was performed using ANOVA and LSD was used for mean separation.

All four fields sampled contained fall panicum (*Panicum dichotomiflorum*) as the primary grassy weed. The distribution was patchy, allowing for sampling of areas where significant patches of fall panicum occurred, and areas where only a minimal amount of fall panicum was present. Rice stinkbugs were found in all fields sampled. Both common species of stinkbugs were found, but over 90% of the rice stinkbugs were found were *Oebalus pugnax*. Data on rice stinkbug populations were combined across the two species. In all fields, higher populations of rice stinkbugs were found when flowering fall panicum was present compared to relatively non-weedy areas of the same field. Nymphal stage rice stinkbugs were found in the fall panicum patches of three fields. This indicates reproduction was occurring within the fields, as the nymphs are not mobile over long distances. One field also had a high population of rice stinkbugs in the roadside area of the field. This field had a high concentration of coast cockspur (*Echinochloa walteri*) that had initiated flowering in the roadside sample. In contrast, all other roadsides were primarily bermudagrass (*Cynodon dactylon*) that had been mowed regularly. These did not contain any rice stinkbugs. This data suggests populations of fall panicum can impact the level of rice stinkbugs found in Florida rice. It is particularly important that the rice stinkbugs were reproducing in weedy patches within rice fields prior to rice flowering. This could lead to higher populations in those fields once the rice begins to flower. Presence of rice stinkbugs in a roadside adjacent to the field that contained flowering coast cockspur suggests sanitation of field edges could also be an important factor in rice stinkbug population dynamics in Florida.

CLINCHER POST-FLOOD FOR GRASS CONTROL IN RICE. T.W. Dillon, R.C. Scott; Cooperative Extension Service, University of Arkansas, Lonoke, AR 72086; and K.L. Smith; Cooperative Extension Service, University of Arkansas, Monticello, AR 71656.

ABSTRACT

Clincher (cyhalofop) is a new post applied herbicide for grass control in rice. Clincher can be applied to rice after the permanent flood is established. Because of its mode of action, Clincher can be used to control barnyardgrass that is propanil-resistant and/or quinclorac-resistant. Resistant barnyardgrass is becoming an increasing problem in Arkansas. It can also be used as a tool to control grass escapes in a salvage treatment situation.

Studies were conducted in 2002 and 2003 to evaluate Clincher applied post-flood for the control of barnyardgrass, and to evaluate tank-mixes of Clincher with other graminicides and broadleaf materials. Clincher at 0.28 lb ai/A applied 2 weeks after flood (WAF) controlled barnyardgrass over 94% in 2002. Antagonism was observed when Clincher was tank-mixed with 2,4-D or Blazer, with control decreasing to below 20%. Clincher at 0.28 lb ai/A provided between 64-78% control of barnyard grass when applied 1, 2, and 3 WAF in 2003. Regiment at 0.026 lb ai/A provided 80% control of barnyardgrass when applied 1 WAF. However, control with Regiment dropped to 20% when applied 2 or 2 WAF. Clincher at 0.28 lb ai/A, regardless of timing, provided above 95% control of broadleaf signalgrass in 2003.

BULLRUSH (*EQUISETUM HYEMALE*) CONTROL. B.A. Hinklin, J.A. Kendig, R.M. Cobill and P.M. Ezell. University of Missouri Delta Center, Portageville, MO. 63873.

ABSTRACT

Bullrush (*Equisetum hyemale*) and related species are often found along streams and drainage ditches. However, infestations in row crop fields appear to be increasing. The increase in problems may be due to reductions in tillage, since this weed reproduces vegetatively. Although the infestations may extend for a mile or more along ditches, our initial observations are that it does not appear to exist more than 50 feet from ditch banks. Also, the weed appears on the ditch bank, as opposed to actually growing in water.

Five potential chemicals were applied at various rates to evaluate the control of Bullrush (*Equisetum hyemale*). The chemicals were applied at three different timings: June, July, and August.

Glyphosate (Roundup Weathermax 4.5L) was applied at 0.75 lb ae/A, 1.5lb ae/A and 3 lb ae/A. 2,4-D (Salvo 5L) was applied at 1 lb ai/A and 2 lb ai/A. Dicamba (Clarity 4L) was applied at 0.25 lb ai/A and 0.5 lb ai/A. Triclopyr (Grandstand 3L) was applied at 0.5 lb ai/A and 1 lb ai/A and picloram (Tordon 22K 2L) was applied at 0.5 ai/A. All treatments except glypshosate were applied with a nonionic surfactant at 0.25 % V/V.

The study was conducted near Caruthersville, Missouri on Tiptonville loam soil, along a drainage ditch infested with 50 to 100 Bullrush stems per square foot. All applications were made with CO2 backpack sprayers at a 20 gpa application volume with TeeJet 8002VS tips at approximately 25 psi. The experiment was a randomized complete block with two replications. Bullrush control was rated 1 month after application.

2,4-D and triclopyr provided the best results; however, the control was inadequate and never exceeded 45%. The best control was observed with June and July applications. Triclopyr and 2,4-D gave 18% or less control when applied in August. Glyphosate and dicamba provided essentially no control at any of the rates and timings. Picloram at 0.5 lb ai/A gave 25% control with the June application but 15% or less with July and August timings. Although, 2,4-D and triclopyr provided the highest control of the 5 chemicals evaluated, the control was inadequate. Further research should probably focus on other chemistry including soil sterilants.

MANAGEMENT OF PERENNIAL GRASSES IN LOUISIANA RICE. R.M. Griffin, E.P. Webster, W. Zhang, C.T. Leon, and C.R. Mudge. Louisiana State University AgCenter, Baton Rouge.

ABSTRACT

A study was conducted in a greenhouse at Louisiana State University in Baton Rouge to evaluate emergence with respect to depth of burial of *Echinochloa polystachya* (Kunth) A.S. Hitchc. The design was a randomized complete block with four replications. Soil depths evaluated were: 0, 1.3, 2.5, 5, 10, and 20-cm. The greenhouse was maintained at a day-night temperature of 30:25 ± 5 C and relative humidity of 60 ± 10%. Soil was a Commerce silt loam (fine-silty, mixed, superactive, nonacid, thermic Aeric Fluvaquents) with less than 0.1% organic matter, 80.3% sand, 5.8 % silt, 13.9% clay, and pH 7.0. An 8-24-24 (N, P_2O_5, K_20) fertilizer was amended to the soil to an equivalent rate of 280 kg/ha. Visual ratings were taken every day for 28 d to evaluate emergence. Emergence was defined as a shoot emerging from the soil line. At the end of the 28 d, the stem segments that had not emerged were removed from the tubes, weighed, and then replanted in shallow pots at a depth of 1.3-cm. Emergence was recorded for the next 28 d.

E. polystachya emergence was 50% when planted at 1.3 or 2.5-cm. Emergence was reduced to 0% when segments were planted at depths of 10 or 20-cm. However, stem segments that had not emerged were recovered at 28 d and resulted in 19% emergence when replanted at 1.3-cm. These results indicate that burial depth of stem segments has an effect on emergence of *E. polystachya*; therefore, deep tillage may be a management option.

To evaluate herbicides for management of *E. polystachya*, a study was conducted in a greenhouse at Louisiana State University in Baton Rouge. The experimental design was a randomized complete block with four replications. Greenhouse conditions and soil were the same as previously described. Herbicide treatments were: 1260 g ae/ha glyphosate, 497 g ai/ha glufosinate, 314 g ai/ha cyhalofop, 9 g ai/ha bispyibac, 71 g ai/ha imazethapyr, 86 g ai/ha fenoxaprop/S (fenoxaprop plus safener), 560 g ai/ha quinclorac, 46 g/ha fenoxaprop/S plus 40 g ai/ha fenoxaprop, 3361 g ai/ha propanil, and a nontreated was added for comparison. Crop oil concentrate at 2.5% and 1% (v/v) was used with cyhalofop and quinclorac; respectively. An organo-silicon surfactant at 0.125 % (v/v) was used with bispyribac, and a nonionic surfactant at 0.25% (v/v) was used with imazethapyr. Stem sections approximately 25-cm in length of *E. polystachya* were weighed and planted in 30 by 20 by 10-cm containers at a depth of 1-cm and allowed to grow for 21 d. Treatments were applied to two- to three-leaf *E. polystachya* with a CO_2-pressurized backpack sprayer calibrated to deliver 94 L/ha at 140 kPa. Visual control ratings were taken at 7, 14, 21, and 28 d after treatment (DAT).

At 7 d after treatment (DAT) glyphosate and glufosinate controlled *E. polystachya* 83 to 86% and all other treatments resulted in 43 to 58%. At 28 DAT, both glyphosate and glufosinate controlled *E. polystachya* 99%; however, control was less than 66% with all other treatments. Glyphosate and glufosinate are not labeled for use in conventional rice; however, with development of glufosinate or glyphosate-resistant rice, these two herbicides may be an option for controlling *E. polystachya*.

DO RICE CULTIVAR AND SEEDING RATE AFFECT THE COMPETITIVE ABILITY OF RED RICE IN WATER-SEEDED RICE? C.T. Leon, E.P. Webster, W. Zhang, C.R. Mudge, and R.M. Griffin. Louisiana State University AgCenter, Baton Rouge.

ABSTRACT

Red rice (*Oryza sativa* L.) is one of the most common and troublesome weeds in Louisiana rice production. To further our understanding of red rice competition with newer rice cultivars, research was conducted at the Rice Research Station near Crowley, LA, to evaluate red rice competition in a water-seeded production system utilizing the cultivars Cocodrie, CL 121, Drew, and Jasmine. These cultivars were chosen to include differences in plant height and maturity date. The objective was to update red rice competition literature to determine whether selection for modern cultivars has affected the competitive ability of rice with red rice. Each cultivar was broadcast-seeded on May 3, 2002, by hand. Permanent flood was established May 28, 2002. The study was conducted using a split-plot design with a 4 x 3 x 2 factorial arrangement of treatments. Cultivars were seeded at 97, 194, and 219 seed m^{-2}. Red rice was simultaneously broadcast to obtain 0 or 20 plants m^{-2}. Molinate at 2.5 kg ha^{-1} plus 2.5 kg ha^{-1} propanil was applied 13 d after planting followed by 0.04 kg ha^{-1} halosulfuron plus 0.43 kg ha^{-1} cyhalofop plus 2.5% COC v/v 27 d after flood establishment. Rice and red rice height, density and panicle number were obtained at rice maturity by randomly hand harvesting 0.05 m^2 from each plot. Rice and red rice samples were separated and dried at 35 C for 3 wks. Rice and red rice biomass and panicle dry weight was recorded. Red rice panicles were removed from each plot before combine harvesting the center of the plot to obtain yield data. Data was subjected to the Mixed Procedure in SAS. Type III statistics were used to test fixed effects and least square means was used for mean separation.

Medium and high seeding rates reduced red rice stem number and panicle dry weight at least 37%, regardless of rice cultivar. As seeding rate increased for each cultivar, red rice panicle number decreased 14, 28, 21, and 56% for CL 121, Cocodrie, Drew and Jasmine, respectively. Jasmine, a cultivar possessing good seedling vigor and tillering ability, resulted in at least 97 fewer red rice panicles m^{-2} than other cultivars. At the lowest Jasmine seeding rate, red rice produced 275 panicles m^{-2}. This was similar to the number of red rice panicles (254 to 295 m^{-2}) produced at the medium seeding rate of the other cultivars. Strawhull and blackhull red rice biotype plant height increased as the height of the rice cultivars increased. Red rice panicle dry weights were lowest in the presence of Jasmine (98 g m^{-2}) compared with the other 3 cultivars (198 to 216 g m^{-2}).

Averaged across cultivars and seeding rates, the presence of red rice reduced rice stems, dry biomass, and panicle number 16, 34, and 20%, respectively. Rice grain yield was reduced 1308 kg ha^{-1} or 23%. With the exception of plant number, red rice reduced all rice parameters measured when taken as a percent of the nontreated. No differences were observed among the 4 cultivars in the study.

As was found in previous research, the long-season, late-maturing Jasmine reduced red rice parameters more than the other cultivars tested, although it was not significantly different. The early results suggest effective selection of rice cultivars for tillering ability, height, and season length can be used to make rice a more efficient competitor with red rice. Combined with current herbicide systems such as Clearfield and Liberty-Link, a competitive rice cultivar should possess an even more pronounced competitive edge. The study will be repeated in 2004.

PENOXSULAM (XDE-638) FOR RICE WEED CONTROL. B.V. Ottis[1], R.B. Lassiter[2], M.S. Malik[1], and R.E. Talbert[1]. [1]Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. [2]Dow AgroSciences, Little Rock, AR.

ABSTRACT

Two experiments were established during the summer of 2003 at the Rice Research and Extension Center near Stuttgart, AR, to evaluate the potential of penoxsulam (XDE-638) as part of a rice weed control program. XDE-638 was recently granted Reduced Risk Pesticide Status by the EPA. It is a member of the triazolopyrimidine sulfonamide family of herbicides, which inhibit the acetolactate synthase (ALS) enzyme of susceptible species. In experiment one, XDE-638 applied alone and in tank mixtures early postemergence (EPOST) (2 lf rice, 1 lf grass, 2 lf weeds) was evaluated while experiment two evaluated XDE-638 applied alone and in tank mixtures mid-postemergence (MPOST) (4 lf rice, 3-4 lf grass, 3-4 lf weeds) following a preemergence (PRE) application of clomazone (Command). Plots were established in a randomized complete block design with four replications. The rice variety 'Francis' was drill-seeded at 78 kg/ha. Weeds evaluated were barnyardgrass (*Echinochloa crus-galli*), broadleaf signalgrass (*Brachiaria platyphylla*), hemp sesbania (*Sesbania exaltata*), northern jointvetch (*Aeschynomene virginica*), and pitted morningglory (*Ipomoea lacunosa*). A CO_2 backpack sprayer calibrated to deliver 94 L/ha was used for all applications.

In experiment one, barnyardgrass control was at least 99% at 21 days after treatment (DAT) with XDE-638 alone and in tank mixtures with Command, Command + cyhalofop-butyl (Clincher), and propanil (Stam M-4). Hemp sesbania, northern jointvetch, and pitted morningglory control was less than 30% with XDE-638 combinations, while Stam M-4 + quinclorac (Facet) provided 63% control of these weeds. Yields ranged from 7120 to 8580 kg/ha, with the treatment of XDE-638 + Stam M-4 having a significantly higher yield than treatments of XDE-638 alone, XDE-638 + Command, or Stam M-4 + Facet.

In experiment two, barnyardgrass control was at least 95% 21 DAT with applications of Command PRE alone or followed by (fb) XDE-638, XDE-638 + Clincher, XDE-638 + Facet, XDE-638 + Stam M-4, Clincher, or an application of Stam M-4 + Facet. Broadleaf signalgrass control was 84% when XDE-638 was applied alone following Command PRE, and control improved to 93% when XDE-638 was applied with Clincher and to 99 and 100% when XDE-638 was applied with Facet or Stam M-4, respectively. XDE-638 applied alone or with Clincher MPOST following Command PRE, provided less than 65% hemp sesbania control. Hemp sesbania control was 100% with XDE-638 + Facet or Stam M-4 MPOST following Command PRE. Pitted morningglory control was 36% with Command PRE fb XDE-638 MPOST. Applications of Command fb XDE-638 + Stam M-4 or Facet increased pitted morningglory control to 74 and 85%, respectively. There were no significant differences in yield observed among XDE-638 treatments, with yields ranging from 7010 to 7420 kg/ha.

XDE-638 applied postemergence appears to provide excellent barnyardgrass control and poor to moderate broadleaf weed control. XDE-638 + Clincher did not result in reduced grass weed control.

EVALUATION OF CYHALOFOP TANK MIXES WITH SELECTED HERBICIDES FOR BROAD SPECTRUM WEED CONTROL IN RICE. B.J. Williams, A.B. Burns, and D.B. Copes; Northeast Research Station, St. Joseph, La., Louisiana State University AgCenter, Baton Rouge, La. 70803.

ABSTRACT

Cyhalofop tank mixes with selected herbicides was evaluated in 2003 at the Northeast Research Station near St. Joseph, La. on a Sharkey clay soil. One water-seeded study was conducted and two dry-seeded studies were conducted. The treatments were 0.27 kg ai/ha cyhalofop plus 0.028 kg ai/ha carfentrazone, 0.14 kg ai/ha acifluorfen, 0.85 kg/ha bentazon, acifluorfen + bentazon, 0.042 kg ai/ha bensulfuron, 0.033 kg ai/ha halosulfuron, 0.032 kg ai/ha bensulfuron + 0.013 kg ai/ha halosulfuron, or 0.04 kg ai/ha penoxsulam in the water seeded trail. Cyhalofop plus each tank mix partner was applied at the 1-2 leaf rice stage. A second 0.25 kg ai/ha cyhalofop application was made at the 4-5 leaf rice stage. The treatments in the first dry-seeded trial were 0.25 kg ai/ha cyhalofop applied when rice was at the 2-3 leaf stage followed by a second application of 0.27 kg ai/ha cyhalofop at the 4-5 leaf stage. Carfentrazone at 0.028 kg ai/ha, 0.21 kg ai/ha triclopyr, 0.022 kg ai/ha bispyribac, or 0.042 kg ai/ha bensulfuron was tank mixed with cyhalofop at either the first or second timing. The treatments in the other dry-seeded trial were 0.21 kg ai/ha cyhalofop applied when rice was at the 2-3 leaf stage followed by a second application of 0.31 kg ai/ha cyhalofop at the 4-5 leaf stage. The first cyhalofop application was made alone or with 1.12 kg ai/ha pendimethalin, 0.42 kg ai/ha clomazone, 0.32 kg ai/ha quinclorac, 3.36 kg ai/ha thiobencarb. The second cyhalofop application was made alone or tank mixed with carfentrazone at 0.028 kg ai/ha, 0.21 kg ai/ha triclopyr, 0.022 kg ai/ha bispyribac, or 0.042 kg ai/ha bensulfuron. Herbicide treatments were applied, using CO2 pressurized backpack sprayer calibrated to deliver 140 L/ha, to plots measuring 2 by 4.5 meters. Rice "Cocodrie" was drill-seeded at 101 kg/ha on a 19 cm spacing in dry-seeded rice and broadcast at 170 kg/ha in water-seeded rice. After draining the seeding flood, plots were flushed weekly and flooded 4 WAP in the water-seeded rice trial. In the dry-seeded trials, plots were flushed as needed and flooded 5 WAP. The experimental design for the experiments was a randomized complete block with a factorial treatment arrangement. Weed control ratings, rice injury ratings, and rice yield data were subjected to analysis of variance. Means were separated using Fisher's Protected LSD at the 5% level. At the 1-2 leaf stage, barnyardgrass (*Echinochloa crus-galli*) control was reduced from 95 to 88 and 82% in water-seeded rice when cyhalofop was applied with bensulfuron and halosulfuron, respectively. There was no difference in barnyardgrass control following the second cyhalofop application. Cyhalofop plus bentazon, bensulfuron, or penoxsulam did a good job of controlling ducksalad (*Heteranthera limosa*). Cyhalofop plus halosulfuron, carfentrazone and acifluorfen did not control ducksalad. Cyhalofop plus carfentrazone controlled purple ammania (*Ammannia coccinea*) 70 to 80%. Cyhalofop plus acifluorfen, bentazon, bensulfuron, halosulfuron, or penoxsulam did a good job of controlling purple ammania. In dry-seeded rice, applying cyhalofop plus carfentrazone, triclopyr, or bensulfuron at the 2-3 leaf stage reduced barnyardgrass control from 85 to 80, 78, and 67%, respectively. After the second cyhalofop application there was no reduction in control when cyhalofop was mixed with carfentrazone. Cyhalofop plus bispyribac did an excellent job of controlling barnyardgrass. Cyhalofop plus carfentrazone, triclopyr, bispyribac, or bensulfuron applied at the 2-3 leaf stage did an excellent job of controlling hemp sesbania (*Sesbania exaltata*), rice flatsedge (*Cyperus iria*), spreading dayflower (*Commelina diffusa*), and eclipta (*Eclipta prostrate*) in dry seeded rice. Occasionally, tank mixing cyhalofop with a residual herbicide at the 2-3 leaf timing reduced the antagonism between cyhalofop and broadleaf herbicides at the 4-5 leaf timing. Barnyardgrass control was 90% or better when cyhalofop plus clomazone or pendimethalin at the 2-3 leaf stage was followed by cyhalofop plus carfentrazone, triclopyr, bispyribac, or bensulfuron at the 4-5 leaf stage. Barnyardgrass control was not as consistent when cyhalofop was mixed with thiobencarb or quinclorac. Amazon sprangletop (*Leptochloa panicoides*) control was excellent when cyhalofop was mixed with a residual herbicide and followed by cyhalofop plus the broadleaf herbicides. Surprisingly, applying

cyhalofop plus pendimethalin, clomazone, thiobencarb, or quinclorac reduced broadleaf weed control in many cases. Differences in control were largely due to the differences in the ability of residual herbicides to provide some level of broadleaf control, which resulted in some weeds being larger or absent when the second application was made. Palmleaf morninnglory (*Ipomoea wrightii*) and tall waterhemp (*Amaranthus tuberculatus*) control was excellent when cyhalofop was mixed with a residual herbicide and followed by cyhalofop plus any of the broadleaf herbicides. Overall, in water-seeded rice these data suggest that cyhalofop tank mixes with carfentrazone, acifluorfen, bentazon, bispyribac, bensulfuron, halosulfuron, or penoxsulam are possible when a second cyhalofop application is planned. Despite some success, these data suggest that the antagonism between cyhalofop and broadleaf herbicides can not be minimized simply by making the applications earlier.

EVALUATION OF IMAZETHAPYR TANK MIXES WITH SELECTED HERBICIDES FOR BROAD SPECTRUM WEED CONTROL IN RICE. D.B. Copes, B.J. Williams, and A.B. Burns; Northeast Research Station, St. Joseph, La., Louisiana State University AgCenter, Baton Rouge, La. 70803.

ABSTRACT

Imazethapyr tank mixes with selected herbicides was evaluated in 2003 at the Northeast Research Station near St. Joseph, La. on a Sharkey clay soil. Imazethapyr at 0.07 kg ai/ha was applied preemergence and followed by a second application of 0.07 kg ai/ha imazethapyr at the 4-5 leaf rice stage. The first imazethapyr application was made alone or with 0.42 kg ai/ha clomazone, 1.12 kg ai/ha pendimethalin, 3.36 kg ai/ha thiobencarb, or 0.32 kg ai/ha quinclorac. The second imazethapyr application was made alone or tank mixed with 0.028 kg ai/ha carfentrazone, 0.042 kg ai/ha bensulfuron, 0.052 kg ai/ha halosulfuron, 0.032 kg ai/ha bensulfuron plus 0.026 kg ai/ha halosulfuron, or 0.026 kg ai/ha bispyribac. Herbicide treatments were applied, using CO2 pressurized backpack sprayer calibrated to deliver 140 L/ha, to plots measuring 2 by 4.5 meters. Clearfield rice 'CL-161' was drill-seeded at 101 kg/ha on 19 cm spacing into stale-seedbeds. Plots were flushed as needed and permanent floods were established 5 WAP. The experimental design for the experiments was a randomized complete block with a factorial treatment arrangement. Weed control ratings, rice injury ratings, and rice yield data were subjected to analysis of variance. Means were separated using Fisher's Protected LSD at the 5% level. Barnyardgrass (*Echinochloa crus-galli*) control 4 weeks after flood (WAF) was improved 10 to 18% when the soil application of imazethapyr was mixed with clomazone, pendimethalin, thiobencarb, or quinclorac and the second application was applied alone. When the second imazethapyr application following imazethapyr plus clomazone or thiobencarb was mixed with carfentrazone, bensulfuron, or halosulfuron barnyardgrass control was reduced 7 to 30%. Following imazethapyr plus pendimethalin with imazethapyr plus carfentrazone or bensulfuron reduced barnyardgrass control from 95 to 83 and 87%, respectively. Following imazethapyr plus quinclorac with imazethapyr plus halosulfuron or bensulfuron reduced barnyardgrass control from 88 to 77 and 78%, respectively. Barnyardgrass control 8 WAF was improved 37 to 42% when the soil application of imazethapyr was mixed with clomazone, pendimethalin, thiobencarb, or quinclorac and the second application was applied alone. Many of the reductions in barnyardgrass control observed at 4 WAF when the second application of imazethapyr was mixed with some herbicides were minimized by 8 WAF. However, some reductions in barnyardgrass control were still observed. Following imazethapyr plus clomazone or pendimethalin with imazethapyr plus carfentrazone or halosulfuron reduced barnyardgrass control 5 to 16%. Following imazethapyr plus quinclorac with imazethapyr plus halosulfuron or bensulfuron reduced barnyardgrass control from 82 to 77 and 78%, respectively. Amazon sprangletop (*Leptochloa panicoides*) control 4 WAF was improved 7 to 12% when the soil application of imazethapyr was mixed with clomazone, pendimethalin, or thiobencarb and the second application was applied alone. With the exception bensulfuron, mixing the second imazethapyr application with broadleaf herbicides did not affect sprangletop control. Annual sedge (*Cyperus compressus*) control was good to excellent when imazethapyr was applied alone or tank mixed with any of the herbicides. Mixing the soil application of imazethapyr with pendimethalin, clomazone, thiobencarb, or quinclorac did not improve hemp sesbania (*Sesbania exaltata*) control 4 or 8 WAF. Mixing the second application of imazethapyr with carfentrazone, halosulfuron, bensulfuron plus halosulfuron, or bispyribac improved sesbania control to 90% or better. Overall, imazethapyr plus pendimethalin followed by imazethapyr plus carfentrazone or halosulfuron resulted in the best barnyard-grass, sprangletop, sedge, and sesbania control. The presence and size of weeds was strongly influenced by the soil program. Thus, many of the reductions in weed control may not have been observed if second imazethapyr application timing had been modified for each soil program.

EVALUATION OF PREEMERGENCE APPLICATIONS OF HALOSULFURON IN DRILL-SEEDED RICE. A.B. Burns, B.J. Williams, and D.B. Copes; Northeast Research Station, St. Joseph, La., Louisiana State University AgCenter, Baton Rouge, La. 70803.

ABSTRACT

The efficacy of pre-plant and preemergence applications of halosulfuron was evaluated in 2002 and 2003 at the Northeast Research Station near St. Joseph, La. on a Sharkey clay soil. Seedbeds were prepared in the Fall. Winter weeds were removed one month before planting with 1.12 kg ai/ha glyphosate plus 0.56 kg ai/ha 2,4-D amine. Clomazone at 0.67 kg ai/ha was applied alone or with 0.018, 0.036, or 0.054 kg ai/ha halosulfuron either 2 weeks prior to planting (WPP) or PRE. Additional treatments included following the pre-plant and PRE clomazone plus halosulfuron combinations with 0.022 kg ai/ha bispyribac plus 0.054, 0.036, or 0.018 kg ai/ha halosulfuron at the 4-5 leaf rice stage. The POST halosulfuron rates were adjusted so that the total rate (Pre-plant or PRE + POST) for the season was equal to 0.072 kg ai/ha. Herbicide treatments were applied, using CO2 pressurized backpack sprayer calibrated to deliver 140 L/ha, to plots measuring 2 by 4.5 meters. Rice "Cocodrie" was drill-seeded at 101 kg/ha on 19 cm spacing into stale-seedbeds. Plots were flushed as needed and permanent floods were established 5 WAP. The experimental design for the experiments was a randomized complete block. Weed control ratings, rice injury ratings, and rice yield data were subjected to analysis of variance. Means were separated using Fisher's Protected LSD at the 5% level. Halosulfuron did not influence barnyardgrass (*Echinochloa crus-galli*) control when applied with clomazone 2 WPP or PRE compared to clomazone alone. When applied 2 WPP, clomazone plus 0.018, 0.036, and 0.054 kg ai/ha halosulfuron controlled yellow nutsedge (*Cyperus esculentus*) 90 to 93% 2 to 4 weeks after planting (WAP). Preemergence applications of clomazone plus 0.018 kg ai/ha halosulfuron only controlled yellow nutsedge 83 and 75%, 2 and 4 WAP, respectively. Preemergence applications of clomazone plus 0.036 and 0.054 kg ai/ha halosulfuron controlled yellow nutsedge 85 to 93% 2 to 4 WAP. Clomazone alone did not control yellow nutsedge. Hemp sesbania (*Sesbania exaltata*) control 4 WAP from pre-plant applications of clomazone plus halosulfuron at 0.018, 0.036, and 0.054 kg ai/ha was 87, 88, and 93%, respectively. The preemergence applications of clomazone plus halosulfuron were not as effective as pre-plant applications and resulted in 77 to 88% sesbania control 4 WAP. By 8 WAP, barnyardgrass, yellow nutsedge, and hemp sesbania control was less than 80% from pre-plant applications of clomazone plus halosulfuron. However, control for each weed was improved to 90% or better when bispyribac plus halosulfuron was applied at the 4-5 leaf rice stage. Yellow nutsedge control was still 85 to 90% at 8 WAP when clomazone plus halosulfuron was applied preemergence, but barnyardgrass and sesbania control was less than 80%. Barnyardgrass control was improved to 82%, while yellow nutsedge and sesbania control was improved to 85% or better when bispyribac plus halosulfuron was applied at the 4-5 leaf rice stage following preemergence applications of clomazone plus halosulfuron. Rice yield was increased from less than 50 bu/A to 170 bu/A when pre-plant applications of clomazone was applied with halosulfuron compared to clomazone alone. Rice yields from preemergence clomazone plus halosulfuron applications were less than the pre-plant applications, but did increase steadily as halosulfuron rate increased. While weed control was improved, the 4-5 leaf application of bispyribac plus halosulfuron did not improve rice yields. These data suggest that halosulfuron applications made before planting rice or preemergence can improve both weed control and rice yield on clay soils. Overall, pre-plant applications of clomazone plus halosulfuron resulted in the best weed control and rice yields.

EFFECT OF INTERMITTENT IRRIGATION ON RICE AGRONOMICS, ENVIRONMENTAL CONSERVATION AND PEST MANAGEMENT. M.C. Smith[1], J.H. Massey[1], E.F. Scherder[2], R.E. Talbert[2], B.V. Ottis[2], E. Vories[2], M. Weaver[3], R.M. Zablotowicz[3], D.R. Shaw[4], M. Locke[5]. [1]Department of Plant and Soil Sciences, Mississippi State University, MS 39762; [2]Department of Agronomy, University of Arkansas, Fayetteville, AR 72701; [3]USDA-ARS Southern Weed Science Research Unit, Stoneville, MS 38776; [4]GeoResources Institute, Mississippi State University, MS 39762. [5]USDA-ARS Water Quality and Ecology Processes Research Unit, Oxford, MS 38655.

ABSTRACT

The alluvial aquifer in the Grand Prairie region of Arkansas will not support irrigated agriculture by 2015 due to overdrafts attributed to intensive rice cultivation. Additionally, the depletion of Arkansas' alluvial aquifer has caught the attention of environmental regulators in Mississippi. The alluvial aquifer within the Mississippi Delta's rice and aquaculture region has declined 11 in yr^{-1} since 1993. To avoid impending regulation, rice producers in Mississippi must demonstrate that alternative cropping systems can slow or reverse groundwater depletion. Rice requires ca. 20 A-in water $season^{-1}$. Water inputs include both natural rainfall and irrigation. Irrigation in continuously flooded rice with levee-gate distribution consumes 30 to 40 A-in of water. With levee-gate flood distribution, each paddy must be filled to overflowing to deliver water to a successive down-slope paddy. However, with multiple-inlet irrigation, each paddy is flooded simultaneously which can reduce over-filling and excessive runoff. With continuously flooded rice, once the flood is established it is maintained at near maximum capacity. Thus, the rice paddies are unable to capture water from the 10 A-in of rainfall during the months of June, July and August. In intermittently flooded rice, flood depth fluctuates between fully flooded and ½ of the paddy 'showing' exposed soil. This decreases the average flood depth, captures rainfall, reduces tail-water runoff and decreases irrigation inputs.

A production-scale project was begun in Mississippi in 2003 to extend water-saving research initiated by the University of Arkansas into the Mississippi rice growing region. This project compared water consumption, agronomics, and pest pressure between rice grown in continuously flooded and intermittently flooded water management systems. The project was located in adjacent production fields in Coahoma County, Mississippi. The soil was a Sharkey silty clay loam with 25% clay, pH 6.7, 1.8% organic matter and 0.1% uniform slope. The continuously flooded treatment used multiple-inlet distribution delivering 17 gal min^{-1} A^{-1} to a 72.2 A field. The intermittently flooded treatment also used multiple-inlet distribution delivering 15 gal min^{-1} A^{-1} to a 32.2 A field. Both fields followed a two year soybean rotation. Sixty-eight lb A^{-1} Cocodrie rice was planted on 21 April 2003. Weed control included Command + Bolero, delayed-PRE followed by (*fb*) Flexstar, preflood *fb* Regiment, postflood. All herbicides were applied at the manufacturer recommended rates. Fertility included 100 lb A^{-1} N preflood *fb* 50 lb A^{-1} N midseason applied as urea. Flood was established on 30 May 2003 and terminated approximately 85 days later.

Initially, the producer was uncomfortable allowing the flood in the intermittently flooded field to subside to the target depth. As a result, both the continuously and intermittently flooded rice systems used approximately 0.34 A-in day^{-1} during the first 30 days after flood initiation. After the initial reluctance to follow an intermittent flooding schedule was overcome, the daily irrigation rate was 0.16 A-in day^{-1} in the intermittently flooded system compared to 0.35 A-in day^{-1} in the continuously flooded system. After 85 days of flooding, the continuously flooded system consumed 28 A-in of water compared to 18 A-in in the intermittently flooded system. Insect, disease and weed infestations did not differ between the two flooding systems. Intermittent flooding did not affect flag-leaf nutrient concentrations when compared rice in the continuously flooded adjacent field. Rice grown in the intermittently flooded system yielded 189 bu A^{-1} compared to 183 bu A^{-1} from rice in the continuously flooded system. Intermittent flooding with multiple-inlet irrigation appears to be a feasible water-saving irrigation practice for

rice producers in Mississippi and Arkansas. By refining this system, producers may be able to capture and store ample in-season rainfall and reduce irrigation inputs by as much as 60% compared to average water use in rice. This could slow the alluvial aquifer decline in both states while saving rice producer from $15 to $30 A^{-1} in irrigation costs.[1]

[1]The authors thank Edwin, Terry, J.D. and Wayne Dulaney and Gary Goode for providing production-scale research locations, guidance and critical assessment of this project. The authors also thank Mississippi Agricultural and Forestry Experiment Station Special Research Initiatives and USDA-CSREES National Water Quality Program for funding.

RIGHT-OF-WAY MANAGEMENT: A KEY TO CONTROLLING THE SPREAD OF COGONGRASS (*IMPERATA CYLINDRICA*). W.H. Faircloth, M.G. Patterson, J.H. Miller, and D.H. Teem. Auburn University, Auburn, AL, and U.S. Forest Service-Southern Research Station, Auburn, AL.

ABSTRACT

Cogongrass [*Imperata cylindrica* (L.) Beauv.] is an undesired species on highway rights-of-way (ROWs) due to its displacement of native and/or more manageable grasses, unsightly growth characteristic, and propensity for fire. Fire not only poses a danger to motorists but could cause property loss to adjoining landowners. Most importantly, ROWs provide corridors to un-infested areas, therefore, expanding the range of this noxious weed. In order to protect natural systems and un-infested areas, ROW management of cogongrass is crucial. Two projects were located on Interstate 10 ROW in Baldwin Co., near the towns of Loxley (est. fall 2000) and Malbis (est. fall 2001). Both projects integrated chemical control with the subsequent revegetation of highly competitive and more desirable species. Herbicides were glyphosate (3.0 lb ai/A) and imazapyr (0.375 and 0.75 lb ai/A). Repacement species were bahiagrass (*Paspalum notatum* var. Pensacola), common bermudagrass *(Cynodon dactylon),* browntop millet *(Panicum ramosum),* crimson clover *(Trifolium incarnatum* var. AU Robin), and annual ryegrass (*Lolium multiflorum* var. Gulf). Treatments were comprised of various combinations of herbicides and replacement species arranged in an RCB design with 4 replications. The initial study located at Loxley had 14 treatments plus an untreated control; the Malbis study consisted of 7 treatments plus an untreated control. Two differences in plot maintenance practices existed between locations:1) plots at Loxley were not mowed during the growing season, and 2) all replacement species were broadcast-seeded. The study at Malbis was designed to more closely follow Alabama Department of Transportation protocols, therefore, plots were mowed 4x during the growing season (May-June, July, Aug.-Sept., and Nov.) and all replacement species were drill-seeded. Plots were 15x30 ft. at both locations. Both studies were designed in triplicate, such that a time factor could be examined. All regimes were treated year one; two of three were re-treated in year two; a third was treated yet again in year three. Thus, all treatments could be evaluated when implemented in one, two, and three successive years. Plot evaluation included visual ratings of cogongrass control and subsequent revegetation, cogongrass stand counts, and cogongrass biomass sampling. Plots were evaluated yearly beginning one year after initial treatment (YAIT).

Loxley Study. The one year treatment regime was ineffective in reducing either the visual control or stand counts of cogongrass. The greatest percent control 2 YAIT on the one year regime was 15%. With a two year regime, all treatments reduced stand counts >60%. Those treatments that included imazapyr either alone or in combination with glyphosate showed the greatest decrease in stand counts (≥80%). All treatments reduced cogongrass stand counts >80% in the three year regime, 3 YAIT. Only after three consecutive years of application did glyphosate alone give control equal to imazapyr either alone or in combination with glyphosate. No treatment or regime resulted in the conversion of cogongrass infested ROW to either bahiagrass or bermudagrass. This is due, in part, to drought conditions which prevailed during the study period and experimental techniques (broadcasting of seeds).

Malbis Study. Reduction in cogongrass stand counts were ≥70% across all regimes and all treatments 1 YAIT. The one year regime began to exhibit regrowth 2 YAIT in plots treated with glyphosate only. Imazapyr in combination with glyphosate reduced stand counts >81%. Both the two and three year regimes gave near 100% control 2 YAIT, regardless of treatment. Conversion to bahiagrass or bermudagrass was greater than the Loxley study, with plots averaging 50% coverage. A three year evaluation will be taken spring 2004.

Summary. At least two years continuous treatment was necessary for adequate visual control and reduction in stand of cogongrass. Glyphosate alone as a treatment was only effective when

applied in the three year regime (Loxley) or in the two year regime (Malbis). Imazapyr consistently provided long-term control regardless of glyphosate. Winter cover crops, especially crimson clover, delayed cogongrass emergence in spring, but made no difference in overall control. Specific treatment combinations were less important than the number of times in which those treatments were applied.

DISTRIBUTION OF HYDRILLA (*HYDRILLA VERTICILLATA*) AND NATIVE SUBMERSED MACROPHTYES IN LAKE GASTON, NORTH CAROLINA AND VIRGINIA. J.D. Madsen, R.M. Stewart, A. Way and C.S. Owens; GeoResources Institute, Mississippi State University, Mississippi State, MS 39762, U.S. Army Corps of Engineers Vicksburg District, Vicksburg, MS 39180, and Lewisville Aquatic Ecosystem Research Facility, Lewisville, TX 75056.

ABSTRACT

Lake Gaston has a history of invasive aquatic plant nuisance problems, the most recent from the invasion of hydrilla. We surveyed Lake Gaston in September 1999 using a point-intercept method, and studied selected sites using hydroacoustic surveys and box core sampling for shoot and tuber biomass. A total of twenty different plant species were identified for Lake Gaston. By conservative estimate, hydrilla can colonize to a depth of 3.1m in Lake Gaston. Therefore, hydrilla could potentially colonize 2,023 ha or 25% of the lake's surface area. While a large proportion of the littoral zone (<3.1 m) was vegetated (76%), providing adequate cover for littoral zone fish; the vast majority of the vegetation is nonnative *Hydrilla verticillata* (65%). Total plant biomass averaged 67.2 g m^{-2}, and was 93% hydrilla. Hydrilla is by far the dominant aquatic plant in the lake. Biomass levels themselves were not high for hydrilla, probably due to poor transparency. Tuber density was low for monoecious hydrilla, and comparable to sites with dioecious hydrilla. The low tuber numbers may be due to intensive hydrilla management. The main restriction for more vegetation, and the enhancement of native vegetation, is poor water clarity in the lake.

INTRODUCTION

Lake Gaston is an 8,220 ha impoundment on the Roanoke River located on the North Carolina and Virginia border. The U.S. Army Corps of Engineers (1994) reported that hydrilla, predominantly the monoecious biotype, rapidly spread within Lake Gaston following lake drawdown during the 1987-88 winter months that had been implemented as a control measure for Brazilian elodea. By 1993, hydrilla had spread to approximately 567 ha. At that time, the distribution of hydrilla was limited mainly to the upper, river-run sections of the reservoir above Interstate 95. Potentially, hydrilla could spread to 2,023 ha, or roughly 25% of the lake's surface area.

Four sampling approaches were used to fully document the species diversity of aquatic plants in the lake, and to quantify the abundance and distribution of *Hydrilla verticillata* and other species within different lake regions: 1) Biomass sampling was used to quantify the abundance of hydrilla and other species; 2) Tuber sampling was used to quantify dormant propagules of hydrilla; 3) Point intercept sampling was used to document the distribution of aquatic plant species on a lake wide basis; and 4) hydroacoustic surveys were used in ten areas of the lake to evaluate this quantification technique.

METHODS AND MATERIALS

Surveys were performed from 13 to 26 September 1999. During this time, water levels fluctuated approximately 1.0 m (60.7 to 61.8 m elev.) due to Hurricane Floyd. Data reported herein have been rectified to normal pool elevation of mean elevation of 60.9 m. Underwater light intensity was measured at 18 different locations within the reservoir. Both standard Secchi disk depth and a profile of underwater light irradiance were measured in 1 m intervals (with a LiCor (Lincoln, NB) LI-1000 meter with surface and submersible photosynthetically-active radiation (PAR) quantum probes).

Biomass and tuber samples were collected from seven areas on Lake Gaston to estimate biomass of individual species and densities of hydrilla tubers (Madsen 1993), with 16 replicates per site

for a total of 112 samples. Samples were collected using a 0.1 m^2 box corer. Once retrieved, samples were washed to separate all vegetative shoot material and hydrilla tubers. Shoots were sorted by species; tubers were separated from shoots, and placed in labeled bags on site. Later, tuber samples were enumerated and then all samples were oven-dried.

A grid of sample points was developed using MapInfo (MapInfo Corp., Troy, NY), a desktop mapping program similar to a geographic information system (GIS). Points were gridded from the HWY 1 bridge (Goodes Ferry Bridge) to the dam on a grid size of 250 m by 250 m for a total of 1290 points. Once on the lake, a global positioning system (GPS, Model NT200D, Trimble Corporation, Santa Rosa, CA) was used to locate the sampling points. At each point, each species (emergent, floating or submersed) present using a rake was identified and water depth was determined.

Transect surveys were conducted using the SAVEWS hydroacoustic surveying system in ten areas using a total of 77 transects (Sabol and Melton 1995). The SAVEWS system provides estimates of average water depth, average plant height, and frequency of occurrence of submersed aquatic vegetation along incremental transect sections. Vegetation coverage is reported as the portion of PLANT pings between successive GPS reports. Plant height is reported as the average of the bottom-to-quiet zone distance within PLANT pings.

RESULTS AND DISCUSSION

While the maximum depth of Lake Gaston is approximately 24 m, a significant portion of points sampled in the reservoir were in water depths less than 6 m (57%). Further, approximately 34% of points sampled in this survey were found to be in water depths less than 3.1 m, the pre-survey estimate for maximum depth of macrophyte colonization.

The average Secchi disk was very low (1.18 m). Therefore, the depth distribution, and possibly biomass, of all plants including hydrilla was severely light-limited. Based on Secchi disk measurements and underwater light readings taken at 18 locations throughout the lake, estimates for maximum depth of macrophyte colonization calculated by three methods ranged from <1.0 m to >5.0 m, with an average of 2.1 m (Canfield et al 1985, Chambers and Kalff 1985, Vant et al. 1986). Plants were most frequent (80%) in 1.5m or less of water, and commonly observed (>40%) to 3.1 m. The deepest plant observation was 5.2 m. For the most part, the calculated estimates concur with previous estimates the maximum depth of native macrophyte colonization was near 3.1 m.

Hydrilla (and total) biomass (Table 1) in Lake Gaston was not very high compared to other reservoirs. Total plant biomass at the seven sites averaged 67.2 g m^{-2}, and was 93% hydrilla. Hydrilla was the dominant aquatic plant in the lake. Biomass levels themselves were not high for hydrilla, probably due to a combination of poor transparency, active hydrilla management, and the effects of Hurricane Floyd. Tuber densities observed in Lake Gaston (Table 1) were in the lower end of the range observed for monoecious hydrilla (Harlan et al. 1985), and consistent with that observed for dioecious hydrilla (Netherland 1997). These lower-than-average tuber numbers (for monoecious hydrilla) may be due to the intensive management of hydrilla in Lake Gaston. Tuber biomass is consistent with the tuber densities observed.

A total of twenty different aquatic plant species were found in Lake Gaston (Table 2). Over 28% of the lake's surface area, and 51.0% of the littoral zone (<6.1 m), was vegetated. Hydrilla occurred in a higher percentage of points than did any other species (Table 1). On a whole-lake basis, hydrilla was collected in 24.0% of samples, while *Chara sp.,* the next most frequently sampled plant species, occurred in only 5.3% of samples. Assuming littoral zone limits of either 6.1 m, hydrilla was present in 43.3% of the littoral zone.

Mean values for maximum vegetated depth as determined by the SAVEWS hydroacoustic surveys ranged from 1.33 m to 4.01 m, with an average of 2.42 m. The mean percent frequency occurrence of vegetation along all SAVEWS hydroacoustic transects was greater than 75% in most of the study areas. Average percent cover of submersed aquatic plants in vegetated portions of SAVEWS transects showed significant differences among the 10 study areas, with four areas less than 50% and four areas greater than 75%.

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Table 1. Estimates (mean and standard error) for water depth, species biomass, total above ground biomass (all species), tuber density, and tuber biomass for seven (7) areas in Lake Gaston. Sample size for each site is N=16.

Site	Depth (m)	Aboveground Biomass (g DW m^{-2})			Hydrilla Tubers	
		Chara	*Hydrilla*	Total	Density (N m^{-2})	Biomass (g DW m^{-2})
ALL (N=112)	1.7 (0.10)	1.8 (0.70)	62.7 (8.1)	67.2 (8.2)	106 (15)	3.0 (0.5)
1	2.1 (0.10)	4.3 (2.0)	39.9 (10.7)	44.1 (10.5)	68 (19)	2.6 (0.73)
2	1.6 (0.10)	0.25 (0.16)	4.5 (1.7)	4.8 (1.8)	95 (16)	4.5 (1.0)
7	2.0 (0.16)	0.32 (0.24)	60.8 (10.5)	66.9 (9.7)	86 (26)	2.0 (0.67)
8	1.8 (0.14)	0.13 (0.08)	70.8 (21.1)	78.5 (88.2)	94 (40)	4.0 (1.9)
9	1.3 (0.13)	7.0 (4.3)	0.39 (0.25)	7.4 (4.3)	128 (35)	7.8 (2.3)
10	1.3 (0.16)	0	138 (36.7)	144 (36.5)	188 (79)	ND
11	1.7 (0.17)	0.51 (0.20)	125 (17.1)	125 (68.3)	84 (12)	ND

Table 2. Percent frequency of occurrence for aquatic plant species sampled in the point-intercept survey of Lake Gaston. Species occurrences are provided on the basis of the lake-wide survey (i.e. all points/depths), as well as on the basis of two water depth categories: (i.e., points with water depths ≤ 6.1 m or water depths ≤ 3.1 m). Estimates are also included for average species diversity and average native species diversity for each of the three depth categories.

Scientific Name	% Frequency (Lake-wide, all depths)	% Frequency (Only pts with depth ≤ 6.1 m)	% Frequency (Only pts. with depth ≤ 3.1 m)
Ceratophyllum demersum L.	1.9	3.5	5.3
Chara sp.	5.3	9.5	14.5
Egeria densa Planch.	0.4	0.7	1.1
Hydrilla verticillata (L.f.) Royle	24.0	43.3	65.0
Juncus sp.	<0.01	0.0	0.0
Justicia americana (L.) Vahl	1.7	3.1	5.0
Myriophyllum spicatum L.	0.2	0.3	0.4
Najas guadalupensis (Sprengel) Magnus	0.2	0.3	0.4
Najas minor Allioni	1.2	2.2	3.4
Nelumbo lutea (Willd.) Pers.	0.8	1.4	2.1
Nuphar advena (Ait.) Ait. f.	0.2	0.3	0.4
Peltandra virginica (L.) Schott & Endlicher	0.2	0.4	0.6
Phragmites australis (Cav.) Trin. ex Steud	0.01	0.1	0.2
Pontederia cordata L.	0.2	0.3	0.4
Potamogeton pusillus L.	0.5	1.0	1.5
Sagittaria latifolia Willd.	0.01	0.1	0.2
Scirpus sp.	0.01	0.1	0.2
Typha latifolia L.	1.1	2.0	3.0
Utricularia vulgaris L.	0.01	0.1	0.2
Vallisneria americana Michx.	ND	ND	ND
Vegetated (any species)	28.1	51.0	76.0
Non-hydrilla cover (any species not hydrilla)	4.1	7.4	11.3
Total species diversity (average species per point)	0.38 (0.02)	0.69 (0.033)	1.03
Native species diversity (average native per point)	0.14 (0.012)	0.24 (0.022)	0.37

HERBICIDE OPTIONS AND APPLICATION TIMINGS FOR WILD CHRYSANTHEMUM (*Artemisia vulgaris* L.) MANAGEMENT IN ORNAMENTAL PLANT PRODUCTION. D.K. Robinson[1], D. Fare[2] and M. Halcomb[3]. [1] Plant Sciences Department, The University of Tennessee, Knoxville; [2] USDA-ARS, McMinnville, TN; [3] U.T. Agricultural Extension Service, McMinnville, TN.

ABSTRACT

Wild chrysanthemum is a clump forming rhizomatous perennial capable of forming solid stands with extensive underground root entanglement. Once established in ornamental plant production systems, especially where post-directed herbicide applications are not possible, physical removal may be the only control option for this weed. Herbicide options and application timings that could be utilized in fallow ornamental production land were evaluated. Initial studies demonstrated that ROUNDUP PRO 4L [(glyphosate) at 2.0 qt./acre], LONTREL 1.5EC [(clopyralid) at 7.5 fl. oz./acre plus non-ionic surfactant (NIS) at 1.0 pt./acre] and ALLY 60WG [(metsulfuron) at 2.0 oz. /acre plus NIS at 1.0 pt./acre] provided varying levels of control of this weed. Two studies where conducted. In the first study, ROUNDUP, LONTREL and ALLY where applied alone and in combinations of ROUNUP + LONTREL, ROUNDUP + ALLY and ROUNDUP + LONTREL + ALLY at three application timings of early-, mid- and late-season. In the second study, ROUNDUP, ROUNDUP + LONTREL, ROUNDUP + ALLY and ROUNDUP + LONTREL + ALLY where applied in multiple applications of early-season, early-season followed by mid-season and early-season followed by mid- and late-season applications. Treatment performance was based on long-term evaluation at the end of the second season after application. The results of the first study demonstrated that a single application of ROUNDUP did not give complete control. A single application of LONTREL applied mid- or late-season gave > 80% long-term control. Combinations of either ROUNDUP + LONTREL or ROUNDUP + ALLY applied mid- or late-season gave > 80% long-term control. Combination of ROUNDUP + LONTREL + ALLY applied mid- or late-season > 90% long-term control. Results of the second study demonstrated that ROUNDUP applied alone either early-season followed by a mid-season application or early- season followed by mid- and late-season applications > 80% long-term control. ROUNDUP + ALLY or ROUNDUP + LONTREL applied early season followed by a mid-season application or early-season followed by mid- and late-season applications gave > 95% long-term control. ROUNDUP + ALLY + LONTREL applied early season followed by a mid-season application or early-season followed by mid- and late-season applications gave > 95% long-term control. Overall, wild chrysanthemum was more sensitive to these herbicides when applied mid- or late-season. Three applications of ROUNDUP alone where required to achieve > 95% long-term control. Two applications of either ROUNDUP + LONTREL or ROUNDUP + ALLY where required to > 95% control.

EFFECT OF MULTIPLE TIMINGS WITH REDUCED RATES OF ARSENAL AND ROUNDUP PRO FOR COGONGRASS [*Imperata cylindrica* (L.) Beauv.] CONTROL. B.S. Peyton, J.D. Byrd, and K.D. Burnell. Department of Plant and Soil Science, Mississippi State University, Mississippi State, MS.

ABSTRACT

Two field studies were conducted during 2002 and 2003 at four locations, in central and southern Mississippi. The objectives of these studies were to determine 1) the effectiveness of sequential glyphosate (Roundup Pro 4L) applications at various rates for cogongrass control and 2) number of applications and years of glyphosate and imazapyr (Arsenal 2 AS) to maintain >50% control. Treatments for test 1 were 3 rates by 4 applications factorial plus a check, arranged in a RCB with three replications. Treatments for test 1 included: 0, 1, 2.5, and 5 qt/A of Roundup Pro 4L applied initially in March at all locations to 36 inch tall cogongrass, then sequentially re-treated at monthly intervals through June. Visual control data were recorded monthly at 30-day intervals until dormancy and presented as days after final application (DAFA). Treatments for test 2 included: 0, 1, 2.5 qt/A, and 2% V/V of glyphosate or imazapyr at 0, 8, 16 oz/A, and 1% V/V. Nonionic surfactant was added to all imazapyr treatments at 0.5% V/V. Initial applications were made to cogongrass at 50% green up in March and April 2003 to foliage 36 to 40 inches tall. Following applications monthly visual ratings were collected and when the average control for a treatment fell below 50%, that treatment was re-sprayed. This continued throughout the growing season to determine the number of applications needed to obtain 50% control and will continue for several years. Treatment design for test 2 was a RCB with 3 replications at each location. All treatments were applied using a CO_2 pressurized backpack equipped with a 4-nozzle boom sprayer delivering 20 GPA with 8002XR nozzle tips.

Averaged results for objective 1 indicated comparable control of 91 to 97% when averaged over rates 30 days after final application (DAFA) between 3, or 4 number of applications (NOA). Averaged over number of applications, 2.5 and 5 qt/A provided similar control of 94 and 97%, while 1 qt/A provided 85% control. Applying 2.5 or 5 qt/A either 3 or 4 times, as well as, 5 qt/A applied 2 times performed similarly with 97 to 99% control. One qt/A applied 3 or 4 times, 2.5 qt/A applied 1 or 2 times, and 5 qt/A applied 1 times provided control from 88 to 95%. By 60 DAFA, when averaged over rates, 2 to 4 applications controlled cogongrass 86 to 90%, respectively, while and 1 NOA application provided only 45% control. The 1, 2.5, and 5 qt/A rates averaged over NOA showed no similarities with 65, 80, and 87% control, respectively. Five qt/A with 3 or 4 NOA provided 93 to 95% control, while 2.5 qt/A with 2 to 4 NOA was comparable to 5 qt/A with 92% control. One qt/A with 2 to 4 NOA were similar with 76 to 86% control.

Control 93 DAFA of 5 qt/A with 2, 3, or 4 NOA provided similar levels of control with 2.5 qt/A of 3 and 4 applications and ranged between 73 and 88%. By the same rating date, no 1 qt/A treatment provided comparable control to 5 qt/A applied 4 times. In addition, 1 qt/A at 4 NOA provided 68% control, while all other 1 qt/A treatments provided less than 45%. When averaged over application timings 93 DAFA, 5 qt/A provided a higher level of control at 71%, than did 2.5 qt/A (58%), or 1 qt/A (38%). Data also suggested that when averaged over rates, 1 application was not adequate for cogongrass control by 93 DAFA, compared to 2, 3, or 4 NOA. However, a higher level of control was obtained with 4 applications (77%) when compared to 2 or 3 applications with 62 or 68%, respectively.

At Hancock County the 8 oz/A rate of imazapyr was re-applied at 55, 82, and 131 days after initial treatment (DAIT). A rate of 1 qt/A glyphosate was re-treated at 55 DAIT. Imazapyr at 16 oz/A was treated 166 DAIT, while a 1% solution was never re-treated after this season. Glyphosate at 2.5 qt/A and 2% were re-treated at 82 and 100 DAIT. Cogongrass in George county was more easily controlled with only 4 re-applications of treatments. Glyphosate at 1

qt/A was treated at 55 DAIT, and 2.5 qt/A and 2% solution were re-treated at 76 DAIT. Imazapyr at 8 oz/A received a second treatment at 82 DAIT.

BIOLOGY AND ECOLOGY OF YELLOW UNICORN-PLANT (*IBICELLA LUTEA*).

C.T. Bryson* and C.H. Koger, USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS 38776; and J.D. Byrd, Jr., Department of Plant and Soil Sciences, Mississippi State University, MS 39762.

ABSTRACT

Yellow unicorn-plant [*Ibicella lutea* (Lindl.) Van Eselt.] [= *Probosidea lutea* (Lindl.) Sapf] is an invasive weed native to Argentina, Brazil, Paraguay, and Uruguay. It is a member of the family Martyniaceae (=Pedaliaceae) and kin to devil's-claw [*Proboscidea Louisiana* (Mill.) Thuellung]. The earliest records of yellow unicorn-plant from the United States are from agricultural fields in the Sacramento and San Joaquin valleys of California over 70 years ago. Yellow unicorn-plant was reported from Florida more than a decade ago. Since 2000, yellow unicorn-plants have been detected at three sites in Mississippi and one location in Georgia. Experiments were conducted at the Southern Weed Science Research Unit Farm at Stoneville, Mississippi during 2001, 2002, and 2003 to evaluate the biology and ecology of yellow unicorn-plant. Seedling plants were started in the greenhouse in March of each year (2001-2003) in 10 cm-diameter pots in a mixture of a Bosket sandy loam (Mollic Hapludalfs) soil and Jiffy Mix at 50/50 v/v and transplanted into the field each year in April. The soil was a Dundee silt loam (fine-silty, mixed thermic Aeric Ochraqualf) soil with pH 6.7, 1% organic matter, a cec of 15 cmol/kg, and soil textural fractions of 26% sand, 56% silt, and 18% clay. Growth (height and width), leaf size, and number of mature fruit were recorded weekly each year. Flowering initiated at the six-leaf stage and continued until frost each year. During the three-year period the largest of yellow unicorn-plant was 5 m wide at frost and had produced 200 pods. Plant height was greatest during mid summer each year and plant width increased during the season until frost (Nov) each year. Maximum leaf size seemed to be dependent on environmental conditions, with largest leaves produced during periods of adequate moisture, while smaller leaves were produced during periods of drought each year. The nearly oval leaves averaged 14 to18 cm in diameter. Yellow unicorn-plants produced an average of 147 pods per plant, and the pods, including the horned beaks, were 11 to 21 cm long and averaged 110 seed per pod. Yellow unicorn-plant seeds were oblong, 0.6 to 0.9 cm long, 0.4 to 0.5 cm wide, and covered by a black rough seed coat. Because the seed coat texture and color are similar to rat pellets, yellow unicorn-plant seed could be easily overlooked in crop seeds and may be one of the pathways of spread. Based on our observations and field research, yellow unicorn-plant has the potential to become a serious weed problem in row crops, pastures, clear-cut forested, and open natural areas in the southern United States. The size and habit of this species suggest that yellow unicorn-plant may be very competitive with forages and row crops. Early detection and effective control methods are essential to prevent additional yellow unicorn-plant establishment and spread in the southern United States.

PHENOLOGICAL MODELING OF FLOWER ONSET IN COGONGRASS [*Imperata cylindrica* (L.) Beauv.]. K.D. Burnell, J.D. Byrd, Jr., K.R. Reddy, and P.D. Meints. Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Knowledge of how crops, weeds, grasses develop morphologically is essential in their management. Systems have been developed for quantifying the developmental stages of cool and warm-season grasses. A common goal of these studies has been to develop quantitative relationships between developmental stage and time, whether measured in days or thermal time (degree days). A growth staging system based on growing degree days (GGD) for cogongrass would lend valuable data for cogongrass management and would allow producers and managers to be more effective and efficient with management tactics, such as, eliminating seedhead production.

Close association between developmental morphology and day of year or growing degree-days GDD (base = 10˚C) of switchgrass (*Panicum virgatum* L.) has been reported. Eliminating seedhead production is possible when treatments are applied at specific growth stages based on that defined growth stage model, but as of yet there is not a growth staging system for cogongrass, an important invasive weed in the southeast U.S. For this reason, the objectives of this study were: 1) to determine optimum germination rates of cogongrass in Mississippi, 2) determine the cardinal temperature requirements for cogongrass in Mississippi, and 3) develop a GGD system to model cogongrass growth through flowering comparing phenological stages of three regions of Mississippi based on cardinal temperature determination parameters.

For the development of a GDD model, information such as the cardinal temperatures (T_{min}, T_{opt}, and T_{max}) for that species is needed. Cardinal temperatures were derived by determining optimum germination rate over a various temperature range (10 to 40°C). A modified bi-linear model in SAS determined the T_{opt} to be 29.8ºC. Values for T_{min} and T_{max} were estimated using equations 1 and 2, along with data produced from PROC NLIN SAS output that determined the constants (a, b_1, and b_2) and T_{opt}. Once this information (a, b_1, b_2, and T_{opt}) is determined GDD were calculated using equation 3, with a T_{base} of 10.6°C where T_{max} + T_{min} are the maximum and minimum daily air temperatures and T_{base} is calculated minimum temperature need for growth of the organism.

Equation 1. $T_{min/base} = a + (b_2 - b_1) \times T_{opt} / b_1 - b_2$ and

Equation 2. $T_{max} = a - (b_2 - b_1) \times T_{opt} / b_1 - b_2$

where; a (102.5) + b_2 (-1.1084) - b_1 (-6.456) and T_{opt}= 29.78 ºC from SAS.

Equation 3. $GDD = (T_{max} + T_{min})/2 - T_{base}$

Once the parameters were determined, the numbers of accumulative GDD needed to reach that specific stage were compared with observed values based on observed phenological data (joint, boot, seedhead emergence, so on) according to Haun's growth scale. Visual data were taken from March 1 through seedhead release in late May for North (Starkville), Central (Preston), and Southern (Hurley) Mississippi sites.

Results of these experiments indicate that the maximum germination rate was 93% at 30°C, while the cardinal temperatures were $T_{min/base}$ =10.6, T_{opt} =29.8, and T_{max} =43.3°C. Data suggest that using a T_{base} =10.6°C, flag leaf extension needed 293 GGD (4/4/03) at Starkville, compared to 230 GDD (3/27/03) at Hurley (southern), MS. The number of GDD need for anthesis to start ranged from 591 (4/28/03) Starkville to 482 (4/17/03) at Hurley. Flowering was competed at

Starkville when 745 GDD (5/05/03) units were accumulated, compared to 605 GGD (4/25/03). Lastly, seedheads were fully developed and ready to release by 967 GGD (5/15/03) at Starkville compared to 708 GGD (5/1/03) at Hurley, indicating that most growth stages vary 10 to 14 days between northern and southern Mississippi. From these data, management decisions and recommendations can be made to producers regardless of location within the state at a more defined time and specific growth stage, based on a GGD. Overall, data shown here will allow for more efficient use of management tactics throughout the state and other areas that have cogongrass.

GENETIC STRUCTURE OF COGONGRASS (*Imperata cylindrica*) POPULATIONS.

L.J.A. Capo-chichi[1], W. Faircloth[1], A. Williamson[1], M. Patterson[1], J.H. Miller[2], and E. van Santen[1]. [1] Department of Agronomy and Soils, Auburn University, Auburn. [2] USDA Forest Service, Southern Research Station, Auburn University, Auburn.

ABSTRACT

Cogongrass (*Imperata cylindrica*), native to southeastern Asia and an invasive weed with no known value, has made its way across the southern United States. Worldwide it has infested more than 500 million hectares, about 100,000 hectares in Alabama, Florida, and Mississippi. Cogongrass has numerous attributes that contribute to its extremely invasive nature, posing serious threat to agriculture, forestry, and wildlife. Understanding the population biology of the invasive species cogongrass is a key factor for a successful control measures that should be implemented to retard the growth and spread of this noxious weed. The objective was to assess the genetic variation within *Imperata cylindrica* at the molecular level. We used the most recent NRCS inventory of invasive species to collect cogongrass accessions in Alabama, radiating in all cardinal directions from the putative introduction point near the city of Grand Bay. Approximately 20 genets and/or ramets were sampled from each geo-referenced site. The amplify fragment length polymorphism (AFLP) were used to probe molecular variation among the accessions collected. Genetic distance between populations varied. Within populations, polymorphic markers varied from 27 (19.7%) to 80 (58.4%). Such levels of variation may imply that local sites are often colonized by several propagules (most likely by seeds and/or vegetative reproduction). The first three principal coordinate axes explained 88% of the total variation. Genetic identity among populations was estimated to be greater than 0.85.

SOIL PERSISTANCE OF RESIDUAL HERBICIDES FOR BARE-GROUND VERSES POLYETHYLENE MULCH CONDITIONS. T.L. Grey*, A.S. Culpepper*, N. Mantripagada*, & T.M. Webster**. Department of Crop and Soil Sciences*, University of Georgia and USDA/ARS**, Coastal Plain Experiment Station, 115 Coastal Way, Tifton, GA 31794.

ABSTRACT

Herbicides for weed control in vegetable production have become more important to producers as the elimination of methyl-bromide is inevitable. Yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*C. rotundus*) continue to be common and troublesome vegetable weeds throughout the southern US. There are different environmental conditions that exist under polyethylene mulch, especially temperature and moisture regimes, which can affect both herbicide degradation and nutsedge growth and reproduction. Thus, herbicides applied to bare-ground verses polyethylene mulch situations could vary with respect to activity and degradation. Metolachlor, halosulfuron, and sulfentrazone have different soil residual potentials and each provide nutsedge control. The objectives of this study were to determine the effect of polyethylene mulch on dissipation of these herbicides.

A field study was initiated in 2003 to compare herbicide dissipation in bare-ground verses polyethylene mulch environments on a Tifton sandy loam soil. Soil was treated with methyl-bromide followed by application of 1.25 mil, low density polyethylene mulch. After removal of the mulch, the entire length of each plot was then treated with the appropriate herbicide using a backpack sprayer. Half of each plot was then recovered. Experimental design was a randomized complete block with treatments arranged as a split plot with four replications. Soil sampling dates were 1, 24, 48, 336, 648, and 1344 hr after treatment (HAT) to 15 cm. Data taken included analysis of soil samples via liquid chromatography in tandem with mass-spectrometry.

Metolachlor concentration was 846 verses 569 ug/kg for the bare soil and polyethylene mulch systems, respectively. This variation in concentration was attributed to the covering of soil with the polyethylene mulch which may have removed part of the metolachlor via plastic-soil contact. No attempt was made to evaluate the polyethylene potential for metolachlor adsorption. However, 24 HAT the concentration of metolachlor for the bare soil and polyethylene mulch systems were equivalent. This trend continued throughout the course of the study and there were no differences between bare soil and polyethylene mulch dissipation of metolachlor. Metolachor dissipation was rapid with none detected for either system at 648 HAT.

Initial halosulfuron concentration was 18.6 and 17.7 ug/kg for the bare soil and polyethylene mulch systems, respectively. Twenty four HAT, halosulfuron dissipation was different for the two systems. For the polyethylene mulch, halosulfuron concentration remained consistent to the initial. However, bare soil concentration of halosulfuron dropped to 3.9 ug/kg soil. At 48 and 336 HAT halosulfuron concentration for bare soil was 3.6 and 1.7 ug/kg of soil, respectively. For this same time frame, polyethylene mulch halosulfuron concentration was 10.4 and 3.0 ug/kg of soil, respectively. These data indicate that polyethylene mulch did decrease the rate of dissipation of halosulfuron verses bare soil. Under polyethylene mulch, the herbicidal activity for halosulfuron should be extended.

Initial sulfentrazone concentration was 260 and 215 ug/kg for the bare soil and polyethylene mulch systems, respectively. After 24 hours, sulfentrazone dissipation was different for the two systems. For the polyethylene mulch, sulfentrazone concentration remained consistent to the initial level. However, bare soil concentration of sulfentrazone had decreased to 100 ug/kg soil. At 48 HAT the concentration of sulfentrazone remained consistent, but different, at 174 and 100 ug/kg of soil for the bare soil and polyethylene mulch, respectively. By 336, 648, and 1344 HAT, sulfentrazone on bare soil treatment continued to decline. This dissipation was attributed to further microbial breakdown and from rainfall. Under the polyethylene mulch for this same

time frame, sulfentrazone concentration remained constant at approximately 50 ug/kg of soil. These data indicate that plastic mulch did decrease the rate of dissipation of sulfentrazone verses bare soil and that under plastic mulch, the herbicidal activity for sulfentrazone should be extended verses bare soil application.

BIOCONTROL OF KUDZU (*pueraria lobata*) IS SYNERGIZED BY GLYPHOSATE INTERACTION. C.D. Boyette* and R.E. Hoagland, USDA-ARS, Southern Weed Science Research Unit, Stoneville, Mississippi.

ABSTRACT

Emulsified formulations of the bioherbicidal fungus *Myrothecium verrucaria* (Alb. & Schwein.) Ditmar:Fr. were tested alone, in combination with, prior to, and following treatment with glyphosate for control of kudzu (*Pueraria lobata* [(Willd.) Ohwii] under field conditions in naturally-infested sites near Lexington, MS in the summers of 2000 and 2001. Maximum mortality (92% and 96%, respectively) occurred 4 DAT when the fungal treatments were tank mixed or applied following glyphosate (Touchdown) treatment at recommended application rates (5 lb ai/gal). However, similar levels of control (89% and 93%, respectively) were achieved when herbicide rates were reduced to 0.1x field rates (0.5 lb ai/gal) when used in conjunction with the bioherbicide at inoculum rates of 1 x 10^7 spores/ml. Even at 0.1x inoculum rates (1 x 10^6 spores/ml) weeds were controlled 83% and 86%. Treated weeds exhibited disease symptomatology within 12 hours following treatment. Disease symptomatology was characterized by necrotic flecking on leaves that coalesced into large lesions. Symptoms progressed from infected cotyledons and leaves to produce stem lesions within 48 h. The fungus sporulated profusely on infected tissue and was readily reisolated. These results suggest that it may be possible to use combinations of glyphosate to improve the bioherbicidal control potential and reduce herbicide and inoculum requirements of *M. verrucaria* for controlling kudzu.

PHYSIOLOGICAL ASPECTS OF FLURIDONE TOLERANT HYDRILLA IN FLORIDA.

A. Puri, G.E. MacDonald, and W.T. Haller; Department of Agronomy, University of Florida, Gainesville, FL.

ABSTRACT

The management of the invasive aquatic plant hydrilla in Florida relies on the use of the carotenoid inhibiting herbicide fluridone. Hydrilla is usually controlled (since 1980) for a year or longer by single applications of fluridone at 6-12 parts per billion (ppb) at a cost of usually less than $100/acre. Recently, aquatic plant managers in Florida began to observe populations of hydrilla that were not being controlled by previously lethal doses of fluridone. This was totally unexpected, given the asexual nature of hydrilla infestations in Florida and the southeast. Investigating this unexplained phenomenon of fluridone tolerance is the main objective of this research. Experiments were conducted under laboratory and green house conditions to monitor changes in pigment levels (phytoene and β carotene) as a function of population and fluridone treatment. Herbicides with similar modes of action as fluridone were also included. Phenotypic studies were also performed to assess differences in biomass and turion development. There was high degree of variability in phytoene: β carotene ratio in susceptible and tolerant hydrilla populations with respect to fluridone and other herbicides. In addition, there was little correlation between tolerant/susceptible populations and turion development and plant biomass. Research is ongoing to further characterize fluridone tolerant hydrilla.

EFFECT OF ORGANOPHOSPHATE INSECTICIDE ON SWEETPOTATO TOLERANCE TO HALOSULFURON. S.T. Kelly, J.M. Cannon, M.W. Shankle, T.F. Garrett and J.L. Main. LSU AgCenter, Winnsboro, LA and Pontotoc Ridge-Flatwoods Branch Experiment Station, Mississippi State University, Pontotoc, MS.

ABSTRACT

An experiment was initiated at Wisner, LA and Pontotoc, MS to determine if organophosphate insecticides influence 'Bearegard' sweetpotato (*Ipomoea batatus*) injury with Sandea (halosulfuron). Sweetpotato vine cuttings were mechanically transplanted at the Wisner location on June 2, 2003 and at the Pontotoc location on July 2, 2003. Experimental design was a factorial arrangement of treatments in a randomized complete block with four replications. Factor A was insecticide: Lorsban (2 pt/A), Mocap (3 lb/A) and Capture (20 oz/A), a pyrethroid included as a comparison. Factor B was Sandea rate: 0.25, 0.5 or 1.0 oz/A, and Factor C was application timing: 21, 28 or 42 days after transplanting (DATR). All insecticides were incorporated by double disking 2 weeks prior to transplanting. ANOVA was conducted and means separated using Fisher's Protected LSD at the 5% level of significance. Sandea was applied in combination with 0.5% (v/v) non-ionic surfactant in 20 gallons per acre (gpa) using a CO_2-powered backpack sprayer. The plot areas were treated with Command (2 pt/A) after transplanting. Weeds present at the Wisner location included yellow nutsedge (*Cyperus rotundus*) and a pigweed (*Amaranthus* spp.) mixture. Yellow nutsedge was also present at the Pontotoc location.

At the Wisner location, no interaction was observed between Sandea and the OP insecticides used in this experiment. Further analysis indicated that sweetpotato injury was influenced by Sandea rate and application timing. When compared to untreated plots at 29 days after treatment (DAT), Sandea applied at 21 DATR caused greater injury than that applied at 28 DATR. However, injury was transient and was 14% or less by 45 DAT. When applied at 42 DATR, 4% or less injury was observed. Injury was generally in the form of yellowing of the foliage. Pigweed control was not influenced by Sandea rate, that is, any rate used controlled pigweed equally within each evaluation time. However, application time did impact pigweed control. When evaluated 29 DAT, greatest pigweed control was observed with Sandea applied 21 DATR. However, at 45 or 63 DAT, Sandea applied 28 DATR controlled pigweed greatest. An interaction was observed between Sandea rate and application timing for yellow nutsedge control. Few consistent differences were observed between rates within application timing at 29 or 45 DAT. By 63 DAT, Sandea applied at 21 or 28 DATR controlled yellow nutsedge greater than when applied at 42 DATR. Control was largely a function of weed size at the later application timing. At this time, yellow nutsedge was fairly large and extended well above the sweetpotato canopy. Sandea application timing had the greatest influence on sweetpotato yield. Greatest yield of ones & twos and jumbos was observed when Sandea was applied at 28 DATR. Canner yield was greatest in those plots receiving Sandea at 21 or 42 DATR. Greatest total yield was with Sandea applied at 28 DATR. When comparing jumbo yield, it appears that applying Sandea early or late, may be delaying crop maturity. Although less foliar injury is observed when applications are made at later timings (42 days or later), these data suggest that yield is being reduced.

At the Pontotoc location, plant injury was at least 26% with Sandea at 1 WAT. At 2 WAT, plant injury was 13, 18, and 23% with Sandea at 0.50, 0.66 and 1.00 oz/A, respectively. This suggests that there is a rate effect for Sandea with respect to plant injury. This rate effect was illustrated again at 3 WAT with 13% plant injury for Sandea at 1 oz/ac compare to 9% and less for the lower rates. Yellow nutsedge control was at least 90% with any rate of Sandea. Application time was evaluated for plant injury and weed control. Plant injury at 1 WAT was 15% for treatments applied at 42 DATR compared to 35 and 33% with 21 or 28 DATR applications. Reduced injury with Sandea applied 42 DATR may be related to growth stage since this is during the late phase of root initiation (4 to 6 WATR). At 3 WAT, injury was less for Sandea applied at

28 DATR compared to 21 DATR. Yellow nutsedge control was greatest at any evaluation date if Sandea was applied at 28 DATR.

The main effects of insecticide type indicated no differences in plant injury among treatments containing Lorsban, Lorsban plus Mocap, or Capture. This suggests that there is no interaction with OP insecticides and Sandea with respect to plant injury. These preliminary results indicate that OP insecticides Lorsban and Mocap may be used in conjunction with Sandea at the rates and application timings evaluated in this experiment without adverse effects to sweetpotato.

There were no differences among US No. 1 yield across application time, Sandea rate, or insecticide. Total marketable yield ranged from 385 to 441 boxes/A and was not different with respect to Sandea rate. Total marketable yield was not different for Sandea applied at 28 or 42 DATR. However, total marketable yield was greater when Sandea was applied at 42 DATR compared to 21 DATR. The OP insecticide treatments were not different with respect to total marketable yield. However, total marketable yield with Lorsban was greater than with Capture.

EFFECT OF SWEETPOTATO CUTTING AGE ON TOLERANCE TO VALOR. C.L. Pinnell-Alison, S.T. Kelly, M.W. Shankle and J.L. Main. LSU AgCenter, Winnsboro, LA and Pontotoc Ridge-Flatwoods Branch Experiment Station, Mississippi State University, Pontotoc, MS.

ABSTRACT

Since vine cutting practices vary among sweetpotato producers, experiments were initiated to determine how long sweetpotato cuttings can be held prior to transplanting and treatment with Valor. Many producers prefer to use fresh cuttings (< two days old), while some producers may use older cuttings that have begun to form lateral roots. Previous research has been conducted evaluating Valor using fresh cuttings. Two experiments were initiated to determine if cutting age influences crop injury with Valor.

At the Wisner, LA location, 'Beauregard' B-14 sweetpotato (*Ipomoea batatus*) vine cuttings were taken daily for five days and held in a cool, light-free environment until planting on June 24, 2003 using a mechanical transplanter. Soil type was a silt loam that is representative of the soils on which sweetpotato are commonly grown. Valor (1, 2 or 3 oz/A) was applied immediately after planting in 20 gpa using a CO_2-powered backpack sprayer in combination with 2 pt/A Command. Experimental design was a randomized complete block with a factorial arrangement of treatments with four replications. Factor A consisted of vine cutting holding time (0, 1, 2, 3, or 4 days) and Factor B was Valor rate. Preplant fertility included an application of N-P-K (45-120-120 lb/A). Sweetpotato injury was evaluated at 7 and 23 days after treatment (DAT), and vigor evaluated at 23 and 41 DAT. Yields were taken at 122 DAT. Vines were mechanically removed and sweetpotato were removed from the soil using a PTO operated one-row digger. Roots were then graded according to USDA standards and separated into 3 grades: ones and twos, canners, and jumbos. ANOVA indicated no interaction of cutting age with Valor. Data was analyzed by Valor rate or holding time. Means were separated at the 5% level of significance using Fisher's Protected LSD.

A similar experiment was also conducted near Pontotoc, MS on a silt loam soil. Experimental design and treatments were as previously mentioned. Sweetpotato cuttings ('Beauregard' B-63) were taken on July 7 and planted daily for five days rather than being held for five days with one planting date as at the Louisiana location. Preplant fertilizer was applied according to Mississippi State Soil Testing Lab recommendations. Valor was applied prior to planting (June 26) with Command (2 pt/A) applied on July 2. Visual injury was evaluated at one, two, or three weeks after treatment. ANOVA was conducted and means separated as previously described.

At the Wisner, LA location, injury at 7DAT was 22 to 26% with any Valor rate. By 23 DAP, no injury was observed. Plant vigor was greatest with 1 oz/A Valor at 23 DAT, however, no differences in vigor were observed by 41 DAT. No differences in yield were observed among any of the parameters measured, whether averaged over Valor rate or holding time. This suggests that although early injury and reduced vigor were observed, sweetpotato yield was not reduced.

At the Pontotoc, MS location, plant injury was less than 10% across all treatments at 1 week after initial transplant (WAP). No injury was observed for cuttings held 0 days with any rate of of Valor at 1 WAP. Injury was highest with cuttings held for 4 days. Plant injury for Valor at 1, 2, and 3 oz/A applied to cuttings held 4 days was 8, 7, and 8%, respectively. Therefore, there was not a rate response with respect to plant injury. This injury was possibly due to poor plant health after being held for 4 days, or earlier transplants were more vigorous at the 1 WAP rating time. In addition, there was no injury observed for any treatment at the 2 and 3 WAP rating time.

EFFECT OF CULTIVATION ON VALOR EFFICACY IN SWEETPOTATO. R.S. Taylor, M.W. Shankle, S.T. Kelly, and J.L. Main; Mississippi State University, Pontotoc Ridge-Flatwoods Branch Experiment station, Pontotoc, MS 38863, and LSU AgCenter, Winnsboro LA, 71295.

ABSTRACT

Currently, an effective broadleaf herbicide is not labeled for use in 'Beauregard' sweetpotato (*Ipomoea batatas*). Many producers rely on clomazone, cultivation, and a graminicide for weed control management. Since this management strategy primarily controls the grass spectrum, there has been a species shift to an abundance of pigweed (*Amaranthus* spp.), morningglory (*Ipomoea* spp.) and other problematic broadleaf weeds. Flumioxazin is currently labeled for broadleaf weed control in cotton, peanuts, soybean, and sugarcane. Therefore, research was conducted in 2003 at Pontotoc County, Mississippi on Ferguson Farms to determine the effect of Valor 51 WDG (flumioxazin) rate and cultivation timing on entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula)* control and sweetpotato yield grade yields.

Sweetpotatoes were produced in a conventional tilled, non-irrigated environment in the hills of Mississippi. Ground was disked, bedded, and beds were rolled prior to transplanting. The two-factor factorial experiment design was a RCB with 4 replications. Plot size was three rows 7.62 m in length. Treatment factors were flumioxazin at 0.036, 0.072, and 0.108 kg ai/ha applied pre-transplant (PRE) to crop and weed emergence and cultivation timings of 1, 2, 3, and 4 weeks after transplant (WAP). A no cultivation treatment was also applied across flumioxazin rates. Fertilizer was applied PRE incorporated according to soil test recommendations on April 29, 2003. 'Beauregard-B63' strain sweetpotato slips were transplanted in 1 m rows on July 2, 2003. Planting rate was 1 plant per 30 cm. A CO_2 tractor mounted sprayer was used to apply flumioxazin treatments. Boom was 3 m in length, equipped with 11015 FF nozzles spaced 37.5 cm apart. Plots were cultivated with a rolling cultivator. Visual observations of morningglory control were made 1 and 2 weeks after each cultivation treatment (WAC). The center row of each 3-row plot was harvested 108 days after transplant (DAT) on October 18, 2003. Sweetpotatoes were graded to determine US No.1, Canners, Culls, and Jumbo yields and reported as number of 18.18 kg boxes/ha. Total marketable yield (Totmkt) was recorded as the sum of US No.1, Canners, and Jumbo grade yields. Analysis of Variance was conducted and means were separated using Fisher's protected LSD (α=0.05).

The main effects of cultivation time were evaluated for entireleaf morningglory control and sweetpotato yield. At 1 WAC, morningglory control was 94, 92, and 87% for cultivation at 1, 2, and 3 WAP, respectively. These treatments were different from the 4 WAP and the no cultivation across flumioxazin treatments. At 2 WAC, morningglory control with cultivation at 1, 2, and 3 WAP was still greater than the no cultivation of flumioxazin treatment. The highest morningglory control was 91% with cultivation at 1 and 2 WAP with no difference from 3 WAP. US No. 1 grade yield ranged from 123 to 778 boxes/ha for no cultivation and cultivation at 3 WAP, respectively. The US No. 1 grade yield with cultivation at 1, 2, and 3 WAP was greater than the 4 WAP and no cultivation across flumioxazin treatments. Total marketable yield was highest for the 1 and 2 WAP treatments, which both yielded 1308 boxes/ha with no difference from 3 WAP cultivation. These treatments were different from the 4 WAP and no cultivation treatments, which yielded 850 and 488 boxes/ha, respectively.

The main effects of flumioxazin rate were evaluated for entireleaf morningglory control and sweetpotato grade yield. At 1 WAC, flumioxazin at 0.108 kg ai/ha controlled morningglory 88% and was greater than the 0.036 and 0.072 kg ai/ha rates of 76 and 80%, respectively. Observations at 2 WAC indicated similar results. US No. 1 grade yield ranged from 453 to 655 boxes/ha. US No. 1 and total marketable grade yields with flumioxazin at 0.108 kg ai/ha was greater than flumioxazin at 0.036 kg ai/ha, but not different than flumioxazin at 0.072 kg ai/ha.

Preliminary research results indicate that flumioxazin is an effective herbicide for control of entireleaf morningglory in sweetpotato production without adverse affects on yield grades. Data analyses indicate that cultivation at 1, 2, and 3 WAP is most efficient with flumioxazin at 0.072 and 0.108 kg ai/ha applied PRE, based on yield. Therefore, the appropriate treatment combinations could be flumioxazin at 0.072 kg ai/ha followed by cultivation at 2 WAP or flumioxazin at 0.108 kg ai/ha followed by cultivation at 3 WAP. By applying the high rate of flumioxazin (0.108 kg ai/ha), there should be more residual control; hence cultivation practices could be performed a week later.

SESAME (*SESAMUM INDICUM L.)* RESPONSE TO SELECTED POSTEMERGENCE HERBICIDES. W.J. Grichar, B.A. Besler, A.J. Jaks, and R. Langham; Texas Agricultural Experiment Station, Beeville, TX 78102 and Sesaco Corp., San Antonio, TX 78230.

ABSTRACT

Sesame acreage has slowly increased in Texas and Oklahoma over the past 3 to 4 years. Because of the slow growth of sesame, early season weed suppression is critical. The use of postemergence (POST) herbicides can be helpful in reducing early-season weed competition. Little is known regarding sesame tolerance to POST herbicides. Field studies were conducted near Batesville,Tx in 2003 to determine the effect of various POST herbicides on sesame tolerance and recovery. Eleven classes of herbicides were evaluated. Diphenylethers included Cobra at 6.25 and 12.5 fl oz/A, Ultra Blazer at 1.0 and 1.5 pt/A, and Reflex at 0.75 and 1.5 pt/A. Triazine herbicides included Caparol at 1.0 and 2.0 qt/A and Atrazine at 0.5 and 1.0 qt/A. Imidiazolinones included Pursuit and Cadre at 0.72 and 1.44 oz/A. The benzoic acid herbicide class included Clarity at 8.0 and 16.0 fl oz/A while the triazolopyrimidine sulfonanilde herbicide included Strongarm at 0.3 and 0.45 oz/A. The cyclohexanedione class included Select at 8.0 and 16.0 fl oz/A while the benzonitrile class included Buctril at 1.0 and 2.0 pt/A. The glycine herbicide included Roundup at 0.8 and 1.6 pt/A. The phenoxy herbicide class was Butyrac at 0.5 and 1.0 pt/A while the triketone herbicide included Callisto at 1.5 and 3.0 oz/A. Sulfonylurea herbicides included Accent, Exceed, and Peak at 0.5 and 1.0 oz/A, Matrix at 0.75 and 1.5 oz/A, Classic at 0.35 and 0.7 oz/A, and Envoke at 0.032 and 0.064 oz/A. All herbicide treatments except Roundup included a crop oil concentrate (Agridex) at 1.0 qt/A. Nine different sesame cultivars were planted May 15 and POST herbicide applications were made June 19 when sesame was approximately 20 inches tall. Herbicides were applied broadcast with a hand-held boom which delivered 20 gpa at 28 psi. The test design was a randomized complete block with 3 replications. Plot size was 3 rows by 13.5 ft long. Sesame stunting evaluations (0=no plant stunting to 100=complete plant death) were taken throughout the growing season. Although nine cultivars were sprayed, data presented reflects only tolerance to the commonly grown commercial variety, Sesaco 26.

Most herbicides caused significant sesame stunting when compared with the untreated check. Select caused no sesame injury. Sesame displayed better tolerance to Cobra, Ultra Blazer, and Reflex when applied at reduced rates. However, at these reduced rates, plant stunting was as high as 25%. All sulfonylurea herbicides severely reduced plant growth throughout the growing season. Sesame plant growth did begin to recover with the reduced rate of Classic when evaluated late season. Sesame stunting was low when the reduced rate of Buctril was applied. Butyrac, Strongarm, and Callisto at both the reduced and the full rate stunted sesame growth at least 40%. Among the imidazolinone herbicides, Cadre reduced plant growth greater than Pursuit at the reduced and full rate. Sesame displayed no tolerance to Roundup Ultra at either rate. Caparol, a triazine herbicide, did not severely stunt sesame when applied at the reduced rates, whereas Atrazine stunted plant growth at least 30% at the reduced and full rates. Clarity severely stunted plant growth at both rates.

This study revealed that sesame is very sensitive to many POST herbicides even at reduced rates. Some herbicides, when applied at reduced rates, did not severely impact plant growth. However, further studies should be conducted to assess plant growth and weed control when reduced rates are used.

SHIKIMATE ACCUMULATION IN CONVENTIONAL CORN AND SOYBEAN AS AFFECTED BY SUB-LETAHL RATES OF GLYPHOSATE. C.H. Koger, W.B. Henry, and D.L. Shaner. USDA-ARS, Southern Weed Science Research Unit, Stoneville MS, Central Great Plains Research Unit, Akron CO, and Water Management Unit, Fort Collins CO.

ABSTRACT

Shikimate, a constituent of aromatic amino acid biosynthesis in plants, often accumulates in non-glyphosate-resistant plants after glyphosate competitively inhibits the enzyme 5-enolypyruvylshikimate-3-phosphate synthase (EPSPS) enzyme. Thus, a non-destructive assay for monitoring shikimate levels may be a useful method for determining the extent of physiological injury to non-glyphosate-resistant plants after treating with sub-lethal rates of glyphosate. A leaf-disc assay was evaluated to measure shikimate accumulation in conventional corn and soybean following glyphosate application.

This research was conducted at Stoneville, MS; Akron, CO; and Fort Collins, CO during the summer of 2003. Conventional corn and soybean and glyphosate resistant corn and soybean were planted sequentially at each location so that effect of growth stage on shikimate accumulation/detection could be evaluated. Glyphosate, (Roundup Weathermax), at 55, 218, and 873 g ae ha^{-1} was applied to 6- to 7-leaf and 9- to 10-leaf corn and to 2- to 3-leaf and 6- to 7-leaf soybean, respectively. Whole plant injury was visually estimated at 1, 4, 7, 14, and 21 d after treatment (DAT). Twelve leaf discs were collected from each of the two youngest leaves of each of each plant type at 1, 4, 7, 14, and 21 days after treatment DAT. The amount of shikimate in leaf discs was measured spectrophotometrically at an optical density of 380.

Injury to conventional crops became apparent by 4 DAT and increased linearly between 4 and 14 DAT and with increasing glyphosate rate. Increasing glyphosate rate from 55 to 873 g ha^{-1} resulted in injury ratings of 5 to 44% at 4 DAT and 2 to 81% at 14 DAT. Shikimate levels were similar in treated and nontreated plants at 1 DAT. Increased shikimate levels when compared to nontreated were detected in conventional soybean at 4 to 7 days after application and in conventional corn at 7 to 14 days when treated with 218 and 873 g ae ha^{-1} glyphosate. By 14 DAT, shikimate levels returned to background detection levels in plants treated with 218 g ha^{-1} as plants recovered from herbicide injury. Shikimate levels in the glyphosate resistant crops were similar to levels in nontreated plants. To use this assay as a measure of physiological response of non-glyphosate-resistant crops to drift rates of glyphosate, one would have to collect samples immediately following appearance of injury symptoms.

EFFECT OF DRILL-SEEDED SOYBEAN AND TILLAGE ON EMERGENCE OF PITTED MORNINGGLORY AND SICKLEPOD FOLLOWING ONE YEAR'S SEED RAIN. M.J. Oliveira and J.K. Norsworthy; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC.

ABSTRACT

An understanding of temporal weed emergence is critical to development of ecologically-based weed management practices. While past studies have characterized temporal emergence, few have determined the extent that crop presence influences emergence periodicity. We hypothesized that temporal emergence would be influenced by soybean compared to bare soil. The objective of this research was to characterize pitted morningglory and sicklepod temporal emergence as affected by tillage and crop presence. Emergence was enumerated throughout 2003, and environmental conditions monitored. Initial emergence occurred on April 4 and continued through November 4. In the absence of tillage, weed emergence prior to soybean planting was minimal. Cumulative emergence of both species in no-till systems increased rapidly following crop canopy formation. In tilled treatments, pitted morningglory emergence throughout the season was similar regardless of soybean presence or absence. Sicklepod emergence in tilled soybean plots was 14% less than in tilled plots without soybean. Emergence models using a Gompertz function that incorporate growing degree days (Tb = 10 C) and a soil moisture threshold (100 kPa) were used to predict emergence with high accuracy. Parameter estimates generally differed among treatments, indicating a single model was not adequate over various tillage systems. This research demonstrates pitted morningglory and sicklepod emergence are influenced by crop canopy formation and emergence can actually be promoted by crop presence.

MANAGING ANNUAL GRASS POPULATIONS IN EARLY-MATURING MISSISSIPPI SOYBEAN.

B.L. Spinks[1], D.H. Poston[2], and C.H. Koger[3]. [1]Plant and Soil Science Department, Mississippi State University, Mississippi State, MS 39762; [2]Delta Research and Extension Center, Stoneville, MS 38776; and [3]USDA-ARS Southern Weed Science Research Unit, Stoneville, MS 38776.

ABSTRACT

Widespread adoption of the Early Soybean Production System (ESPS) has occurred in Mississippi. With the ESPS, MG IV and V soybeans are planted in April in an effort to avoid seasonal drought and maximize yield. Early-planted soybean emerges before most summer annual weeds and therefore have a competitive advantage over weeds that emerge several weeks after planting. However, many early-planted soybean are harvested in August when there is a risk of weed resurgence during the period of soybean senescence, especially during periods of ample rainfall. Resurgence can be the result of newly germinating weeds or the recovery of weeds that have been suppressed by the soybean canopy. In many early-planted glyphosate-resistant soybean fields throughout the Mississippi delta, annual grasses have become especially problematic and appear to have become the predominant weed species indicating a potential weed shift from once problematic broadleaf weeds to annual grasses. Glyphosate provides excellent control of most annual grasses but offers no residual activity to control grasses that emerge later in the growing season.

Field studies were conducted in 2002 and 2003 at the Delta Research and Extension Center in Stoneville, MS on a Dundee silt loam soil to evaluate the impact of postemergence metolachlor, tillage, and row spacing on late-season annual grass infestations in early-maturing soybean grown in the Mississippi delta. The test area was naturally infested with barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] and browntop millet [*Brachiaria ramosa* (L.) Stapaf] and was also seeded with broadleaf signalgrass [*Brachiaria platyphylla* (Griseb.) Nash] and barnyardgrass seed to ensure uniformity across plots and to add one additional grass species. Plots were 3 x 12 m and arranged in a randomized complete block experimental design with a split-split plot treatment arrangement (herbicide treatment x tillage treatment x row spacing). Tilled and non-tilled plots were established in the test area. Row spacings were 38 and 76 cm. Tilled plots were disked once and field cultivated and non-tilled plots were treated with 1.12 kg/ha glyphosate prior to planting. DK3961RR soybean was planted April 25, 2002 and AG 4403 was planted April 2, 2003. All plots were treated postemergence (POST) with 1.12 kg/ha glyphosate in the form of the isopropylamine salt May 14, 2002. Non-treated controls received no post application of glyphosate in 2003. Annual grass density determined prior to this application in 2002 and 2003 were approximately 63 plants/m^2 and 19 plants/m^2, respectively. Follow-up POST herbicide treatments applied June 3, 2002 and May 12, 2003 were: 1) no sequential glyphosate application (2002) and non-treated control (2003), 2) 0.84 kg/ha glyphosate, 3) 0.84 kg/ha glyphosate + 1.8 kg/ha *s*-metolachlor, 4) 0.84 kg/ha glyphosate + 1.3 kg/ha *s*-metolachlor, 5) 0.84 kg/ha glyphosate + 0.9 kg/ha *s*-metolachlor, and 6) 0.84 kg/ha glyphosate + 0.4 kg/ha *s*-metolachlor. Annual grass density at the time of follow-up treatments was approximately 19 plants/m^2 and 9 plants/m^2. All POST treatments were applied with a tractor-mounted compressed air sprayer delivering 140 L/ha at 221 kPa. Annual grass biomass/m^2 was determined in each plot August 21, 2002 and July 28, 2003 and soybeans were harvested August 22, 2002 and August 12, 2003.

Annual grass biomass was 31 to 38% lower in plots treated with 0.84 kg/ha glyphosate + 1.8 or 1.3 kg/ha *s*-metolachlor in 2002 compared to plots treated with glyphosate alone. Adding 0.9 or 0.4 kg/ha *s*-metolachlor to postemergence glyphosate applications did not reduce biomass compared to plots receiving glyphosate alone. In 2003, the addition of 1.8, 1.3, 0.9, and 0.4 kg/ha metolachlor to the second glyphosate application in a sequential program reduced annual grass biomass 58, 70, 86, and 67%, respectively compared to glyphosate only plots. These findings suggest a potential benefit of incorporating a residual grass herbicide into glyphosate only weed

control programs to manage annual grass populations in early-maturing glyphosate-resistant soybeans. In addition, residual grass herbicides may become more beneficial over time and could potentially reduce the level of annual grass seed in the soil seed bank. This needs to be investigated. Annual grass populations were too high to accurately count in many plots at harvest, but it appeared that grass populations were lower in plots treated with *s*-metolachlor than in plots treated with glyphosate alone. As this study progresses, attempts will be made to determine plant populations as well as weed biomass. Annual grass biomass at harvest was not influenced by tillage either year. In contrast, row spacing had a tremendous impact on the annual grass biomass at harvest. There was 51 and 63% less grass biomass in 38 cm rows than in 76 cm rows in 2002 and 2003, respectively. Herbicide program and tillage did not influence yields either year (data not presented). Yields were slightly higher in 38 cm rows in 2003. These results indicate that the most immediate and effective strategy for producers to implement to combat late-season annual grass control problems in glyphosate-resistant soybeans is to use narrow row spacings.

CONTROL OF VOLUNTEER ROUNDUP READY® AND LIBERTY LINK® COTTON IN SOYBEAN. M.A. Thompson and R.M. Hayes, Plant Sciences Department, University of Tennessee, West TN Experiment Station, Jackson, TN.

ABSTRACT

It is critical that producers control volunteer cotton to avoid paying monitoring fees which are part of the ongoing Boll Weevil Eradication Program. In 2002, Reflex® at 8 oz/A provided some control of Roundup Ready® cotton that was smaller than six inches, but poor control of 10 to 12 inch cotton. Bayer Cropscience is introducing glufosinate tolerant or Liberty Link® cotton in 2004, which could potentially be a volunteer weed in soybean fields. Little is known about the best method to control volunteer plants tolerant to glufosinate. The objectives of this work were to evaluate control of small cotton compared to large cotton, and compare effectiveness of selected herbicides on Liberty Link® cotton compared to Roundup Ready® cotton.

Paymaster 1199RR and Fibermax 966LL were planted at two dates to achieve two growth stages (2 to 3 leaf cotton and 5 to 7 leaf cotton) at the time treatments were applied. Treatments were: Gramoxone Max® at 24 oz/A + Sencor® at 4 oz/A, Liberty® at 32 oz/A, Roundup WeatherMax™ at 22 oz/A, Classic® at 0.5 oz/A, Classic® at 0.5 oz/A + Aim® at 0.38 oz/A, Resource® at 8 or 12 oz/A, or Flexstar® at 24 oz/A applied to 2 to 3 leaf cotton or to 5 to 7 leaf cotton. Resource® was also applied sequentially at 8 oz/A to 5 to 7 leaf cotton to try to improve control of larger cotton. All treatments included adjuvants as recommended.

Small 2 to 3 leaf cotton was more easily controlled than 5 to 7 leaf cotton. Roundup Ready® cotton was more easily killed than Liberty Link® cotton with Resource®, Flexstar® and Gramoxone Max® + Sencor.® Classic® and Aim® were not effective in controlling cotton at either stage. The most effective treatments for controlling Roundup Ready® cotton were Gramoxone Max® + Sencor® + NIS (24 oz/A + 4 oz/A + 32 oz/100 gal), Liberty® (32 oz/A + 3 lb/A AMS) or Resource® at 8 oz/A applied to 2 to 3 leaf cotton. Resource controlled >96% of 2 to 3 leaf cotton but less than 30% of 5 to 7 leaf cotton. Liberty® controlled > 98% of 2 to 3 leaf Roundup Ready® cotton and 80% of 5 to 7 leaf Ready Ready® cotton. Gramoxone Max® + Sencor® + NIS (24 oz/A + 4 oz/A+ 32 oz/100 gal) and Resource at 12 oz/A were the most consistent treatments for controlling 2 to 3 leaf Liberty Link® cotton. Roundup WeatherMax™ did not effectively control Liberty Link® cotton at either stage. Liberty Link® cotton treated with Roundup WeatherMax™ appeared stunted but terminals and stem tissue were still green at the two week evaluation. Resource® at 12 oz/A controlled 2 to 3 leaf Liberty Link® cotton greater than 98%, but less than 20% of 5 to 7 leaf cotton.

WEED POPULATIONS IN A LONG-TERM NO-TILL/ROUNDUP READY™ SOYBEAN PRODUCTION SYSTEM. D.M. Dodds, D.R. Shaw and K.C. Hutto; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State.

ABSTRACT

It is estimated that 80% of US soybean acres were planted with glyphosate-tolerant seed in 2003. This is double the acres planted with glyphosate-tolerant seed in 1998. It was theorized that in the long term, primary reliance on glyphosate for weed control particularly in continuous cropping or in rotations of glyphosate-tolerant crops will result in a shift in the weed spectrum towards more tolerant weed species, similar to what occurred with the ALS inhibitors in the late 1980s and early 1990s. Previous research has also shown that more diverse populations of perennial weeds with greater densities developed in reduced tillage systems. However, these populations and densities may be highly dependant on management practices. Little research has been found that deals with the long term effects of weed management using glyphosate-tolerant soybeans on weed populations in a no-till production system.

Research was conducted at the Black Belt Branch Experiment Station near Brooksville, MS from 1998-present in a no-till production system. Weed control strategies were as follows: burndown application of paraquat followed by multiple POST applications of glyphosate, burndown application of glyphosate followed by multiple POST application of glyphosate, strictly conventional burndown and POST treatments, burndown application of glyphosate followed by one conventional and one glyphosate POST treatment, and a burndown application of paraquat followed by one conventional and one glyphosate POST application. Plots measure 0.3 ha, within each plot 10 -m grids were overlaid and weed populations were recorded from 1-m^2 areas from the center of each grid.

The highest level of weed control was obtained with multiple applications of glyphosate POST, regardless of burndown treatment. Plots that received only conventional herbicides tended to have higher populations of perennial species such as horsenettle (*Solanum carolinense* L.), broomsedge (*Andropogon virginicus* L.), and perennial tree species [e.g. hackberry (*Celtis* spp.)]. Decreased weed control in conventionally treated plots may be, in part, due to delayed herbicide application due to environmental conditions. However, high levels of weed control in glyphosate treated plots demonstrated flexibility in timing of herbicide application using glyphosate.

USING MULTIRESOLUTIONAL TEXTURE ANALYSIS TO DETECT WEEDS IN SOYBEAN. W.A. Givens, D.R. Shaw, and M.C. Smith. Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Remotely sensed images offer the potential for rapid, cost-effective weed mapping for precision agriculture. To effectively detect weed patches in a remotely sensed multispectral or hyperspectral image, one can use spatial and/or spectral information. In low spatial resolution imagery, spectral information can be used to discriminate between broad classes, such as vegetation and non-vegetation; whereas, spatial information can be used to discriminate between homogenous areas versus non-homogeneous areas in the image, for example with the use of image texture analysis.

Research was conducted at the Black Belt Branch Experiment Station near Brooksville, MS during the 2003 growing season to test multiresolutional texture analysis methods for the detection of aggregated weed patches in a row crop agricultural setting. These features were tested for their ability to discriminate between non-weedy and weedy areas of a soybean field. The method was tested on multispectral imagery where extensive ground truthing had been conducted. The ground truthing consists of 10 meter grid overlaid on the study site with weed population counts recorded from $1m^2$ areas located at the center of each grid, and was collected within 5 days of the multispectral imagery acquisition.

The Soil Adjusted Vegetative Index (SAVI) was applied to the image to reduce the effects of soil reflectance on the analysis. The resulting SAVI image was then analyzed using discrete wavelet transform (DWT) at 3 levels. This analysis breaks the image into 3 texture components: vertical, diagonal, and horizontal. At the highest level, the sum of the 3 components approximate the original image. Correlation coefficients were found between the weed density map and the 3 components of the DWT at each level. The highest correlations found were between the weed density map and the 3 levels of the vertical component, with correlation values of 0.77, 0.69, and 0.60, respectively.

UTILITY OF ET IN CONTROLLING WEEDS IN SOYBEAN. P.R. Vidrine, D.K. Miller, and D.M. Scroggs. LSU AgCenter, Baton Rouge, La. 70894.

ABSTRACT

Soybean varieties tolerant of the nonselective herbicide glyphosate have rapidly increased in commercial availability. It would be desirable, from a grower's perspective, to delay the initial glyphosate application to allow more weeds to emerge. Delaying treatment allows weeds to be larger, although higher rates of glyphosate may be needed for acceptable control. Also, delaying initial glyphosate application beyond the 1-to-3-inch stage can result in a longer period of weed competition with the crop, which can reduce crop yield. Like most new technologies, there are concerns about their usage and if they can be considered stand-alone methods or if they require support of existing technologies. Under varying environmental conditions and plant sizes, control of some weeds can be difficult with a single herbicide or by using reduced rates of that herbicide. Current research has shown that the use of tank mix partners in a Roundup Ready® program has been favorable. Use of additional herbicides with some activity on weeds considered difficult to control would be beneficial in improving the overall performance of a Roundup Ready® program.

A field study was conducted on soybean at Alexandria, La., in 2003 to evaluate ET alone and in mixture with glyphosate (Roundup Weathermax). ET was applied at 0.5, 1.0, and 2.0 oz product/acre. Glyphosate was added to ET at 16 and 22 oz product/acre. Treatments were applied in 15 GPA. Soybean variety was Deltapine 5806RR. POST treatments were applied to soybeans 16 d after planting at the V3 stage. Weeds present at the time of application included a mixed population of pitted morningglory, *Ipomoea lacunosa,* and ivyleaf morningglory, *Ipomoea hederacea*, which were 2 to 4 inches with 2 to 4 leaves; smellmelon, *Cucumis melo*, was 1 to 3 inches with 1 to 2 leaves; hophornbeam copperleaf, *Acalypha ostryifolia,* was 2 to 3 inches with 2 to 4 leaves; browntop millet, *Panicum ramosum,* and barnyardgrass, *Echinochloa crus-galli,* were 1 to 3 inches with 2 to 3 leaves; and johnsongrass, *Sorghum halepense,* was 4 to 6 inches with 4 to 6 leaves. Visual estimates of weed control were recorded 8 and 28 days after treatment (DAT). Treatments were arranged in a randomized complete block design with 3 replications. Data were subjected to analysis of variance, and means were separated using Fisher's protected LSD test (P=0.05).

At 8 DAT, ET applications either alone or in mixture controlled morningglory equally and ranged from 88% to 99%. At 28 DAT, control was 90% to 93% following treatments of ET at 2.0 oz/acre and ET in mixture with glyphosate. Morningglory control following ET applied alone or in mixture was better than glyphosate applied alone. Smellmelon control at 8 DAT was best controlled following treatments of ET in mixture, except ET at 2.0 oz/acre. Smellmelon control when treatments were applied in mixture was 93% to 98%. Smellmelon control tapered off at the 28 DAT rating and ranged from 63% to 89% overall. Wild poinsettia control was 98% to 99% and similar following ET alone at 2.0 oz/acre, glyphosate alone at 16 oz/acre, and ET plus glyphosate at all rates. Hophornbeam copperleaf was controlled 91% to 96% and was similar following treatments. Very little johnsongrass control was noted from ET; however, the addition of glyphosate provided control. Poor control of annual grasses was obtained following solo ET applications when rated 8 and 28 DAT. The addition of glyphosate to ET or glyphosate applied alone provided adequate grass control. An 8 DAT evaluation of ET showed unacceptable soybean injury (45%) when applied alone, especially at the 2.0 oz/acre rate. The addition of glyphosate to ET at all rates showed reduced soybean injury that ranged from 8% to 18%. Either glyphosate is providing some type of safening effect when added to ET or the crop oil concentrate that was added to ET when applied alone may account for the phytotoxicity. Soybean injury evaluations at 28 DAT showed less phytotoxicity and ranged from 0 to 25%. Future research will concentrate on repeating the study to determine if glyphosate is indeed providing soybean protection or if the crop oil concentrate is contributing to the injury.

FLUROXYPYR HERBICIDE OPTIONS FOR WARM SEASON TURF. D.W. Lickfeldt, Dow Agrosciences LLC, Indianapolis, IN.

ABSTRACT

In 2002 and 2003, Dow AgroSciences, with the assistance of numerous contract researchers, evaluated a pyridine herbicide [fluroxypyr 1-methylheptyl ester (MHE) or (4-amino-3,5-dichloro-6-fluoro-2-pyridinyl) oxy) acetic acid, 1-methylheptyl ester)] for use on turfgrass for postemergent broadleaf weed control. Since herbicides containing clopyralid will no longer be available on residential turf, due to allegations of persistence in yard waste compost, Dow recognized the need for a new broad spectrum herbicide that was not phytotoxic to turfgrasses. Many broadleaf herbicides containing phenoxys such as 2,4-D, MCPP, and/or Dicamba can be injurious to warm season turf species such as St. Augustinegrass and Bermudagrass, but clopyralid (Lontrel T&O*) has gained a reputation as being one of the least phytotoxic options in the marketplace. Furthermore, sulfonyl urea herbicides are relatively expensive to the end user while other options such as triazines are under regulatory pressure to limit their use. Studies have demonstrated how a 1.5EC formulation of fluroxypyr MHE is efficacious to prevalent broadleaf weeds such as white clover without causing unacceptable turf injury. Warm season turf tolerance is comparable to that of the 3SL formulation of triclopyr and clopyralid (Confront*). This 1.5EC formulation of fluroxypyr MHE was granted a federal label for postemergent broadleaf weed control in turfgrass in late 2003 and the new product will be called Spotlight*. Other formulations (such as EF-1063 a 3.1EW with Fluroxypyr (0.6 lb/gal) and MCPP (2.5 lb/gal)) combining fluroxypyr with other active ingredients are being explored. Spotlight* will be a viable option for safe and effective broadleaf weed control in turfgrass.

TURFGRASS TOLERANCE TO REDUCED RATES OF CLINCHER AND DE-638. B.A. Besler, W.J. Grichar, J.M. Taylor, V.B. Langston, J.S. Richburg, and R. Jahn. Texas Agricultural Experiment Station, Beeville; Mississippi State Univ., Starkville and Greenville; Dow AgroSciences, The Woodlands, TX and Texas Cooperative Extension, Wharton.

ABSTRACT

Field studies were conducted during the 2003 growing season near Wharton, Texas and the Plant Science Research Center (PSRC) at Mississippi State University to determine the effects of Clincher (cyhalofop-butyl) and DE-638 (Penoxsulam) on 'Raleigh' St. Augustine, 'Empire' zoysiagrass, 'Tifway' bermudagrass, and 'Common' centipedegrass. Clincher was applied at 0.15, 1.5, 3.7 and 15.0 fl oz/A while DE-498 was applied at 0.026, 0.29, 0.72 and 2.85 fl oz/A. Both herbicides were applied with a CO_2 backpack sprayer calibrated to deliver 20 GPA at Wharton and 25 GPA at the PSRC. Agri-dex at 2.5% v/v was included with all herbicide treatments. Grasses were approximately 0.75 to 3 inches in height at time of application. The test design was a randomized complete block with 4 replications.

At Wharton, no stunting or yellowing was noted on either St. Augustine and Zoysiagrass when rated 1, 3 and 7 days after application (DAA). Clincher at 15.0 fl oz/A caused 4% stunting and yellowing on St Augustine grass, when rated 14 DAA, while DE-638 caused 2% stunting and yellowing. At 21 DAA, Clincher at 15.0 fl oz/A caused 2% stunting while DE-638 at 2.85 fl oz/A resulted in 1.5% stunting. No yellowing was observed at this rating date. With zoysiagrass, no stunting or yellowing was noted with Clincher or DE-638 at either the 14 or 21 DAA ratings.

Significant 'Tifway' bermudagrass injury (yellowing) was noted 4, 7, and 21 DAA with Clincher at 15.0 fl oz/A at the PSRC test site. At 21 DAA injury was > 40%. However, injury was not evident when rated 35 DAA. Also, Clincher at 3.7 fl oz/A stunted bermudagrass 23% when rated 7 DAA but was low or non-existent at subsequent ratings. Clincher at 15.0 fl oz/A also injured centipedegrass 3, 23 and 53% respectively, when rated 4, 7 and 21 DAA but fully recovered by the 35 DAA rating. Significant injury (yellowing) with Clincher at 3.7 fl oz/A only caused stunting when rated 7 DAA. No injury was observed with DE-638 with either grass species.

MANAGEMENT OPTIONS FOR STAR-OF-BETHLEHEM (*ORNITHAGALUM UMBELLATUM* L.) CONTROL IN BERMUDAGRASS TURF. C.L. Main, D.K. Robinson, T.C. Teuton, and T.C. Mueller. Department of Plant Sciences, University of Tennessee, Knoxville.

ABSTRACT

Star-of-Bethlehem is a perennial of the liliaceae (lily) family that is commonly confused with wild garlic (*Allium canadense* L.). Star-of-Bethlehem leaves are channeled, and are 3-8 mm wide with a conspicuous pale green to white midrib. Plants grow to a maximum height of 15-20 cm at flowering.

Field studies were conducted near Knoxville, TN during late March and early April 2002 and 2003, respectively, for star-of-Bethlehem control in dormant bermudagrass turf. Plots (1.5 m by 4.5 m) were arranged on established common bermudagrass turf containing a uniform infestation of newly emerged star-of-Bethlehem (50 plants/m^2). Herbicides evaluated for star-of-Bethlehem control included: bromoxynil at 1.24 kg ai/ha, halosulfuron at 0.07 kg ai/ha, imazaquin at 0.56 kg ai/ha, metsulfuron at 0.04 kg ai/ha, bromoxynil plus imazaquin, bromoxynil plus halosulfuron, bromoxynil plus metsulfuron, 2,4-D at 1.88 kg ai/ha plus dicamba at 1.0 kg ai/ha plus mecoprop at 0.20 kg ai/ha, and triclopyr at 1.62 kg ai/ha plus clopyralid at 0.54 kg ai/ha. A nontreated control was included for comparison and non-ionic surfactant at 0.25% v/v was included with treatments that contained halosulfuron, imazaquin, or metsulfuron. Herbicides were applied using a CO_2-pressurized backpack sprayer that delivered 215 L/ha of water carrier with 11001 nozzles at 240 kPa. Treatments were arranged in a randomized complete block design with four replications of each treatment. Applications were made on April 3, 2002 and March 25, 2003 to dormant common bermudagrass turf. Star-of-Bethlehem was 8 to 10 cm tall when treated. Visual evaluations of star-of-Bethlehem control and injury to bermudagrass turf (0% = no control or injury and 100% = complete control or turfgrass death) were recorded 21, 35, and 90 DAT.

Halosulfuron, imazaquin, metsulfuron, 2,4-D plus dicamba plus mecoprop, and triclopyr plus clopyralid controlled star-of-Bethlehem 35% at most 35 days after treatment (DAT). Bromoxynil alone or mixed with halosulfuron, imazaquin, or metsulfuron controlled star-of-Bethlehem at least 80% at 35 DAT. Imazaquin and imazaquin plus bromoxynil injured bermudagrass 51% 35 DAT. This injury was characterized by decreased bermudagrass post-dormancy transition and was transient.

HYPERSPECTRAL RADIOMETRY TO IDENTIFY TURFGRASS STRESS AND WEED SPECIES. K.C. Hutto, D.R. Shaw, J.D. Byrd, Jr., J.M. Taylor, and C.J. Gray; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Research was conducted in summer 2002 and 2003 at the Plant Science Research Center, Starkville, MS to identify spectral reflectance characteristics of certain warm season turfgrass weeds, as well as to determine the accuracy of hyperspectral radiometry to distinguish between various turfgrass stresses. The weed species analyzed were large crabgrass [*Digitaria sanguinalis* (L.) Scop.], dallisgrass (*Paspalum dilatatum* Poir.), Virginia buttonweed (*Diodia virginiana* L.), and eclipta (*Eclipta prostrata* L.). The simulated stresses were traffic (three levels), herbicide application (2.0 lb ai/A MSMA or 3 pt/A Trimec Classic), and moisture stress. Major warm season turfgrasses were also evaluated, which consisted of 'Tifway' bermudagrass (*Cynodon dactylon* Pers. x *transvaalensis* Burrt-Davy), 'Meyer' zoysiagrass (*Zoysia japonica* Steud.), centipedegrass [*Eremochloa ophiuroides* (Munro) Hack.], and St. Augustinegrass [*Stenotaphrum secundatum* (Walt.) Kuntze]. Data were analyzed using receiver operating characteristics-best spectral band combination with a feature classification of maximum likelihood to identify best spectral bands used to separate all classes. These bands were subjected to stepwise linear regression to identify the most significant bands attributing to the classification of species and stresses. Discriminant analysis was used to obtain classification accuracies. The 2003 data was validated against the 2002 data to evaluate the accuracy of classification methods over years.

An overall classification accuracy of 99% using the 15 most weighted bands (ranging from 350 to 439 nm, and 2327 nm) was achieved for all weed species. Using discriminant analysis, an overall accuracy of 87% was achieved using 13 of 15 bands (excluding 376 and 378 nm). Only Virginia buttonweed was classified accurately (96%) when validating the method over years. All other weeds were classified below 57%. An overall accuracy of 63% was achieved using bands in the near infrared region (NIR) (ranging from 746 to 841 nm) for all turfgrass stresses with moisture stress being the most accurately classified (94%). Discriminant analysis eliminated bands 816 and 824 nm, classifying moisture stress correctly 88%. The validation analysis classified moisture stress correctly 43%. Turfgrass species were all correctly classified using bands in the visible (ranging from 386 to 405 nm) and NIR (ranging from 725 to 764 nm). All turfgrass species, with the exception of centipedegrass, were correctly classified 93% or greater validating over years (excluding 389 and 728 nm). An overall accuracy of 80% was achieved for all species analyzed using bands in the visible region (ranging from 350 to 389 nm). Discriminant analysis provided an overall accuracy of 50% (excluding bands 356, 357, 358, 361, and 369 nm). Validation analysis provided an overall accuracy of 57% for all species. Bermudagrass (71%), centipedegrass (77%), and dallisgrass (70%) were the most accurately classified species over years.

IMPACT OF FLAME-WEEDING IN COTTON AND SOYBEANS. C.E. Snipes, D.H. Poston, and S.P. Nichols. Delta Research and Extension Center, Stoneville, MS 38776.

ABSTRACT

Several field studies were conducted in 2003 at the Delta Research and Extension Center (DREC) in Stoneville, MS on a silty clay loam soil to evaluate the efficacy and economics of flame cultivation for weed control in organically grown soybean. Studies were conducted in an area previously used for weed control research that was infested with annual morningglory, hemp sesbania, annual grasses (primarily barnyardgrass), prickly sida, and sicklepod. The soil type at this location is commonly used for soybean production. The cloddy nature of this soil created problems with soil preparation. Beds were difficult to establish using equipment designed to prepare beds for precision flaming. Additional soil preparation was needed prior to planting thereby increasing tillage costs. Weed control with flame cultivation ranged from 75 to 93 percent depending on species evaluated. Weed control with flame cultivation was generally higher than the level of control achieved with cultivation only. Annual morningglories and annual grasses were the most difficult to control weeds with flame cultivation. However, the level of morningglory control with flame cultivation was similar to that provided by the Roundup Ready weed control system. In addition, the level of sicklepod control with flame cultivation was 93 percent compared to 83 percent with a conventional herbicide system supplemented with cultivation. Labor costs associated with hand weeding were $343/A, $284/A, and $208/A for plots that were hand-weeded, cultivated + hand-weeded, and flame-cultivated + hand-weeded, respectively. Therefore, cultivation and flame cultivation reduced labor costs associated with supplemental hand-weeding 18 and 39 percent, respectively. Consequently, the added cost of flame cultivation may be slightly offset by savings in labor that are likely to be inevitable in organic production systems, especially during the first years of transition from conventional to organic production.

Similar studies were conducted on silt loam soils traditionally reserved for cotton production. These soils were far less cloddy, better drained, and more suited for timely field operations. Soybean yields from studies planted in April using the Early Soybean Production System were 33, 50, and 63 Bu/A for untreated, flame-weeded, and Roundup Ready plots, respectively. Estimated economic returns from these studies look promising.

In 2002 and 2003, studies were conducted at the DREC on a Bosket very fine sandy loam to determine the effectiveness of flame cultivation in current weed control systems in Mississippi cotton. These studies provided flame weed control comparisons to conventional programs, including Roundup Ready systems. Generally, flaming was a suitable replacement for late postemergence and postemergence-directed herbicide applications in cotton. Use of flame as a component of an overall weed control system that utilized preemergence and postemergence herbicide applications was most successful. Parallel flaming requires use of precision guidance systems to achieve early season weed control with flame cultivation. This system was used in conjunction with conventional cross flaming at later timings to obtain acceptable weed control levels. Also, studies utilizing combinations of parallel and cross flaming were conducted to determine the effectiveness of flame systems without the use of any herbicides. These systems would be beneficial to organic farmers. Flame-only systems were successful, but the level of weed control was dependant upon favorable environmental conditions and precise, timely flame application. Such conditions are not always met and non-herbicide (or organic) weed control systems in cotton should allow for the use of occasional hand labor.

EFFECT OF POSTEMERGENCE IMAZAPIC ON COMMON GRASS WEEDS AND FORAGES IN VIRGINIA. S.R. King, K.W. Bradley*, E.S. Hagood, Jr., P.L. Hipkins, and H.L. Witt; Dept. of Plant Pathology, Physiology and Weed Science, VPI&SU, Blacksburg; *Dept. of Agronomy, University of Missouri, Columbia.

ABSTRACT

Forage quality and yield are often reduced when fields become infested with annual and perennial grass weeds. Currently, Plateau® 2L herbicide, containing the active ingredient imazapic, is used for the control of many annual and perennial weeds in warm season grasses such as bermudagrass (*Cynodon dactylon*) and centipede grass (*Eremochloa ophiuroides*). In Virginia, common perennial grass forages utilized for hay include orchardgrass (*Dactylis glomerata),* timothy (*Phleum pretense*) and tall fescue (*Festuca arundinacea*). At present, there are no herbicides registered for the selective removal of grass weeds in these forages. However, previous unpublished research by the authors has indicated the potential of using Plateau applied postemergence (POST) for the selective removal of some annual grass species with limited phytotoxicity to orchardgrass. Therefore, greenhouse trials were conducted to determine the effects of a range of Plateau rates for the control of common grass weeds and to evaluate the effects to the predominant forages in Virginia. Weeds evaluated include: sweet vernalgrass (*Anthoxanthum odoratum*), common velvetgrass (*Holcus lanatus*), large crabgrass (*Digitaria sanguinalis*), barnyardgrass (*Echinochloa crus-galli*), and johnsongrass (*Sorghum halepense*). Plateau was applied at 0, 2, 4, 6, 8, 10, and 12 oz/A with 0.25% v/v nonionic surfactant to 4 inch tall weeds and forages. Greenhouse experiments had six replications and were repeated. A field experiment was also conducted to evaluate the effect of a range of Plateau rates applied POST for the selective removal of large crabgrass from an established orchardgrass and tall fescue hayfield. In this experiment, Plateau was applied at 0, 2, 4, 8, and 12 oz/A with 0.25% v/v nonionic surfactant in early June. The field experiment had four replications. Treatments in all trials were applied in a randomized complete block design and were subjected to a two-way factorial analysis of variance. The factors subjected to analysis were Plateau rate and plant type. In the greenhouse experiments, Plateau applied at rates of 4 oz/A or greater successfully controlled large crabgrass, barnyardgrass, and johnsongrass. However, Plateau had limited efficacy for the control of sweet vernalgrass and common velvetgrass. Orchardgrass was injured less than all the other forage species evaluated within all rates of Plateau. Orchardgrass, however, was injured 32 and 55% when Plateau was applied at 2.0 and 4.0 oz/A, respectively. The high level of injury can be attributed to Plateau application to orchardgrass in a seedling stage rather than to an established perennial. Timothy and tall fescue were controlled 73% or greater with 2 oz/A of Plateau. In the field experiment, Plateau applied at rates greater than 4 oz/A resulted in significant injury to orchardgrass. At 6 WAT, greater orchardgrass injury was observed with 4 oz/A compared to 2 oz/A of Plateau. However at 3 MAT, less than 15% orchardgrass injury was observed with either rate and there was no difference in orchardgrass injury between the two rates. Large crabgrass was controlled greater than 80% at 6 WAT and 3 MAT when Plateau was applied at 2 oz/acre. However, significantly higher levels of large crabgrass control occurred at both 6 WAT and 3 MAT when the 4 oz/A rate was applied compared to the 2 oz/A rate. Fescue was injured less than 25% with the 2 oz/A rate of Plateau at both rating times and injury was not greater than that which occurred to orchardgrass. With the 4 oz/A rate of Plateau, fescue was injured approximately 50% at both rating times and injury was greater than that which occurred to orchardgrass.

SELECTIVE CONTROL OF OVERSEEDED PERENNIAL RYEGRASS IN BERMUDAGRASS WITH ALS HERBICIDES. T.C. Teuton, J.C. Sorochan, C.L. Main, B.N. Campbell, and T.C. Mueller. Department of Plant Sciences, University of Tennessee, Knoxville, TN 37996.

ABSTRACT

Perennial ryegrass (*Lolium perenne* L.) is commonly used in the transition zone for overseeding home lawns, golf courses, and sports fields of dormant bermudagrass (*Cynodon dactylon* L. Pers.). Traditionally turfgrass managers have relied on warmer weather and bermudagrass competition to transition back to the bermudagrass base. However, with the recent influx of acetolactate synthase (ALS) inhibiting herbicides, chemical transition may be possible. This would allow for healthier, more uniform bermudagrass turf for the warmer months of summer. Research was initiated in the spring of 2003 at the University of Tennessee football practice facility to evaluate selective control of perennial ryegrass with ALS herbicides compared to diclofop, a non-ALS herbicide. Treatments included foramsulfuron at 0.02, 0.05, and 0.02 followed by (fb) 0.02 kg ai/ha, trifloxysulfuron at 0.03, 0.05, and 0.03 fb 0.03 kg ai/ha, metsulfuron 0.02, 0.04, and 0.02 fb 0.02 kg ai/ha, rimsulfuron at 0.02 and 0.01 fb 0.01 kg ai/ha, and diclofop at 1.14 and 1.14 fb 1.14 kg ai/ha. Sequential applications were made 5 wk after initial application (WAA). Perennial ryegrass was evaluated for percent control (0-100) and bermudagrass was evaluated for percent injury (0-100) and quality (0-9). All herbicides, except diclofop, provided > 90% control 3 WAA. However, by 5 WAA only foramsulfuron at 0.05 kg ai/ha and trifloxysulfuron at 0.03, 0.05, and 0.03 fb 0.03 kg ai/ha provided > 90% control. Perennial ryegrass control 7 WAA improved following the sequential herbicide application (>98% control) for all herbicides except diclofop. Trifloxysulfuron was the only herbicide to provide acceptable control (96%) 7 WAA with a single application. Rimsulfuron was the only herbicide to cause bermudagrass injury (8%), however injury was mostly stunting and did not effect overall turfgrass quality. Quality evaluations for all herbicide treatments were not statistically different from the untreated control 7 WAA. Overall, all ALS herbicides tested performed better than diclofop and can be used with excellent bermudagrass safety. ALS herbicides allow turfgrass managers another safe option for transitioning from bermudagrass winter dormancy to a vigorous bermudagrass base for summer.

BEYOND FOR ITALIAN RYEGRASS CONTROL IN CLEARFIELD WHEAT. K.B. Meins, R.C. Scott, and N.D. Pearrow; Cooperative Extension Service, University of Arkansas, Lonoke, AR 72086.

ABSTRACT

Diclofop-resistant ryegrass is a growing problem in Arkansas winter wheat production. Imazamox herbicide applied to imidazolinone-tolerant wheat could be one tool to combat this problem. A field study was conducted at two locations to evaluate imazamox efficacy in wheat. Imazamox, diclofop, pendimethalin, dimethenamid, and chlorsulfuron-metsulfuron were among 28 treatments applied and evaluated. Diclofop provided 88% ryegrass control on diclofop-susceptible plants. Imazamox at 4 oz/A provided 64-69% control of ryegrass when applied to 1-2 leaf ryegrass. Control of ryegrass was increased to 79-90% when imazamox was used in a sequential post program, with or without a residual tank-mix partner. Control with imazamox was lost when applied to bigger ryegrass, but was not rate dependent. Dimethenamid or chlorsulfuron-metsulfuron provided above 85% ryegrass control when applied PRE. Yield of wheat did not differ between diclofop and imazamox at the diclofop-susceptible site. Yield of wheat at the diclofop-resistant site was better when a residual was applied. Imazamox controlled diclofop-resistant ryegrass only 68% at the resistant site; however, this resulted in a 20 bu/A increase in yield over diclofop applied alone.

OSPREY FOR HOELON RESISTANT RYEGRASS CONTROL IN WHEAT. N.D. Pearrow, R.C. Scott, and K.B. Meins; Cooperative Extension Service, University of Arkansas, Lonoke, AR 72086.

ABSTRACT

Diclofop (Hoelon) herbicide has provided Arkansas wheat producers with a valuable tool for controlling ryegrass in wheat for over 20 years. Due to its consistent use, populations of diclofop-resistant ryegrass have developed across the state. This has been an increasing problem in Arkansas wheat production over the last five years. Mesosulfuron-methyl (Osprey) is a new product being developed by Bayer CropScience that has the potential to replace diclofop as the product of choice in wheat production for ryegrass control.

A study was conducted in the 2001-2002 and again in the 2002-2003 growing seasons. In both years, diclofop provided 0% control of the resistant ryegrass population. Mesosulfuron-methyl controlled diclofop-resistant ryegrass over 96% in 2001-2002 and over 86% in 2002-2003. Based on the results of this two year study, mesosulfuron-methyl will provide excellent control of diclofop-resistant ryegrass.

THE VALUE OF HERBICIDES IN CROP PRODUCTION OF THE SOUTHERN UNITED STATES. L. Gianessi and S. Sankula, National Center for Food and Agricultural Policy, Washington, DC.

ABSTRACT

The discovery of synthetic herbicides serves as a significant milestone in the history of weed management. Crop production in the United States has undergone several changes since that time. Prior to the advent of herbicides, weeds in crop fields were removed by manual labor and mechanical cultivation powered by animals or tractors.

Among pesticides used in crop production, herbicides account for greatest volume and expenditure, which emphasizes the importance of weeds as crop pests. In spite of obvious benefits, the role of herbicides in crop production is poorly understood, often misunderstood, and frequently questioned by the public and media.

A study was conducted by the National Center for Food and Agricultural Policy to document the value of herbicides on crop production in the United States. The role of herbicides in the production of 40 specific crops was evaluated by estimating the likely impacts on crop yields, weed control costs, labor requirements, and soil erosion of substituting alternative weed control methods for herbicides. Estimates were drawn from studies conducted by WSSA, USDA, and AFBF in 1990s. The crops were categorized into field crops, vegetables, fruits and berries, and specialty crops. This paper highlights the impact of herbicides on vegetables (tomatoes, potatoes, sweet potatoes, carrots, cucumbers, and sweet corn) and fruits (apples, peaches, and grapes) grown in the southern region of the United States.

In general, yields of vegetable and fruit crops in the southern region have increased significantly since the introduction of herbicides. On an average, yields of southern tomatoes, potatoes, sweet potatoes, carrots, cucumbers, sweet corn, apples, peaches, and grapes would drop by 27, 30, 23, 25, 25, 17, 21, 18, 25%, respectively, if herbicides were not used in crop production.

The study identified that hand labor is a major replacement for herbicides. Timed right, hand-weeding may be equally effective as herbicides for most crops. However, growers may not substitute herbicides with hand-weeding due to high labor demands and high costs associated with this practice. For example, the number of hours needed to hand-weed an acre of tomatoes and maintain yields similar to those achieved with herbicide use ranges from 182 – 259/acre. Hand-weeding costs were approximately $0.50 an hour through the 1950s, doubled in the early 1960s to $1.0/hr, and have increased steadily since then to $7.0/hr in 2000.

Mechanical weed control methods are not viable as stand-alone alternatives to herbicide use. In certain crops such as cucumbers, mechanical methods are not feasible due to spreading nature of the crop. Other shortcomings such as inadequate weed control in crop rows, root injury, and loss of soil moisture prevent sole dependence on mechanical weed control.

Overall, the study indicated that a movement away from herbicide use would result in severe yield losses, increased crop production costs, and increased soil erosion. The findings from this study may serve as a guide for regulatory agencies, policy makers, the public and media to understand crop production realities in the United States and the implications of herbicide policy changes on weed management, crop yields, and overall crop production.

NON-LINEAR MIXED MODELS – A NEW APPROACH FOR COLBY'S HERBICIDE INTERACTION ANALYSIS. W. Zhang, E.P. Webster, and D.C. Blouin. Louisiana State University AgCenter, Baton Rouge.

ABSTRACT

Colby's formula is widely used for analyzing herbicide interactions. One of the main advantages of using Colby's formula is its capability to differentiate antagonistic and synergistic from additive effects. However, there are two major limitations associated with it. First, it lacks a statistical test for deviations of the observed from the predicted response. Second, least significant difference (LSD) is usually used to contrast the observed and the expected response, which is not appropriate in reflecting the non-linear multiplicative function of means in Colby's formula. Those limitations may reduce the sensitivity of Colby's formula in detecting herbicide interactions. New statistical methodology is needed to take advantage of Colby's formula and at the same time to increase its sensitivity by removing the limitations. In addition, it is important to be able to analyze changes of herbicide interaction over time and to rank herbicide compatibility based on results of an herbicide interaction study.

Three statistical models, Traditional Colby's (TColby's), Linear Mixed (LMixed), and None-linear Mixed (NLMixed), are compared in their sensitivity to detect interactions between glufosinate and bensulfuron or triclopyr for barnyardgrass control at 7 DAT. TColby's detects an antagonistic relationship between triclopyr at 0.28 kg ai/ha glufosinate at 0.42 kg ai/ha. All other combinations are additive based on TColby's. Both LMixed and NLMixed detect an additional antagonistic effect of bensulfuron on glufosinate at 0.42 kg/ha, indicating greater sensitivity compared with TColby's. The difference between LMixed and NLMixed is that p-values for the NLMixed are generally smaller than the p-values of LMixed, indicating that NLMixed was more sensitive in detecting herbicide interactions. The main reason for the smaller p-values or greater sensitivity of NLMixed is its smaller standard error compared with that of LMixed.

NLMixed Model is also more sensitive compared with LMixed in determining changes of herbicide interaction over time as reflected by smaller p-values. In addition, NLMixed can be used with Colby's in determining herbicide compatibility. Therefore, NLMixed is statistically better than the other models and should be recommended for herbicide interaction analysis with Colby's.

POWER PROGRAM FOR THE COMPLETELY + FACTORIAL AND RANDOMIZED FACTORIAL BLOCK DESIGNS. C.L. VanderSchaaf, College of Natural Resources, Virginia Tech University, VA 24061. D.B. South; School of Forestry and Wildlife Sciences, Auburn University, AL 36849. J.A. Earl; Arkansas Agricultural Experiment Station and School of Forest Resources, University of Arkansas at Monticello, AR 71656.

ABSTRACT

Methodology for the Statistical Analysis Software package is presented to determine the power of completely randomized factorial and randomized factorial block designs. The code can be used to calculate power for any number of factors and their interactions within these two designs.

INTRODUCTION

Research conclusions are based upon the assumption that studies have proper replication and sampling. When this occurs, most real differences between treatments will likely be declared statistically significant. Power, in a sense, is similar to the power rating of a microscope. Scopes with greater power are usually more expensive. Likewise, an experiment with a high degree of power is likely more expensive to install than one with low power. When conducted before the installation of a study, a power analysis allows the investigator to determine the trade-offs between time/money and proper replication. A power test can answer the question: if a treatment mean is 10% greater than the overall mean for a factor, what is the minimum amount of time and money that is required to detect a statistically significant difference? As researchers, we would all love to have an experiment that contained 1000 experimental units, each containing 1000 individual observations. But, this is often not feasible in terms of time and money. An earlier paper presented methodology to calculate the power for both the completely randomized and randomized block designs (3). This paper presents the methodology for completely randomized factorial and randomized factorial block designs.

METHODS

Data from a study using a completely randomized factorial design with two factors was used as an example of how to calculate power. An ANOVA was conducted using Proc GLM of SAS (1985). The mean square for the error term (MSWG) was obtained and was used as an estimate of σ^2_ϵ. The overall mean was calculated, multiplied by 10 % (we feel that a 10% difference in seedling height is biologically significant), this number was squared, and then multiplied by the number of treatment levels for a particular factor; also referred to as the sum of the treatment effects squared - $\Sigma\ \alpha_j^2$. The same procedure was used for interaction terms; i.e. $\Sigma\ (\alpha\beta)^2_{jk}$ for a two-way factorial design. For the rest of this paper, treatment level refers to the different rates, timings, etc. of different factors. Methodologies were based on previous works (1,3).

Equation 1 allows us to calculate the non-centrality parameter (λ):

$$\lambda = n\ (\Sigma\ \alpha_j^2)/\ \sigma^2_\epsilon \qquad (1)$$

where: n = the number of replications or blocks,
We then determined v_1 and v_2 for a particular factor or interaction; v_1= factor or interaction degrees of freedom, and v_2 = error term degrees of freedom. Two functions in SAS called FINV and PROBF are used to calculate power.

$$\text{F-value} = \text{FINV}\ (PR,\ v_1,\ v_2,\ 0) \qquad (2)$$

where: PR = 1- α

$$\text{Power} = 1\text{- PROBF (F-value, } v_1, v_2, \lambda) \quad (3)$$

Where: F-value = F-value that must be exceeded at the selected alpha level to determine that there is a significant difference between at least two factor or interaction levels.

The following SAS printout is a completely randomized two-way factorial design. Factor A involves different levels of weed control and Factor B is seedling size. The response value is tree height. The trial was conducted with two levels of factor A (*p*) and two levels of factor B (*q*), using n = 3 replications:

Source	DF	Squares	Mean Square	F Value	Pr > F
Model	3	9.69931444	3.23310481	2.49	0.1340
Error	8	10.36782218	1.29597777		
Corrected Total	11	20.06713662			

R-Square	Coeff Var	Root MSE	mht10 Mean
0.483343	2.924507	1.138410	38.92657

Source	DF	Type I SS	Mean Square	F Value	Pr > F
A	1	6.20721120	6.20721120	4.79	0.0601
B	1	3.36037459	3.36037459	2.59	0.1460
A*B	1	0.13172865	0.13172865	0.10	0.7580

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	1	6.20721120	6.20721120	4.79	0.0601
B	1	3.36037459	3.36037459	2.59	0.1460
A*B	1	0.13172865	0.13172865	0.10	0.7580

The following procedure was used to calculate power for factor A at a 0.05 alpha level. The MSerror term (MSWG) was 1.2960. Ten percent of the overall mean (38.93 cm) is 3.893, and this value squared is equal to 15.16. To determine $\Sigma\ \alpha_j^2$, we multiply this value by the number of treatment levels (2 * 15.16 = 30.32). Plugging these values into equation 1 yields, λ = 3(30.32)/1.2960, so that λ = 70.19. The values of v_1 (2 – 1) and v_2 (2*2(3-1)) are 1 and 8; respectively. Placing these values into equation 3, F-value = FINV (0.95, 1, 8, 0) yields a value of 5.3177. This value can then be entered into equation 4, Power = 1- PROBF (5.3177, 1, 8, 70.19), yielding a power value of 1.000. Interaction terms can be calculated in a similar fashion. They differ in that, to determine $\Sigma(\alpha\beta)^2_{jk}$, the number of crossed treatment levels (i.e. 2 x 2 = 4) for an interaction are multiplied by the sum of the treatment effects squared (4*15.16 = 60.64). This yields, λ = 3(60.64)/1.2960, so that λ = 140.31. The values of v_1 (2-1)(2-1) and v_2 (2*2(3-1)) are 1 and 8; respectively (although v_1 in this case is the same for both the factor A and the interaction term power calculations, notice the difference in the calculations). The rest of the calculations are the same except that Power = 1- PROBF (5.3177, 1, 8, 140.31); yielding a power of 1.000. SAS code for two-way and three-way factorial, and two-way and three-way factorial block designs, can be found in Appendix 1. These results can be extrapolated to a factorial design containing any number of factors. In the code, v_1 is the degrees of freedom for the variable (i.e. Factor A) or interaction term, while v_2 is the degrees of freedom for the error term.

DISCUSSION

As seen from the equations above, the calculation of power is directly dependent on MSWG, the selected alpha level, number of replications, number of treatment levels within a factor, and the percent difference from the overall mean that is considered biologically or economically

important.

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Appendix I. SAS code to calculate *a priori* power for completely randomized factorial and randomized factorial block designs to determine the number of replications necessary to detect a 10% difference from the mean.

* Completely randomized factorial (CRF) with two treatments using an alpha level of 0.05. In a previous step, you must determine the overall mean for a particular factor or interaction. The number of treatment levels must be entered manually (p – for treatment A, and q – for treatment B). Different alpha levels can be used by changing the first number in the FINV term. You can use various percent differences by manipulating perdiff (for example, "0.05*mean", is a 5% difference). You can also increase the number of potentially required replications by manipulating "do n = 2 to 100". These three manipulations can be seen in the CRF design code for the interaction term. The inclusion of "by site" allows a user to conduct power on many different studies/sites/locations, etc. at the same time ("site" can be replaced with any name of a variable). If you want to determine power for only one analysis, remove "by site". ;

```
proc GLM outstat = t1 ;
class A B ;
model ht = A B A*B ;
by site ;
run ;

data t2 ; set t1 ; if _SOURCE_ = "ERROR" ; MSWG = SS/DF ; drop _SOURCE_ _TYPE_ F SS ;
run ;

data t3 ; merge t2 xx (the file with the overall variable mean) ; by   ; run ;

* Power of CRF design with two Factors for Factor A using an alpha level of 0.05. ;

data t4 ; set t3 ;
p = 4 ; q = 5 ; pq = p*q ; perdiff = 0.10*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * p ;
do n = 2 to 100 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.95, p-1, (pq*(n-1)), 0);
POWER = 1 - PROBF(F, p-1, (pq*(n-1)), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;


* Power of the interaction term of a CRF design with two factors using an alpha level
of 0.10. ;

data t4 ; set t3 ;
p = 4 ; q = 5 ; pq = p*q ; perdiff = 0.05*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * (p*q) ;
do n = 2 to 1000 ;
```

```
noncen = n*sumtreat/MSWG ;
F = FINV(0.90, (p-1)*(q-1), pq*(n-1), 0);
POWER = 1 - PROBF(F, (p-1)*(q-1), pq*(n-1), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;

* Power of CRF design with three Factors for Factor A using an alpha level of 0.10. ;
data t4 ; set t3 ;
p = 4 ; q = 6 ; r = 4 ; pqr = p*q*r ; perdiff = 0.05*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * p ;
do n = 2 to 1000 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.90, p-1, pqr*(n-1), 0);
POWER = 1 - PROBF(F, p-1, pqr*(n-1), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;

* Power of the interaction term between Factors B and C of a CRF design with three
Factors using an alpha level of 0.10. ;

data t4 ; set t3 ;
p = 4 ; q = 6 ; r = 4 ; pqr = p*q*r ; perdiff = 0.05*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * (q*r) ;
do n = 2 to 1000 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.90, (q-1)*(r-1), pqr*(n-1), 0);
POWER = 1 - PROBF(F, (q-1)*(r-1), pqr*(n-1), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;

* Power of the interaction term between Factors A, B, and C of a CRF design with three
Factors using an alpha level of 0.10. ;

data t4 ; set t3 ;
p = 4 ; q = 6 ; r = 4 ; pqr = p*q*r ; perdiff = 0.05*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * (p*q*r) ;
do n = 2 to 1000 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.90, (p-1)*(q-1)*(r-1), pqr*(n-1), 0);
POWER = 1 - PROBF(F, (p-1)(q-1)(r-1), pqr*(n-1), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;

* Power of Randomized Factorial Block (RFB) design with two Factors for Factor B using
an alpha level of 0.10. ;

data t4 ; set t3 ;
p = 4 ; q = 5 ; pq = p*q ; perdiff = 0.10*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * q ;
do n = 2 to 100 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.90, q-1, ((n-1)*(pq-1)), 0);
POWER = 1 - PROBF(F, q-1, ((n-1)*(pq-1)), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;


* Power of the interaction term of a RFB design with two Factors using an alpha level
of 0.10. ;

data t4 ; set t3 ;
p = 4 ; q = 5 ; pq = p*q ; perdiff = 0.05*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * (p*q) ;
do n = 2 to 1000 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.90, (p-1)*(q-1), (n-1)*(pq-1), 0);
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POWER = 1 - PROBF(F, (p-1)*(q-1), (n-1)*(pq-1), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;

* Power of a RFB design with three Factors for Factor A using an alpha level of 0.05.
;
data t4 ; set t3 ;
p = 4 ; q = 6 ; r = 4 ; pqr = p*q*r ; perdiff = 0.05*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * p ;
do n = 2 to 1000 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.95, p-1, (n-1)*(pqr-1), 0);
POWER = 1 - PROBF(F, p-1, (n-1)*(pqr-1), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;

* Power of the interaction term between treatments B and C of a RFB design with three
treatments using an alpha level of 0.10. ;

data t4 ; set t3 ;
p = 4 ; q = 6 ; r = 4 ; pqr = p*q*r ; perdiff = 0.05*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * (q*r) ;
do n = 2 to 1000 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.90, (q-1)*(r-1), (n-1)*(pqr-1), 0);
POWER = 1 - PROBF(F, (q-1)*(r-1), (n-1)*(pqr-1), noncen); output ;
if power ge 0.80 then leave ;
end ;
run ;

* Power of the interaction term between treatments A, B, and C of a RFB design with
three treatments using an alpha level of 0.05. ;

data t4 ; set t3 ;
p = 4 ; q = 6 ; r = 4 ; pqr = p*q*r ; perdiff = 0.10*mean ; sqpd = perdiff*perdiff ;
sumtreat = sqpd * (p*q*r) ;
do n = 2 to 1000 ;
noncen = n*sumtreat/MSWG ;
F = FINV(0.95, (p-1)(q-1)(r-1), (n-1)*(pqr-1), 0);
POWER = 1 - PROBF(F, (p-1)(q-1)(r-1), (n-1)*(pqr-1), noncen); output ;
if power ge 0.80 then leave ;
end ; run ;
```

MODELING PESTICIDE AND SEDIMENT RUNOFF IN THE UPPER PEARL RIVER BASIN. M.L. Tagert, J.H. Massey, D.R. Shaw, D.M. Dodds, and W.G. Powell; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

The Upper Pearl River Basin (UPRB) drains into the Ross Barnett Reservoir, which is the largest of Mississippi's three surface water drinking sources. The reservoir supplies approximately 90% of the City of Jackson's drinking water. For this reason, the UPRB is an area of great interest with respect to the listing of waters on the state's 303(d) list and the establishment of Total Maximum Daily Loads (TMDLs). Seven sites within the UPRB were sampled for fifteen different pesticides, and three of these seven sites were also sampled for sediment runoff. Each site was sampled twenty-four times from May 2002 through May 2003. Pesticides were extracted via solid-phase extraction (SPE) disks, and the extracts were analyzed using gas chromatography – mass selective detection (GC-MSD) or high performance liquid chromatography – photodiode array detection (HPLC-PDA). The level of quantification (LOQ) for all compounds was 0.1 ppb. Results include only detections that were at or above the LOQ. Out of 690 total detections, Burnside was the site with the highest percentage of total detections at 18.7%. Walnut Grove had the lowest percentage of detections at 11.4%. Metolachlor was the most frequently detected compound at 76%, and atrazine was also detected 51% of the time. Fluometuron was the least detected compound at 9% out of a possible 167 detections. These pesticide results are being compared with pesticide loads predicted by a runoff model based on remotely sensed land use patterns. Pesticide detections and loads are also being compared to types of land use/land cover near the sampling sites.

SLENDER AMARANTH (*Amaranthus viridis* L.) SEED GERMINATION AS INFLUENCED BY TEMPERATURE, SOLUTION PH, MOISTURE STRESS, AND PLANTING DEPTH. W.E. Thomas, I.C. Burke, W.J. Everman, J.F. Spears, and J.W. Wilcut; Department of Crop Science, North Carolina State University, Raleigh, NC.

ABSTRACT

There is extensive biological data on many of the *Amaranthus* spp. However, limited information is available on the biological and ecological aspects of slender amaranth (*Amaranthus viridis* L.). These aspects on troublesome weeds are necessary for optimum control and efficient integrated management. Therefore, our objectives were to evaluate the effect of constant and alternating temperature regimes, solution pH, moisture stress, and planting depth on seed germination.

Constant temperatures of 15, 20, 25, 30, 35, and 40 C were produced using a thermogradient table. Due to low germination in constant temperature regime studies, a subsample of seed were submerged overnight in a 250 ppm gibberillic acid solution. Both a non-treated and gibberillic acid treated seed were examined in alternating temperature regimes of 35/20, 30/20, 30/15, and 25/10 corresponding to the mean daily high and low temperatures for the months of May, June, July, and August, respectively, in Goldsboro, NC. Buffered pH solutions were prepared using potassium hydrogen pthalate in combination with either 0.1 M HCl or 0.1 M NaOH to obtain solution pH levels of 3, 4, 5, and 6. A 25 mM borax solution was used in combination with 0.1 M HCl or 0.1 M NaOH to prepare solutions with pH levels of 7, 8, or 9. Solutions with osmotic potentials of 0.0, -0.3, -0.4, -0.6, -0.9, and -1.2 MPa were prepared by dissolving 0, 154, 191, 230, 297, or 350 g of polyethylene glycol (PEG 8000) in 1 L of deionized water. Both solution pH and moisture stress were evaluated using both non-treated and gibberillic acid treated seed in all four alternating temperature regimes.

Slender amaranth germination was influenced by constant and alternating temperature regimes. In constant temperatures, germination occurred between 15 and 35 C with maximum germination near 32 C. All alternating temperature regimes showed similar cumulative germination rates at 21 d (70 to 80%). Regardless of GA_3 treatment, rate of germination increased as temperature regimes increased. Therefore, based on temperature requirements, slender amaranth has the capability to germinate throughout most of the growing season. As the level of moisture stress increased, the germination rate decreased across all four alternating temperature regimes. However, germination with the -0.3 MPa treatment increased to 24% in the 35/20 regime compared to the other three regimes (< 14%). Less than 2% germination was observed at any temperature with -0.4 MPa. No germination was observed with any other moisture stress or temperature regime. Germination of slender amaranth was optimal between 0.5 and 2 cm in soil depth. These data show that slender amaranth can germinate under a wide range of environmental conditions. These characteristics coupled with tolerance of larger plants to many herbicides will likely lead to increased prevalence across the southern United States.

QUINCLORAC AND QUINMERAC EFFECTS ON HEMP SESBANIA AND SICKLEPOD SEEDLINGS. R.E. Hoagland, USDA-ARS, Stoneville MS.

ABSTRACT

Quinclorac (3,7-dichloro-8-quinolinecarboxylic acid) is a pre- or post-emergence herbicide that controls certain grasses and broadleaf weeds. Quinclorac induces some auxin-like symptomatology behaves somewhat differently than typical auxenic compounds, depending on the plant species treated, and its mechanism of action is not completely understood. Studies examined the effects of quinclorac and its herbicidal analog, quinmerac (7-chloro-3-methyl-8-quinolinecarboxylic acid) on hemp sesbania [*Sesbania exaltata* (Raf.)] and sicklepod (*Senna obtusifolia* L.) using several bioassays. Etiolated plants (4-day old) or seeds were treated with the compounds (high purity, technical grade), generally at 2.5 mM or less. Both herbicides slightly inhibited chlorophyll accumulation in greening cotyledons or stems, and the quinclorac effect was slightly greater than quinmerac. Etiolated shoot cuttings exposed to herbicide solutions, followed by incubation in darkness, showed that quinclorac inhibited elongation by 27% in hemp sesbania and sicklepod after 48 h. Quinmerac inhibition of elongation in hemp sesbania and sicklepod equaled that of quinclorac. Electrolyte leakage in hemp sesbania and sicklepod tissue segments was 15- and 30-fold greater than in untreated tissue, 48 and 72 h after treatment, respectively. Growth inhibition (organ elongation) also occurred when seeds of these weeds imbibed herbicide solutions, followed by incubation in the dark. Quinclorac reduced elongation by 85% in hemp sesbania and sicklepod after 96 h, and quinmerac reduced growth by 75% and 65% in sesbania and sicklepod, respectively. Both compounds caused club-root formation in hemp sesbania and sicklepod. Results indicate differential activity of these closely related herbicides on these species that may be related to susceptibility.

ENVIRONMENTAL FATE OF ATRAZINE AND FLUOMENTURON IN A WETLAND SYSTEM. M.A. Weaver[1], R.M. Zablotowicz[1] and M.A. Locke[2] USDA ARS 1 SWSRU Stoneville, MS. 2 NSL Oxford, MS.

ABSTRACT

A wetland was recently constructed to intercept and process agricultural runoff water. Laboratory assays were conducted to assess the potential of the wetland soils to bind and degrade two commonly used herbicides, atrazine and fluometuron. Surface soil was collected from the excavated cell of the wetland and from a shallow, unexcavated adjacent area. The excavated area was more acidic on average (pH 4.85 vs. 5.21), but otherwise the physical properties and general microbial enzyme activities in the two areas were similar. Soils were adjusted to saturated conditions (88% moisture) treated with radiolabled atrazine and fluometuron (84 and 68 $\mu g\ kg^{-1}$, respectively) and some treatments received additional water to simulate flooded conditions. Soils were sampled over 32 d and extracted for herbicide and metabolite analysis. After 32 d up to 12% of the applied atrazine was mineralized in soils from the shallow, unexcavated area and about 9% mineralization occurred in soils from the excavated region. After incubation, most of the atrazine was incorporated into soil-bound residues. Flumeturon was metabolized to desmethylfluometuron, but the rate of this metabolism was low and greatly reduced under flooded conditions.

A POTENTIAL CORRELATION BETWEEN TIMING OF HERBACEOUS RELEASE, PLANTING DATE, AND LONGLEAF SEEDLING MORTALITY. M.J. Hainds, D.H. Gjerstad and E.E. Johnson; The Longleaf Alliance and Auburn University School of Forestry and Wildlife Sciences. Solon Dixon Forestry Education Center. Andalusia, AL 36420.

ABSTRACT

Releasing young longleaf pine seedlings from herbaceous competition is a more risky endeavor than treating young loblolly pine stands. Many contractors or herbicide applicators in the southeastern, US primarily deal with loblolly pine. As compared to longleaf pine, loblolly is labeled for higher release rates with some commonly applied forest herbicides (i.e. Arsenal®). Other herbicides (i.e. Escort®) are labeled for loblolly but are highly injurious to young longleaf pine seedlings (1*997 Herbicide Screening Trial*). The Longleaf Alliance has tested virtually every herbicide currently labeled for longleaf release. These herbicides have been tested at various rates and timings over young longleaf pine seedlings. After examining data from these herbicide screening trials, and visiting numerous sites where a herbaceous release treatment was suspected of injuring or killing young longleaf pine seedlings, it appears that there may be a correlation between the time of planting, timing of the herbicide application, and injury or mortality or newly planted longleaf seedlings. Greater mortality rates may be evident with newly planted container-grown longleaf pine seedlings that were released before establishing root-systems on the planting site.

2nd YEAR RESULTS FOR MULTIPLE SPECIES PLANTINGS IN THE ARKANSAS DELTA. R.A. Williams[1], M.H. Pelkki, and J.A. Earl; [1]West Florida Research and Education Center – IFAS, University of Florida, Milton, FL; Arkansas Agricultural Experiment Station and School of Forest Resources, University of Arkansas at Monticello.

INTRODUCTION

The Forest Statistics for Arkansas Counties – 1995 showed 1.8 million acres of planted pines. Each year the number of planted pine seedlings adds to the 1.8 million acres (London 1997). Arkansas is now growing more pine volume than it is removing. Arkansas only has five operating pulp mills to use this tremendous amount of pine fiber. A pulp mill located in northeast Louisiana uses some pine fiber from Arkansas, as does a mill in northeast Texas. Another important fact is that hardwood pulpwood is increasingly difficult to find close to the mills that use hardwood fiber for pulp. In the southwest region of Arkansas, hardwood growth was 100 M. ft3 while removals exceeded 150 M. ft3 (Rosson et al. 1995). These conditions led me to the conclusion that southern Arkansas needs to increase its supply of hardwood pulpwood. Thus, this study is an attempt to grow hardwood trees to replace a dwindling supply of hardwood fiber. Hardwood pulpwood alone would not pay for itself because the price received for hardwood pulpwood is not that great. However, if hardwood pulpwood could be grown in conjunction with other tree species that do produce higher valued products such as pine and/or hardwood sawtimber, then this may be an attractive alternative. Thus the idea of a "Multiple Species" plantation appears to be a possible alternative to increase hardwood fiber while earning the landowner a respectable return for their investment.

METHODS

This study is a first attempt at planting multiple tree species (more than two) in a plantation. The tree species used were green ash (Fraxinus pennsylvanica), loblolly pine (Pinus taeda) and shumard oak (Quercus shumardii). These species were selected because they would grow naturally on the site selected for this study. The seedlings were hand planted in rows of like species (oak – ash – pine – ash – oak – ash….). Planting seedlings in rows allows for mechanical harvesting of desired trees. The initial target is to harvest the green ash before age 20 as hardwood pulpwood. The second cut will include pine sawtimber and some pine and hardwood pulpwood. The green ash should have re-sprouted after the first cut and could be harvested again as the third harvest. The resulting stand is red oak sawtimber which is a highly desirable product for the final harvest. If the lumber market changes over the course of growing this plantation, the final product could shift from hardwood to pine by altering the intermediate harvests.

A 10 acre portion of a field was divided into ten one-acre blocks. Each acre received the same number of ash, oak and pine seedlings, however, the difference is whether the acre received containerized or bareroot oak seedlings. The determination as to the acre being planted with containerized or bareroot oak seedlings was randomly selected. Two measurement plots were placed in each of the ten one-acre plots. Half of these plots were treated with 2 ounces of Oust herbicide for herbaceous weed control at the beginning of the first growing season, prior to bud break of the hardwood trees. The study followed a Complete Randomized Split-Plot Design.

RESULTS

This study had excellent survival at the end of the first and second growing seasons. Adequate rainfall occurred throughout the growing season with at least 2 inches of rain per month. One-hundred percent of the green ash seedlings survived the first year and after the second growing season, 100 percent are still surviving. This included both treated and untreated green ash seedlings. Ninety-five percent of the loblolly pine seedlings survived with 100 percent survival on pine seedlings treated for herbaceous weed control and 85 percent survival without weed control at the end of the first growing season. No loblolly pine seedlings were lost during the

second growing season, so their survival numbers are the same as the first year. Containerized oak seedlings survival is 100 percent on both treated and untreated sites for herbaceous weed control after two growing seasons. Bareroot oak seedlings had 85 percent survival on areas untreated for herbaceous weed control and 78 percent on areas receiving weed control during the first growing season. However, bareroot oak seedlings had 8 percent mortality for both treated and untreated seedlings dropping their numbers to 70 percent on areas receiving weed control and 78 percent for untreated seedlings (Table 1).

Seedlings receiving herbaceous weed control had significantly more height growth compared to seedlings without weed control. The height differences were apparent through all three species planted on this site except for bareroot oak seedlings. Containerized oak seedlings had twice the height growth compared to bareroot oak seedlings. Treated containerized oak seedlings had 3.5 times more height growth compared to treated bareroot oak seedlings (Table 2). Treated green ash seedlings grew 1.3 times more than untreated ash seedlings. Loblolly pine height growth was greater on treated plots compared to untreated plots by over a foot of height growth.

Similar growth responses were observed in ground line diameter growth as well. Ground line diameter (GLD) growth was greater on the containerized oak seedlings compared to the bareroot oak seedlings, in fact 3 times greater. The treated containerized oak seedlings had 2.4 times the GLD growth compared to treated bareroot oak seedlings. All treated seedlings including ash, pine and oak had greater GLD growth than untreated seedlings. Treated green ash seedlings had significantly more GLD growth compared to untreated ash seedlings. Pine seedlings on plots treated for herbaceous weed control also had significantly more GLD growth than seedlings on untreated plots (Table 3).

Volume growth calculated in cubic inches really shows the differences between the treated and untreated seedlings and between containerized oak seedlings and bareroot oak seedlings. Containerized oak seedlings had 2.5 times more growth compared to bareroot oak seedlings over two growing seasons. Treated green ash seedlings had 1.5 times more growth compared to untreated ash seedlings. Loblolly pines treated for herbaceous weed control had over 2 times more growth compared to untreated seedlings and all of these differences were significant at the .05 level (Table 4).

CONCLUSIONS

Containerized oak seedlings continue to out grow the bareroot oak seedlings in both height and ground line diameter. Survival is 100 percent for the containerized seedlings while the bareroot oak seedlings are still suffering losses through two growing seasons. The green ash and loblolly pine seedlings did not lose any additional seedlings in the second year of growth. All seedlings receiving herbaceous weed control out grew those that did not receiving weed control. This study is off to a good start with regard to initial growth and survival through two growing seasons. The study will be monitored and measured in the future to determine the effects of planting multiple species as a plantation. The real challenge will be to evaluate this plantation for hardwood pulpwood production while growing high quality sawlogs. The opportunity for the land manager is to match appropriate tree species to their selected site. There is great flexibility in choosing seedlings that match the site and fill market needs of that area. This type of management also allows for the stand to be managed to enhance wildlife habitat while producing needed wood products.

LITERATURE

London, J. D. 1997. Forest statistics for Arkansas counties – 1995. USDA Forest Service Department of Agriculture, Southern Research Station, Resource Bulletin SRS-17. Asheville, NC. 86 p.

Rosson, J. F., Jr., A. J. Hartsell, and J. D. London. 1995. Forest statistics for southwest Arkansas counties – 1995. USDA Forest Service Department of Agriculture, Southern Research Station, Resource Bulletin SRS-194. Asheville, NC. 40 p.

Table 1. Seedling survival rates (percent).

Species	Treated	Untreated
Green Ash	100	100
Loblolly Pine	100	95
Cont. Oak	100	100
B.R. Oak	70	78

Table 2. Height growth (feet).

Containerized Oak	.63a
Bareroot Oak	.32b
Treated C. Oak	.77a
Untreat C. Oak	.21b
Untreat C. Oak	.48a
Untreat BR Oak	.42b
Green Ash treated	1.62a
Green Ash untreated	1.26b
Loblolly pine treated	4.01a
Loblolly pine untreated	3.05b

*Different letters denotes significant differences at .05 level.

Table 3. Ground line diameter growth (inches).

Containerized Oak	.18a
Bareroot Oak	.08b
Treated C. Oak	.22a
Untreat C. Oak	.09b
Untreat C. Oak	.12a
Untreat BR Oak	.07b
Green Ash treated	.54a
Green Ash untreated	.41b
Loblolly pine treated	1.34a
Loblolly pine untreated	1.02b

*Different letters denotes significant differences at .05 level.

Table 4. Volume growth (cubic inches)

Containerized Oak	108.1a
Bareroot Oak	42.8b
Treated C. Oak	135.3a
Untreat C. Oak	80.8b
Untreat C. Oak	80.8a
Untreat BR Oak	47.8b
Green Ash treated	436.5a
Green Ash untreated	301.4b
Loblolly pine treated	1762.8a
Loblolly pine untreated	833.1b

*Different letters denotes significant differences at .05 level.

GLYPHOSATE TOLERANCE OF HORSEWEED (*CONYZA CANADENSIS*) ACCESSIONS FROM KENTUCKY. T. Saphangthong and W.W. Witt; Department of Agronomy, University of Kentucky, Lexington.

ABSTRACT

Field studies were conducted in 2003 to investigate tolerance of horseweed (*Conyza canadensis*) tolerance to glyphosate. Horseweed, also known as marestail in some areas, is native of North America and is a winter annual weed that most often is a problem in continuous no-till fields; although it can be a problem in tilled fields. Eleven Kentucky counties reported problems in controlling horseweed following multiple glyphosate applications in 2001. University of Kentucky weed scientists conducted greenhouse studies on these populations to evaluate glyphosate tolerance in 2002. Plants were grown in the greenhouse and treated with glyphosate at 1.5 lb ae/A. Seven of the eleven biotypes were tolerant of this glyphosate rate. The objective of this current study was to confirm glyphosate tolerance from these horseweed accessions in Kentucky. Horseweed seeds from 5 locations (Spindletop, Trigg, Hardin, Henderson and Calloway) were grown in a greenhouse and then transplanted at the University of Kentucky's Spindletop research station near Lexington. The experimental design was a randomized complete block with a three-factor factorial arrangement of treatments. The first factor was horseweed accession (biotype), one known susceptible (Spindletop) and four suspected tolerant (Trigg, Hardin, Henderson, and Calloway). The second factor was glyphosate rate (Roundup WeatherMax = 0, 32, 64 oz/A) and the third was horseweed height (15, 30 cm). Each treatment was replicated five times. Horseweed height, diameter, number of stems and visual rating were collected 43 DAT and height data 77 DAT. Data were analyzed by using PROC GLM of SAS. The percent height reduction 43 DAT and 77 DAT for the Spindletop accession showed a high degree of susceptibility to Roundup WeatherMax at both rates. In contrast, 40% height reduction of Trigg, Hardin, Henderson and Calloway accessions was noted with Roundup WeatherMax at 32 and 64 oz/A which indicated a high degree of tolerance. The Roundup WeatherMax at 32 or 64 oz/A did not significantly reduce the diameter of the plants from Trigg, Hardin, Henderson and Calloway accessions 43 DAT. However, Spindletop horseweed populations showed a 100% diameter and stem reduction 43 DAT indicating that it was susceptible to Roundup WeatherMax at 32 oz/A. No differences in horseweed height were noted among plants from Hardin, Henderson or Calloway at any time. Roundup WeatherMax at 32 or 64 oz/A had no effect on number of stems per plant compared to the untreated control from the Trigg, Hardin, Henderson and Calloway plants. Roundup WeatherMax at 32 or 64 oz/A did not kill horseweed populations from Trigg, Hardin, Henderson, and Calloway confirming that these plants exhibited tolerance. Roundup WeatherMax at 32 or 64 oz/A killed Spindletop horseweed populations confirming that they were susceptible.

SYMPOSIA

XV. RICE WEED MANAGEMENT & PRODUCTION SYMPOSIUM

NEW RICE VARIETIES AND CURRENT ISSUES IN RICE BREEDING. K.A.K. Moldenhauer, and J. Gibbons University of Arkansas, Rice Research and Extension Center, Stuttgart, AR.

ABSTRACT

Three new rice varieties, Banks, Cybonnet, and Medark are being considered for release by the University of Arkansas Division of Agriculture. They were developed in the breeding program at the University of Arkansas, Rice Research and Extension Center (RREC), Stuttgart, AR. Banks is a high-yielding long-grain with blast resistance. It is derived from a back cross with LaGrue and very similar to LaGrue for yield, plant height, plant type, straighthead resistance and like LaGrue is very susceptible to kernel smut. Cybonnet, the first semidwarf considered for release by Arkansas, is a very- high, stable milling, high-yielding long-grain with blast resistance. In comparison with Cocodrie, Cybonnet has better straight head resistance and does not have the sticky bran layer. Cybonnet is very susceptible to sheath blight. Medark is a semidwarf, medium-grain variety which is very similar to the Bengal variety. Medark has better blast and straight head resistance than Bengal.

The Arkansas rice breeding program involves a multi disciplinary team approach to meet the objectives which include high rough rice and milling yields coupled with acceptable cooking quality, good disease and lodging resistance. Other specific objectives include the development of cold tolerant, straighthead resistant, and insect resistant material as well as extremely early lines that mature in 90 to 100 days. Challenges confronting the breeding program include: combining multiple traits in a single variety; utilizing innovative techniques like marker assisted selection; and a willingness to inspire partnerships and improve integration with industry. Currently, newer breeding approaches, such as anther culture and marker assisted selection are utilized to efficiently speed up the breeding process. Currently, only a few markers are available in closely related germplasm for traits of economic importance, enabling rice breeders to discard "junk" in early generations, for these traits, increasing the efficiency of selection. As availability of markers for other important traits increases they will be evaluated and useful ones will be incorporated into the selection process.

RICE DISEASES AND OTHER WEIRD PROBLEMS IN RICE. R. Cartwright, University of Arkansas, Cooperative Extension Service, Little Rock, AR.

ABSTRACT

Rice (Oryza sativa L.) grown in the southern U.S.A. has several major diseases including sheath blight, blast, kernel smut, seedling disease complex, straighthead, stem rot and bacterial panicle blight. Diseases that can be locally important include false smut, crown (black) sheath rot and brown spot while very minor diseases include white tip, narrow brown leaf spot, leaf smut, sheath rot, scald, aggregate sheath spot, bordered sheath spot and head scab. Besides conventional diseases, many other conditions and factors impact rice health. In recent years, herbicide injury has become a significant confounding factor in diagnosing "diseased" rice and this is particularly true for glyphosate injury associated with nearby glyphosate-resistant crops. As soil fertility levels have decreased in some areas, nutrient deficiencies have become more commonplace including sulfur, phosphorus and potassium deficiencies. Increasing salinity and soil pH in certain regions not only directly impact rice health but also interact with herbicide, nutrient and disease factors to further complicate diagnoses and management. While the southern U.S. rice region does not yet have several important rice diseases common elsewhere, the increasing globalization of agriculture makes introduction of new pathogens more likely. And based on recent history, the increasing sophistication and intensity of rice culture in the South will lead to more complex problems in addition to higher productivity overall.

RICE WEED CONTROL-WHERE HAVE WE BEEN AND WHERE ARE WE HEADING? M.E. Kurtz, Delta Research and Extension Center, Stoneville, MS 38776.

ABSTRACT

This presentation has been a review of rice research presented at the Southern from 1979 to 2003. In 1979, 4 papers were presented with a gradual increase in number to around 38 papers in 2003. Bentazon, bifenox, molinate, oxadiazon, propanil, thiobencarb, and 2,4-D were introduced in 1980; pendimethalin in 1981; lactofen, bromoxynil, and acifluorfen in 1982; fenoxaprop in 1984; quinclorac and mefluidide in 1985; amidachlor and triclopyr in 1986; sethoxydim in 1987; bensulfuron and haloxyfop in 1988; flumioxazin in 1991; bispyribac-sodium, glufosinate, and clomazone in 1994; carfentrazone and halosulfuron in 1997; imazethapyr and fenoxaprop+safener in 1998; maleic hydrazide in 1999; cyhalofop, clefoxadim, and glyphosate in 2000; and mesotrione in 2003.

Comments about the future of rice production and where we are going, reported more biotechnology; no silver bullets on the horizon; a need for a burndown herbicide with residual activity; more regulations are on the way; more postemergence and fewer soil applied herbicides; external influences beyond our control will cause problems; herbicide tolerant rice with output traits is only the beginning; development costs will be supported by the rice market outside the United States; roundup ready has driven several companies from weed control product research; drift will be managed by users or regulatory agencies; glyphosate complaints are not going away; outcrossing with red rice is huge; and with all of this in mind, water is the most important issue. Will we be the problem or part of the solution?

A COUNTY AGENTS PERSPECTIVE ON RICE WEED CONTROL. H. Chaney and B. Griffin, University of Arkansas, Cooperative Extension Service, Prairie County, AR.

ABSTRACT

Prairie County is located in central Arkansas and is a truly agricultural based county. Agriculture is the number one industry for the population of around 9500 folks. Rice is the most important crop in the county with production of over 70,000 acres. Rice yields in Prairie County are often among the highest in the state. Rice weed control is one of the most important production concerns facing our rice growers. The most common weeds in the county include: barnyardgrass, broadleaf signalgrass, red rice, hemp sesbania, jointvetch and aquatic weeds. There is also a growing problem with barnyardgrass that is resistant to propanil and Facet herbicides. Other herbicide related concerns include: glyphosate drift, herbicide carryover, herbicide injury on salt or high pH damaged fields, and herbicide costs.

RICE HYBRIDS BRING DYNAMISM TO THE RICE INDUSTRY IN THE 21ST CENTURY. F. Cuevas, V. McNeely, J. Stroike, M. Wallace, and B. Graf. RiceTec, Inc. Alvin, TX 77512.

ABSTRACT

Hybrid rice was first commercialized in China in 1976 delivering a 20% yield advantage over traditional varieties. The subsequent growth in planted area to about 50% of the 75 million acres grown in that country created great interest among US rice growers. However, differences in rice production systems and grain quality requirements between the two created significant difficulties in commercializing hybrid rice in America. RiceTec, Inc focused on developing hybrid rice for mechanized rice production in the US and released XL6 in 1999. This first product demonstrated the high yield potential, disease resistance, and Nitrogen use efficiency possible with hybrids. Subsequent products, namely XL7, XL8, CLEARFIELD XL8, XP710, and XP712 have expanded hybrid advantage to standability, milling quality, and crop production competitive ability.

Information on probability of return on investment is provided along with the introduction of higher seed-priced hybrids. Chances of reaching above State mean yields in Arkansas (147 bu/A in 2003) increased 40% by growing hybrid XL8 instead of variety Cocodrie, and the probability of the same variety outyielding the hybrid is less that 5%. Hybrid CLEARFIELD XL8 delivered a $50/acre profit over competitive CLEARFIELD varieties in farmers' fields in 2003. Late planted and/or after wheat rice crop is a profitable option to a soybean crop with rice hybrids. Hybrids increased competitive ability allows for efficient lower plant stand management; which also helps reduce red rice dockage at the mill.

Germplasm introduced to US rice production through hybrids has the potential to bring savings for the milling industry by allowing whiter grain in less milling time. Inability to replant hybrid grain as seed represents the best stewardship option for new trait introductions as pollen contamination is more likely to come from red to white rice and exposing a single copy of the gene while providing effective commercial expression. Dynamism of the rice industry can now benefit from speed-to-market tools such as off-season seed multiplication, available to crops other than rice.

XVI. ORGANIC WEED CONTROL SYMPOSIUM

OVERVIEW OF CERTIFICATION FOR ORGANIC CROPS. S. Burwick, Tennessee Crop Improvement Association, Nashville.

ABSTRACT

The Tennessee Department of Agriculture has been responsible for certifying organic crop and livestock production since 2000. For a product to be designated "organic" production and pest management practices must follow National Organic Program guidelines. These guidelines make no claims to food safety or quality. All ingredients must be certified organic and must contain 95% organic products with the remaining 5% which are non-organic substances allowed on the National list. Products that are made with organic ingredients must be at least 70% certified organic with no genetically modified organism (GMO) in remaining 30%. To become certified, growers must apply with certifying agent and be inspected by a certified inspector. To farm organically, the farm must be in organic production for 36 months prior to the crop in question, documentation must be maintained, sources of organic products must be know, seeds cannot be treated, and GMOs cannot be utilized. Cost of certification is approximately $300 to $500, which includes a 3-5 hour inspection. Certification is not required if income is under $5000. The Tennessee Department of Agriculture can rebate up to 75% of cost or up to $500.

CHALLENGES ASSOCIATED WITH WEED MANAGEMENT AT THE ORGANIC UNIT AT THE "CENTER FOR ENVIRONMENTAL FARMING SYSTEMS". N. Ranells, Department of Crop Science, North Carolina State University, Raleigh; N. Creamer, Department of Horticulture, North Carolina State University, Raleigh; J. Gruver, Department of Soil Science, North Carolina State University, Raleigh; and D. Jordan, Department of Crop Science, North Carolina State University, Raleigh.

ABSTRACT

The Center for Environmental Farming Systems (CEFS) has several major components including an Organic Unit. The Organic Unit is comprised of a student farm, an organic research area, and a comparative research area (organic vs. non-organic production). Approximately 20 interns are involved in an intensive 8-week summer internship on sustainable agriculture. Students from classes taught at North Carolina State University and surrounding universities, community colleges, secondary schools along with farmers, Cooperative Extension Agents, and local residents visit the CEFS and the Organic Unit for hands-on instruction on sustainable agriculture issues. Although weed management continues to be a major challenge, variation in the magnitude of the challenge varies among the three units (student farm, research area, and comparative research area). A holistic approach to pest management, including weeds, is employed at the student farm, and weeds have been more easily managed in this system. In contrast, weeds have been more difficult to manage in the organic research area and in the comparative research area, in part because treatments are administered in selected blocks, and the ability to treat production in a more holistic manner is much more difficult. One of the challenges in these research areas relates to typical land approval system for research common to most state ag research services, which may delay implementation of specific research protocols. Timeliness and integration are more critical for organic production than for many crops grown in traditional agriculture. Individual components of management can be more easily incorporated in traditional systems, while careful and holistic management is essential in organic production. The ability to apply salvage treatments once a problem has been exacerbated is a possibility in many cases in traditional agriculture. However, lack of similar backup treatments in organic production makes management and timeliness exceptionally critical. This realization is not only critical for the organic producer but also for researchers comparing the merits of organic and traditional production systems. Research at the organic unit at CEFS continues to help in the development of effective weed management systems for organic producers. Additional information on organic production at CEFS is available at: http://www.cefs.ncsu.edu/organic.htm.

CULTIVATION TO CONTROL WEEDS IN ORGANICALLY PRODUCED CROPS.

D.W. Monks, N.G. Creamer, J.E. Seem and K.M. Jennings, N.C. State University, Raleigh, NC.

ABSTRACT

Cultivation is an integral part of most weed management systems in bareground vegetable production. These crops are high value crops and are very diverse in weed species. Weed management in organically produced crops utilizes non-chemical methods such as cultural practices (living mulches, planting dates, etc), tillage including cultivation, hand removal and flame cultivation. Colquhoun, Bellinder and Kirkwyland from Cornell University in 1999 reported in the Weed Technology Journal that efficacy of cultivation implements can be greatly influenced by soil type, rainfall and crop canopy characteristics. Thus, these methods may not be successful under certain conditions (soils with high clay content, above average rainfall, vine crops).

Critical weed free period (CWFP) is the time during the growth of a crop that the crop needs to be weed free to prevent yield and quality reductions. Implementation of a weed management program in crops produced organically should be based on the CWFP of a crop if known. Many crops such as cabbage, cucumber, muskmelon, squash, sweetpotato, tomato and watermelon have a CWFP of approximately 2 to 6 wk. Thus, maintaining the crop weed free during this time will prevent weeds from having a detrimental affect on these crops.

Studies were conducted at Goldsboro and Kinston NC in 2002 to determine the CWFP of organically produced Beauregard sweetpotato having a mixed weed stand. Two planting dates were included at both locations, and five establishment treatments and five removal treatments (0, 2, 4, 6, and 8 WAT). Weeds were more numerous in early (late May or early June) planted treatments than late (late June) planted treatments suggesting that late season planting might be one method of reducing weed pressure. In addition, at both planting dates and both locations, a CWFP of 2 to 6 wk was observed.

Tillage: A number of cultivating implements are available to maintain the CWFP in organically produced vegetables. They include the flex tine weeder, or the rotary hoe which can be used after seeding but prior to crop emergence; the flex tine weeder, rotary hoe, spring hoe torsion weeder, spiders, sweep, rolling or basket weeder which can be used to kill weeds between crop rows after crop emergence; and the in-row finger cultivators which can be used to kill weeds growing in the row. Each cultivator has optimum crop and weed stages for control.

Mowing: This method of control can be used to establish a CWFP in certain crops such as those crops that are low growing and where weeds emerge over the crop canopy. Studies were conducted in 2001 and 2002 at Clinton NC to determine when Palmer amaranth must be removed from 'Beauregard' sweetpotato to avoid a yield and quality reduction. Palmer amaranth was established at crop transplanting and then removed every 10 days either by cutting at the ground level or mowing at the top of the crop canopy. Mowing Palmer amaranth at the top of the crop canopy produced similar results to cutting the weed at the ground surface. That is, regardless of whether Palmer amaranth is mowed at the top of the crop canopy or cut at the ground surface, this weed must be removed within 10 to 20 days to prevent yield and quality reductions.

Flaming: This method for controlling weeds became popular in the 1960s and recently interest has again increased. Flaming can be used preplant with many crops, after seeding but before emergence of crops that are slow in emergence, and used as a directed or spot treatment after establishment of crops that are either not very susceptible to flaming, or those that quickly recover from flaming.

THE NON-CHEMICAL WEED CONTROL RESEARCH PROGRAM IN GEORGIA: THE GOOD, THE BAD, THE UGLY. W.C. Johnson, III; USDA-ARS, Coastal Plain Experiment Station, Tifton, GA.

ABSTRACT

Weed management in organic crop production systems requires an integration of cultural and mechanical controls, augmented with thermal and biological tactics. Successful weed control depends on careful integration of these tactics, tailored to the crop, weed species composition, and tillage system. Unfortunately, there is little research information on non-chemical weed control on crops grown in the southeastern coastal plain. Therefore, research projects were initiated in 2003 to evaluate nonchemical weed controls in leguminous vegetables, peanut, and turnip green.

Solarization is a proven means of weed control in regions of intense solarization, i.e. the Middle East. In these regions, sunlight is intense enough to heat soil covered by clear plastic to temperatures lethal to weed seed and other propagules. Previous research in the southeastern U. S. has shown unsatisfactory weed control by short-term solarization. It is hypothesized that sacrificing the use of field for an entire summer for solarization and repeated fallow tillage may help reduce densities of yellow nutsedge in future crops. Therefore, trials were initiated in Tifton, GA in 2003 to determine if combinations of summer solarization and frequent fallow tillage deplete populations of yellow nutsedge and provide acceptable non-chemical weed control in fall seeded turnip green. This trial was conducted in a field with a heavy infestation of yellow nutsedge (>50 plants/m^2). Treatments included all possible combinations of solarization (beginning in May, July, September, and nonsolarized) and frequency of shallow tillage (weekly, monthly, and nontilled). Plots were solarized using clear plastic, spread over moist clean seedbeds at the designated times and remained covered for the duration of the summer. Plots were shallow tilled to a depth of 7.6 cm at the appropriate times using a power tiller. Preliminary data analysis showed that weekly tillage and solarization beginning in May reduced the number of yellow nutsedge tubers in the soil and numbers of yellow nutsedge plants in direct seeded turnip green compared to the nontilled and nonsolarized controls. The preliminary analysis of these data suggests that densities of troublesome weeds may be reduced by summer solarization and tillage, which can be useful in organic cropping systems.

Trials were initiated in 2003 to evaluate systems of weed management in peanut using propane flaming. Propane flaming provided acceptable control of small broadleaf weeds, however annual grasses were not controlled. Peanut was very tolerant to over-the-top propane flaming. These preliminary studies show that propane flaming is not a stand-alone practice for non-chemical weed control in peanut due to poor control of annual grasses, but offers potential when carefully integrated with other strategies.

EVALUATION OF WEED CONTROL PRACTICES IN AN ORGANIC BELL PEPPER PRODUCTION SYSTEM. M. Williams; Department of Horticulture, University of Kentucky, Lexington, KY 40546.

ABSTRACT

Bell peppers are a popular and profitable crop for many Kentucky vegetable growers, particularly those selling to the wholesale fresh market. An additional demand exists for bell peppers and a variety of other fruit and vegetable crops produced in large quantities using certified organic practices. Since organic agriculture has quickly become one of the fastest growing segments of American agriculture, there is an economic basis for developing organic production techniques suitable for Kentucky farmers. Five weed management treatments were compared for their weed control effectiveness and influence on bell pepper yields at the University of Kentucky Horticulture Research farm during summer 2003. Treatments included straw, chipped wood mulch, compost, corn gluten and undersown clover as a living mulch. Treatments were applied to peppers planted in bare ground or on black plastic-covered raised beds. Weed density was recorded using objective visual analysis and pepper yield data was collected. Overall pepper yields were greatly reduced on both raised bed and flat ground treatments compared to conventional controls. The plastic-covered raised bed treatments yielded some marketable peppers; however those grown on flat ground produced minimal amounts. Although there was weed control difference between the treatments, none gave acceptable levels of control.

EFFECT OF MOWING ON SICKLEPOD REPRODUCTIVE OUTPUT AND SEED VIABILITY IN ORGANIC SWEET POTATO. M. Burton; Department of Crop Science, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Production of crops without the use of herbicides has gained increasing public interest. Such interest has caught the attention of organic food markets. The organic baby food market is of particular interest to the sweetpotato industry. This study focused on the effects on potential seedbank return of sicklepod after treatment by mowing. Crop yield loss as affected by the presence of sicklepod or mowing treatments was not measured. Benefits of mowing sicklepod are expected to be measured not by immediate economic return, but by long-term benefits of reduced seedrain. As an indeterminate weed, sicklepod continues vegetative (vertical) growth after flowering begins. Consequently, in taller crops, such as soybean, many fruit are borne below the final height of the crop. However, in sweetpotato sicklepod (*Senna obtusifolia*) and other weeds (e.g. *Amaranthus* spp.) tend to produce nearly all of their reproductive structures above the short (approx. 30 cm) sweetpotato canopy, mowing just above the crop canopy may nearly eliminate or drastically reduce weed seedbank return. Therefore, properly timed mowing at a height even with the top of the sweetpotato canopy can drastically reduce the amount of reproductive output. Experiments were conducted on mowing as a weed control alternative to herbicides in 'Beauregard' sweetpotato in Goldsboro, NC, in 2001 and 2002. Time of mowing was based upon the reproductive phenology of sicklepod: mowing when sicklepod fruit were small. In 2001, 46 sicklepod plants in an organic sweetpotato field were numbered and marked with flagging tape. One-half of the sicklepod plants (23) were mowed (September 17) with a bushhog (rotary mower) just above the crop canopy. The bushhog deck height was set as low as possible such that few sweetpotato leaves would be removed during the mowing operation. Two-weeks later, the day before scheduled sweetpotato harvest, all fruit were removed from sicklepod plants. These fruit were sorted into size and color classes (small green, large green, yellow, or brown). The experiment was repeated in 2002, except that sicklepod grew rapidly after the first mowing event (September 9) such that a second mowing operation (September 19) was recommended. In each 2002 treatment (unmowed, mowed once, and mowed twice), 30 plants were evaluated for reproductive output. In each year, fruit were counted and dried to constant weight at 60 C each year. Fruit of the same size classes were collected from neighboring plants to be examined for seed size and viability. These fruit were cut in half and allowed to dry in the field to simulate a mowing treatment. At the time of harvest, average final reproductive biomass of mowed sicklepod plants was reduced by 97% by a single mowing event 2001. In 2002, a single mowing event reduced average reproductive biomass by 63% but mowing a second time reduced final average reproductive biomass by >99%. Although regrowth of branches on many sicklepod plants was as much as 0.5 m, nearly all fruit of mowed plants were borne on new branches and were small due to the short time for development. Seeds within small green pods had almost no cotylendonary resources (flat, shriveled testa) and were non-viable. Sicklepod seeds from larger green pods were viable, but smaller than physiologically mature seeds (1.44 g/100 seeds vs. 2.07 g/100 seeds, respectively).

XVII. GRADUATE STUDENTS SYMPOSIUM

HIRING TWO WEED SCIENCE FACULTY AT THE UNIVERSITY OF TENNESSEE: A SEARCH COMMITTEE'S PERSPECTIVE. T.C. Mueller, G.N. Rhodes, Jr., C.C. Craig, M.A. Thompson, and B.A. Brown; Department of Plant Sciences, University of Tennessee, Knoxville.

ABSTRACT

Several aspects are involved in the process of searching for, interviewing, and eventually hiring new faculty. This presentation focused on the role and functions of a search committee in this important process. The talk included an overview of recent history and the changes at the University of Tennessee, and why two positions were available. It also provided an overview of the faculty selection process, including key milestones, search committee criteria, and aspects used in the evaluation of applicants.

Key milestones in the faculty hiring process include official permission to search (or advertise), then permission to bring in candidates to interview, and then eventually permission to make an offer to the selected person. Prior to advertising the position, a written job description must be drafted and approved. This is not a trivial matter, as this document describes the position, such as the relative percentages (Research/Teaching/Extension) in a joint appointment, the characteristics of the position (i.e. tenure track, 12 month), and a full description of qualifications and duties. Once the position is advertised, the committee (sometimes referred to as a "search and selection" committee) seeks to attract a diverse pool of qualified applicants. Once applications are received by the committee, they are evaluated and a primary and secondary candidate pool is recommended to the hiring authority (administration). An important consideration in searches is that equal opportunity be afforded to all interested candidates, without any preferential treatment. Universities usually have a separate office designated to affirm that no improper prejudicial actions are taken by the search committee. The committee is usually involved in interviewing the candidates, and is often asked to evaluate specifically those people. Once that evaluation is reported to the administration, there role is substantially complete.

Items usually included within an application packet include a letter of interest, a curriculum vitae (CV), transcripts from all attended universities, and a list of references and their contact information. Factors used in the evaluation of candidates vary depending upon the position. In general, most positions will require effective oral and written communications skills, technical aptitude relevant to the position, and the ability to work well with others. Specific items often examined include number of refereed publications, participation in regional or national meetings, and other items relevant to that particular position.

There were two positions recently filled at the University of Tennessee. In one position, we had 14 applicants, 3 candidates, and one person was hired; in the other position, we had 25 applicants, 3 candidates were interviewed, and one person was hired. Students or others should not be overly-discouraged because they did not get an interview, or get the offer. Faculty positions are highly coveted, and vigorously competed for when they open. Much of why a certain person is chosen is a "goodness of fit" for that individual person at that particular time for the needs of that particular department.

SO YOU WANT TO BE A WEED SCIENTIST: VIEWS FROM A DEPARTMENT HEAD. G.N. Rhodes, Jr.; Department of Plant Sciences, University of Tennessee, Knoxville.

ABSTRACT

We have been fortunate in the Plant Sciences Department during the past two years to hire eight new faculty members, two of which are in weed science positions. This presentation focused on how we evaluate candidates for faculty positions, in particular, weed science positions. Of equal importance, it also gave some insight into items that candidates should consider as they evaluate a potential academic employment opportunity in weed science.

Compared to a decade ago, most academic departments at Land Grant universities are larger, more complex and more diverse. This has come about due to several reasons, most of which relate to streamlining and reduction of administrative costs. Consequently, weed scientists find themselves grouped in some cases with various combinations of entomologists, plant pathologists, soil scientists, botanists, molecular geneticists, landscape architects and other diverse professionals. An aspiring young weed scientist may in all likelihood interview with a department which only faintly resembles his or her home department.

Broadly, the most critical thing we look for in candidates is strong evidence of raw talent, creativity, work ethic, cooperation, and communication. Gathering this evidence begins well before the interview, and continues until after the interview. It is essential that you develop a resumé or curriculum vitae (CV) which is competitive with other candidates. Of particular value are refereed journal articles published or accepted, co-authorship on successful grant proposals, and senior authorship on published abstracts.

A high level of professionalism in communications with the Department Head, search committee and faculty before, during and after the interview is expected. Candidates are encouraged to make this their top priority in all written/email communications, telephone conversations, presentation of the seminar(s), and interactions with faculty, students and administrators during the interview. Appearance, eye contact, grammar, diction and enthusiasm do matter. Candidates are also advised to anticipate, and be prepared for, certain questions which relate to their vision for the program, personal and professional goals, and core values.

When evaluating an academic employment opportunity in weed science, candidates should evaluate facilities, technical support, startup funds, “chemistry” of the weed science group and the department as a whole, robustness of the graduate program, and expectations for tenure and promotion. Consideration should also be given to the potential quality of life in that location. Candidates should carefully evaluate the compensation package in terms of benefits such as insurance and leave, retirement, savings opportunities, moving expenses, and salary. If an offer is extended, it is recommended that the candidate get in writing all commitments such as technical support, startup funds, graduate assistantship(s), and time line for tenure and promotion.

WEED SCIENCE RESEARCH OPPORTUNITIES WITH USDA-ARS. W.C. Johnson, III; USDA-ARS, Coastal Plain Experiment Station, Tifton, GA.

ABSTRACT

The Agricultural Research Service (ARS) is the in-house research agency for the United States Department of Agriculture (USDA). The ARS employees 2,100 scientists and 6,000 other employees to conduct agricultural research at 100 locations throughout the U. S. Weed science research is one of the areas of science serviced by the ARS. Long-term, high-risk research is the primary objective of ARS, with technology transfer being an important service as well. ARS research projects on weed science topics can be an individual scientist or several scientists comprising a team. Depending on the local administrative structure, an ARS weed scientist may be assigned to a project with other weed scientists or part of a multidisciplinary team that includes several disciplines. ARS scientists have two levels of supervision; an administrative leader and disciplinary leader. The administrative leader is usually a Research Leader or Laboratory Director, analogous to an academic department head. The administrative leader is responsible for managing the research unit and evaluates annual performance of research scientists in the unit. The discipline leader is the ARS National Program Leader (NPL) for Weed Science. The NPL coordinates and facilitates all weed science research programs in ARS and represents the research programs to Congress and customer groups. ARS compensates research scientists commensurate with their training, experience, and level of responsibility. Employee benefits reflect the Agency's commitment to the well-being of all employees and their families. Performance is evaluated annually, based on the quality of the research program, publications, resource management, and agency representation. In-depth evaluation of a scientist's research program is done on a cyclical basis through the Research Position Evaluation System (RPES). This evaluation is through an anonymous review panel chosen with nationwide representation. Results from this review determine if an employee is promoted within the GS/GM system. Graduate students interested in a weed science research career with ARS are encouraged to monitor to the ARS website at www.ars.usda.gov for position announcements. All applications are submitted to ARS Headquarters in Beltsville, MD for initial screening. A list of qualified applicants is sent to the Research Leader for evaluation by an appointed screening committee. Applicants must clearly document their knowledge, skills, and abilities to fulfill specific research tasks when submitting their application. ARS weed scientists have considerable freedom to tailor their research program according current research needs, with full Agency support. The ARS also provides many opportunities for continuing education through high-quality training. ARS has a legacy of quality weed science research accomplishments and graduate students are encouraged to consider ARS for their career.

MIND MAPPING AND GROUP WRITING/EDITING: A COUPLE OF IDEAS TO REDUCE THE PAIN OF WRITING. S.A. Senseman, Texas A&M University System, Texas Agricultural Experiment Station, College Station, TX.

ABSTRACT

Students are often intimidated when faced with writing assignments. Although there is no magic formula, there are a couple of techniques that may help if they can keep an open mind.

Mind mapping is an expression of radiant thinking which is a more natural method for making and remembering notes than what most of us have been taught. This method employs central themes and images that are connected by a nodal architecture. Mind mapping can be used as a visualization tool for the beginning writer to brainstorm the manuscript and visualize key concepts prior to drafting the paper. Advantages to this type of approach are that the author visualizes a clear start and finish to the writing assignment, the method is easily expandable, key words are clear, and it engages the mind in an exercise of creative thinking compared to the standard linear notes.

Group writing/editing is a concept that involves displaying a manuscript on a screen using a laptop, and LCD projector to edit the manuscript line by line after all co-authors have thoroughly reviewed the manuscript. All authors meet in a conference room without possibility of interruption. This activity takes approximately one day assuming a good quality first draft. After the editing session, the manuscript can be submitted to the journal. In the author's opinion, group writing and editing create a better learning environment for the student and a better mentoring environment for the professor because the writing process occurs within a team-oriented approach. This process encourages more dialogue between co-authors through a focused, decisive, and ultimately efficient writing atmosphere while providing a sense of accomplishment when the article is complete. Ultimately, this process results in a high quality document ready for publication that has been created and co-authored as a group.

TIME MANAGEMENT: THE IMPORTANT, THE URGENT, AND THE EXTRANEOUS. D.R. Shaw; Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Demands on our time seem to be at an all-time high, even though technology gives us the opportunity to be more productive and efficient than ever before. However, expectations seem to increase more rapidly than our productivity, leaving one often feeling pulled in eight directions at once. Career, family, religious, charitable, and personal time demands conflict for the limited amount of time available. Pitfalls that can occur include continuing to do the same thing in the same way while expecting different results, and continually focusing on learning new ways of doing something (e.g. new technologies) rather than just getting the task done. I continually try to remind myself that the urgent things in my life are not necessarily the most important things in my life, and I shouldn't confuse the two. Conscious, honest thought about how I'm spending my time can be as revealing as anything that can be done. Regardless of what you say, how you spend your time and energy says to those around you what you believe to be most important. Thus, planning on specifically how I spend my time can lead to better productivity, better performance, and much greater satisfaction with myself, and with life in general. Failing to plan is equivalent to planning to fail. This not only applies to career-oriented time management, but all of your time – personal, family, and religious. Many of us know that if we spent 24 hours a day, seven days a week, fifty-two weeks a year on our careers, we could still feel like we were not "caught up". However, is this what is most important to me? We should be making conscious decisions regarding the allocation of our time, rather than being caught up in moving from crisis to crisis. Certainly, we should use technologies (cell phones, new software, etc.) to gain efficiency, but don't become a slave to them. Also, learn what works best for you and capitalize on that. For me, my most productive time is early in the morning; I try to use that time for the most urgent and important priorities.

Above all, make the commitment that you will consciously take care of the important aspects of your life, rather than just the urgent. Remember, you move in the direction of your dominant thoughts.

STATE EXTENSION WEED CONTROL PUBLICATIONS

J. D. Byrd, Jr., Section Chairman

Extension weed identification and control publications for all commodities are listed by state. Publication numbers, titles and ordering sources are provided. Publications that must be purchased are designated with price in parentheses following the title. URL addresses are listed for states that have Extension weed control information on the Internet. This report will be updated each year, and published in the Proceedings.

State: ALABAMA

Prepared by: John W. Everest and Mike Patterson

Internet URL: http://www.aces.edu/pubs/

Source: Bulletin Room, Alabama Cooperative Extension System, #6 Duncan Hall, Auburn University, Auburn, AL 36849

Number	Title
CIRCULARS	
ANR-48	Weed Control in Lake and Ponds
ANR-65	Kudzu: History, Uses, & Control
ANR-104	Controlling Smutgrass in Alabama Pastures
ANR-322	Weed Control in Home Gardens
ANR-453	Christmas Tree IPM
ANR-465	Weed Control for Commercial Nurseries
ANR-616	Weeds of Southern Turfgrasses ($15.00)
ANR-715	Cotton Defoliation
ANR-811	Conservation Tillage for Corn in Alabama
ANR-854	Weed Control in Residential Landscape Plantings
ANR-908	Moss and Algae Control in Lawns
ANR-909	Tropical Soda Apple in Alabama
ANR-951	Weed Control Around Poultry Houses and Other Farm Building
ANR-975	Poisonous Plants of the Southeastern United States ($4.00)
ANR-1058	Brush Control
ANR-1128	Weed Identification for Horticultural Crops
ANR-1241	Wanted Dead Not Alive: Cogongrass
INFORMATION SHEETS	
2004IPM-2	Commercial Vegetable IPM
2004IPM-8	Peach IPM
2004IPM-11	Apple IPM
2004IPM-22	Weed Control in Commercial Turfgrass
2004IPM-27	Pecan IPM
2004IPM-28	Forage Crops IPM
2004IPM-223	Noncropland IPM
2004IPM-360	Peanut IPM
2004IPM-413	Soybean IPM
2004IPM-415	Cotton IPM
2004IPM-428	Corn IPM
2004IPM-429	Grain Sorghum IPM
2004IPM-453	Christmas Tree IPM
2004IPM-458	Small Grain IPM
2004IPM-478	Small Fruit IPM
2004IPM-590	Chemical Weed Control for Home Lawns
2004IPM-978	Alfalfa IPM

State: ARKANSAS

Prepared by: Bob Scott, John Boyd, and Ken Smith

Internet URL: http://pubs4sale.uaex.edu/

Order from: Dr. Bob Scott, Box 391, 2301 South University, University of Arkansas Cooperative Extension, Little Rock, AR 72204
[1]Bernadette Hinkle, Box 391, Little Rock, AR 72203

Number	Title
PUBLICATIONS	
MP-44	Recommended Chemicals for Weed and Brush Control in Arkansas
MP-169[1]	Weeds of Arkansas Lawns, Turf, Roadsides, and Recreation Areas: A Guide to Identification ($5.00)
MP-370	Turfgrass Weed Control for Professionals
MP-415	Weed Control in Landscape Plantings
FSA-2109	Home Lawn Weed Control
FSA-2145	Spot Spraying Pasture Brush
FSA-2146	Thistle Control in Arkansas Pastures

A weed control chapter is included in each of the following publications:

MP-192	Rice Production Handbook
MP-197	Soybean Production Handbook
MP-214	Corn Production Handbook
-----	Grain Sorghum Production Handbook
-----	Technology for Optimum Production of Soybeans

Information fact sheets for weed problems in commodity groups such as rice, soybean, forage, cotton, etc. are published as necessary. Color posters of weeds in Wheat, Pastures, and Lawns I and II are also available.

State: FLORIDA

Prepared by: Ken Langeland, William Stall, and Brian Unruh

Internet URL: http://edis.ifas.ufl.edu/publications.html

Order from: Extension Weed Specialist, Agronomy Department, 303 Newell Hall, P. O. Box 110500, University of Florida, Gainesville, FL 32611-0500

[1] Dr. W. M. Stall, Extension Vegetable Weed Specialist, 1255 Fifield Hall, Univ. of Florida, Gainesville, FL 32611-0690

[2] Dr. D. P. H. Tucker, Extension Citrus Management Specialist, IFAS-AREC, 700 Experiment Station Road, Lake Alfred, FL 33850

[3] Dr. K. A. Langeland, Extension Aquatic Weed Specialist, Center for Aquatic Plant Research, 7922 NW 71st Street, Gainesville, FL 32606

[4] Dr. B. R. Unruh, 1523 Fifield Hall, Gainesville, FL 32611

[5] University of Florida Publications, P. O. Box 110011, Gainesville, FL 32611-0011

Number	Title
PUBLICATIONS	
SS-AGR-001	Weed Control in Tobacco
SS-AGR-002	Weed Control in Corn
SS-AGR-003	Weed Control in Peanuts
SS-AGR-004	Weed Control in Cotton
SS-AGR-005	Weed Control in Soybeans
SS-AGR-006	Weed Control in Sorghum
SS-AGR-007	Weed Control in Small Grains Harvested for Grain
SS-AGR-008	Weed Control in Pastures and Rangeland
SS-AGR-009	Weed Control in Sugarcane
SS-AGR-010	Weed Control in Rice
SS-AGR-012	Florida Organo-Auxin Herbicide Rule
SS-AGR-014	Herbicide Prepackage Mixtures
SS-AGR-015	Diagnosing Herbicide Injury
SS-AGR-016	Approximate Herbicide Pricing
SS-AGR-11	Weed Management in Transgenic, Herbicide-Resistant Soybeans
SS-AGR-13	Weed Management in Transgenic, Herbicide-Resistant Cotton
SS-AGR-17	Brazilian Pepper-Tree Control
SS-AGR-22	Identification and Control of Bahiagrass Varieties in Florida
SS-AGR-50	Tropical Soda Apple in Florida
SS-AGR-52	Cogongrass (*Imperata cylindrica*) Biology, Ecology and Control in Florida
SS-AGR-58	Tropical Soda Apple Control - Best Management Practices in 2003
SS-AGR-80	NATURAL AREA WEEDS: Skunkvine (*Paederia foetida*)
SS-AGR-100	Principles of Weed Management
SS-AGR-101	Application Equipment and Techniques
SS-AGR-102	Calibration of Herbicide Applicators
SS-AGR-103	Trade Name, Active Ingredient and Manufacturer
SS-AGR-104	Trade Names of Herbicides Containing a Given Active Ingredient
SS-AGR-105	Common Name, Chemical Name, and Toxicity Rating of Some Herbicides
SS-AGR-106	Names and Addresses of Some Herbicide Manufacturers and Formulators
SS-AGR-108	Using Herbicides Safely and Herbicide Toxicity
SS-AGR-109	Adjuvants
SS-AGR-111	Weed Management in Fence Rows and Non-Cropped Areas

SS-AGR-112	Poison Control Centers
SS-AGR-164	Natural Area Weeds: Air Potato (*Dioscorea bulbifera*)
SS-AGR-165	Natural Area Weeds: Carrotwood (*Cupaniopsis anacardioides*)
SS-Agr-21	Natural Area Weeds: Old World Climbing Fern (*Lygodium microphyllum*)
SS-ORH-004[4]	2003 University of Florida's Pest Control Recommendations for Turfgrass Managers
AGR-72	Labelled Aquatic Sites for Specific Herbicides
AGR-74	Listing of Herbicide, Registrant, and Amount of Active Ingredient
AGR-79	Florida Department of Environmental Protection Aquatic Plant Management Permits
A-87-6[3]	Application Procedure for Use of Grass Carp for Control of Aquatic Weeds
A-87-7[3]	Biology and Chemical Control of Algae
A-87-10[3]	Biology and Chemical Control of Duckweed
A-87-11[3]	Chemical Control of Hydrilla
A-87-12[3]	Florida DNA Aquatic Plant Control Permit Program
ENH-84	Weed Control Guide for Florida Lawns
ENH-88	Activated Charcoal for Pesticide Deactivation
ENH-90	Pesticide Calibration Formulas and Information
ENH-94	Metric System Conversion Factors
ENH-100	Response of Turfgrass and Turfgrass Weeds to Herbicides
ENH-124	Pest Control Guide for Turfgrass Managers
FS WRS-7	Tropical Soda Apple: A New Noxious Weed in Florida
HS-88	Weed Management in Apples
HS-89	Weed Management in Blackberries
HS-90	Weed Managment in Blueberries
HS-91	Weed Management in Grapes
HS-92	Weed Management in Nectarines
HS-93	Weed Management in Peaches
HS-94	Weed Management in Pears
HS-95	Weed Management in Pecans
HS-96	Weed Management in Plums
HS-97	Susceptibility of Weeds to Herbicides
HS-107	2001 Florida Citrus Pest Management Guide
HS-188[1]	Weed Management in Commercial Citrus
HS-189[1]	Weed Control in Cole or Brassica Leafy Vegetables
HS-190[1]	Weed Control in Cucurbit Crops
HS-191[1]	Weed Control in Eggplant
HS-192[1]	Weed Control in Okra
HS-193[1]	Weed Control in Bulb Crops
HS-194[1]	Weed Control in Potato
HS-195[1]	Potato Vine Dessicants
HS-196[1]	Weed Control in Strawberry
HS-197[1]	Weed Control in Sweet Corn
HS-198[1]	Weed Control in Sweet Potato
HS-199[1]	Weed Control in Pepper
HS-200[1]	Weed Control in Tomato
HS-201[1]	Weed Control in Carrots and Parsley
HS-202[1]	Weed Control in Celery
HS-203[1]	Weed Control in Lettuce, Endive, and Spinach
HS-706[1]	Estimated Effectiveness of Recommended Herbicides on Selected Common Weeds in Florida Vegetables

CIRCULAR, BOOKS, AND GUIDES

SS-AGR-20	2003 Weed Management Guide in Agronomic Crops and Non-Crop Areas
280[5]	Families, Mode of Action and Characteristics of Agronomic, Non-Crop and Turf Herbicides
459[2]	Weed Control Guide for Florida Citrus
676	Weed Control in Centipede and St. Augustinegrass
678	Container Nursery Weed Control
707	Weed Control in Florida Ponds
852[4]	Weed Control in Sod Production
1114	Weed Management for Florida Golf Courses
-----[5]	Florida Weed Control Guide ($8.00)
DH-88-05[4]	Turfgrass Weed Control Guide for Lawn Care Professionals
DH-88-07[4]	Commercial Bermudagrass Weed Control Guide
SM-44[5]	Aquatic and Wetland Plants of Florida ($11.00)
SP-35[5]	Identification Manual for Wetland Plant Species of Florida ($18.00)
SP-37[5]	Weeds in Florida ($7.00)
	Florida Weeds Part II ($1.00)
SP-79[5]	Weeds of Southern Turfgrasses ($8.00)
SP-242	Control of Non-native Plants in Natural Areas of Florida

State: GEORGIA

Prepared by: Stanley Culpepper, Tim R. Murphy, and Eric Prostko

Internet URL: http://pubs.caes.uga.edu/caespubs/pubs.html (use for print-on-demand publications)
http://www.gaweed.com/ (contains weed science slide presentations, some publications, etc.)
http://www.georgiaturf.com (contains weed science popular articles related to turfgrasses, weed identification, etc.)

Order from: [1]Ag. Business Office, Room 203, Conner Hall, The University of Georgia, Athens, GA 30602
Make check payable to: Georgia Cooperative Extension Service
[2]HADSS, c/o AgRenaissance Software LLC, P. O. Box 68007, Raleigh, NC 27613

The University of Georgia Cooperative Extension Service is currently in the process of switching to a print -on-demand system for Extension publications. Unless noted by an asterisk (*) the publications shown below are not available at this time through the print-on-demand system. Hard copies of these publications may be obtained by contacting one of Georgia weed scientists listed above.

Number	Title
LEAFLETS	
263	Renovation of Home Lawns
400	Musk Thistle and It's Control
418	Use of Sterile Grass Carp to Control Aquatic Weeds
425	Florida Betony Control in Turfgrass and Ornamentals
CIRCULARS	
713	Commercial Blueberry Culture
796	Roadside Vegetation Management
823	Controlling Moss and Algae in Turf
855	Wild Poinsettia Identification and Control*
865	Tropic Croton Identification and Control in Cotton and Peanut
EXTENSION BULLETINS	
654	Weed Control in Noncropland
829	Principles and Practices of Weed Control in Cotton
978	Weed Control in Home Lawns
984	Turfgrass Pest Control Recommendations for Professionals
986	Forest Site Preparation Alternatives
996	Commercial Watermelon Production
998	Conservation Tillage Crop Production in Georgia
1004	Herbicide Use in Forestry
1005	Georgia Handbook of Cotton Herbicides
1006	Weed Control in Ponds and Small Lakes
1008	Weed Facts: Texas Panicum
1009	Weed Facts: Morningglory Complex
1010	Weed Facts: Sicklepod and Coffee Senna
1019	Cotton Defoliation and Crop Maturity
1023	Herbicide Incorporation
1032	Forestry on a Budget
1043	Weed Facts: Yellow and Purple Nutsedge

1049	Perennial Weed Identification and Control in Georgia
1069	How to Set Up a Post-Emergence Directed Herbicide Sprayer for Cotton
1070	Forage Weed Management
1072	Weed Facts: Florida Beggarweed
1093	Guide to Field Crop Troubleshooting
1098	How to Control Poison Ivy
1100	Peanut Herbicides for Georgia
1118	Non-Chemical Weed Control Methods
1125	Weed Management in Conservation Tillage Cotton
1135	Intensive Wheat Management in Georgia
1138	Conservation Tillage for Peanut Production
1144	Commercial Production of Vegetable Transplants

SPECIAL BULLETINS

28[1]	Georgia Pest Control Handbook ($15.00)*

MISCELLANEOUS

Pub. 46	2004 Georgia Peach Spray and Production Guide
Pub. 377	2004 Georgia Tobacco Growers Guide
Pub. 380	2004 Cotton Production Package
Hdbk. No. 1[1]	Peach Growers Handbook ($25.00)
[1]	Pecan Pest Management Handbook ($20.00)
[1]	Weeds of Southern Turfgrasses ($8.00)
[1]	Poisonous Plants of the Southeastern United States ($4.00)
761[1]	Weeds of the Southern United States ($3.00)
839[1]	Identification and Control of Weeds in Southern Ponds ($3.00)*
----[2]	Georgia HADSS ($95)

State: KENTUCKY

Prepared by: J. D. Green

Internet URL: http://www.ca.uky.edu/agc/pubs/pubs.htm

Order from: Dr. J. D. Green, Extension Weed Control Specialist, Department of Agronomy, N-106B Ag. Sci. Bldg-North, University of Kentucky, Lexington, KY 40546
Dr. James R. Martin, Extension Weed Control Specialist, University of Kentucky Research and Education Center, P. O. Box 469, Princeton, KY 42445

Number	Title
AGR-6	Chemical Control of Weeds in Kentucky Farm Crops
AGR-12	Weeds of Kentucky Turf
AGR-78	Weed Control Recommendations for Kentucky Bluegrass and Tall Fescue Lawns and Recreational Turf
AGR-139	Herbicide Persistence and Carryover in Kentucky
AGR-140	Herbicides with Potential to Carryover and Injure Rotational Crops in Kentucky
AGR-148	Weed Control Strategies for Alfalfa and Other Forage Legume Crops
AGR-172	Weed Management in Grass Pastures, Hayfields, and Fencerows
ID-2	Some Plants of Kentucky Poisonous to Livestock
ID-36	Commercial Vegetable Crop Recommendations
ID-125	A Comprehensive Guide to Wheat Management in Kentucky ($10.00)
ID-139	A Comprehensive Guide to Corn Management in Kentucky ($10.00)

State: LOUISIANA

Prepared by: Steve Kelly

Internet URL: http://www.lsuagcenter.com/nav/publications/pubs.asp

Order from: LSU AgCenter communications, Publications Office, PO Box 25100, Baton Rouge, LA 70894-5100

Number	Title
PUBLICATIONS	
1565	Louisiana's Suggested Chemical Weed Control Guide for 2004 ($4)
1618	Prescribed Burning in Louisiana Pinelands ($1)
2314	Controlling Weeds in Sugarcane ($0.50)
2398	Aquatic Weed Management Herbicides ($0.50)
2410	Aquatic Weed Management Control Methods ($0.50)
2472	Aquafacts: Algal Blooms in Fish Production Ponds ($0.50)
2476	Aquafacts: Grass Carp for Aquatic Vegetation Control ($0.50)
2500	Herbicide Application for the Small Landowner ($0.50)
2740	Control Weeds in Soybeans with Pre and Postemergence Chemicals in 2004 ($1)
2746	2004 Controlling Weeds in Cotton ($1)
2778	Nonchemical Weed Control for Home Landscapes ($0.50)
2820	Louisiana Sugarcane Burning ($1)
8909	Conservation Tillage Systems for Energy Reduction -- Preplant Weed Control in Cotton ($0.50)
RIS 105	Guidelines for Managing Winter Vegetation in Northeast Louisiana

State: MISSISSIPPI

Prepared by: John D. Byrd, Jr.

Internet URL: http://www.ces.msstate.edu/anr/plantsoil/weeds
http://www.msucares.com/pubs/index.html

Order from: Department of Plant & Soil Sciences, Box 9555, Mississippi State, MS 39762-9555
[1] Dr. Marty Brunson, Wildlife & Fisheries, Box 9690, Mississippi State, MS 39762-9690
[2] Dr. John Byrd, Plant & Soil Sciences, Box 9555, Mississippi State, MS 39762-9555
[3] Dr. Andy Londo, Forestry Department, Box 9681, Mississippi State, MS 39762-9681
[4] Mr. Herb Willcutt, Agric. & Bio. Engineering, Box 9632, Mississippi State, MS 39762-9632
[5] Dr. Joe Street, Delta Research & Extension Center, P. O. Box 68, Stoneville, MS 38776
[6] HADSS, c/o AgRenaissance Software LLC, P.O. Box 68007, Raleigh, NC 27613

Number	Title
INFORMATION SHEETS	
673[1]	Control of Fish Diseases and Aquatic Weeds
803	Grain and Forage Sorghum Weed Control
875	Cotton Postemergence and Layby Herbicides
945	Forages Weed Control in Pastures
962	Soybean Preplant Foliar and Preplant Incorporated
963	Soybean Preemergence Weed Control
1024	Soybean - Management Strategies for Sicklepod
1025[1]	Aquatic Weed Identification and Control--Bushy Pondweed and Coontail
1026[1]	Aquatic Weed Identification and Control--Willows and Arrowhead
1027[1]	Aquatic Weed Identification and Control--Cattail and Spikerush
1028[1]	Aquatic Weed Identification and Control--Pondweed and Bladderwort
1029[1]	Aquatic Weed Identification and Control--Fanwort and Parrotfeather
1030[1]	Aquatic Weed Identification and Control--Frogbit and Watershield
1031[1]	Aquatic Weed Identification and Control--Burreed and Bulrush
1032[1]	Aquatic Weed Identification and Control--White Waterlily and American Lotus
1033[1]	Aquatic Weed Identification and Control--Duckweed and Water Hyacinth
1034[1]	Aquatic Weed Identification and Control--Hydrilla and Alligatorweed
1035[1]	Aquatic Weed Identification and Control--Algae
1036[1]	Aquatic Weed Identification and Control--Methods of Aquatic Weed Control
1037[1]	Aquatic Weed Identification and Control--Smartweed and Primrose
1500	Flame Cultivation in Cotton
1527	Peanut Weed Control Recommendations
1528	Kenaf Weed Control Recommendations
1580	Nonchemical Weed Control for Home Owners
1619	Cotton Preplant and Preemergence Weed Control
-----[2]	Tropical Soda Apple in Mississippi
-----[2]	Tropical Soda Apple in the United States
-----[2]	Management Strategies for Tropical Soda Apple in Mississippi

PUBLICATIONS

475	Corn Weed Control Recommendations
461	Commercial Pecan Pest Control-Insects, Diseases and Weeds
553	Weed Science for 4-H'ers
1005[3]	Christmas Tree Production in Mississippi
1006[4]	Calibration of Ground Spray Equipment
1091	Garden Tabloid
1100	Soybeans Postemergence Weed Control
1217[5]	Rice Weed Control
1277[3]	Forest Management Alternatives for Private Landowners
1322	Establish and Manage Your Home Lawn
1344	Weed Control in Small Grain Crops
1532	2004 Weed Control Guidelines for Mississippi ($7.00)
1664	Disease, Insect and Weed Control Guide for Commercial Peach Orchards
1744	Weed Control in Home Lawns
1907	Herbicide Resistance Prevention and Detection
1934	Weed Response to Selected Herbicides
1962	Pesticides - Benefits and Risks
2036	Organic Vegetable IPM Guide
2166[2]	Poisonous Plants of the Southeastern United States

TECHNICAL NOTES

MTN-SG[3]	Weed Control in Christmas Tree Plantations
MTN-7F[3]	An Overview of Herbicide Alternatives for the Private Forest Landowner
MTN-8F[3]	Tree Injection: Equipment, Methods, Effective Herbicides, Productivity, and Costs
MTN-11F[3]	Effective Kudzu Control

COMPUTER SOFTWARE

-----[6]	Mississippi HADSS ($95.00)

State: MISSOURI

Prepared by: Andy Kendig

Internet URL: http://outreach.missouri.edu/main/publications.shtml

Order from: Extension Publications, 2800 Maguire, University of Missouri, Columbia, MO 65211
Add $1.00 for shipping and handling with each order.

Number	Title
MP575	Weed Control Guide for Missouri Field Crops ($7.50)
MP581	Weed and Brush Control Guide for Forages, Pastures, and Non-Cropland in Missouri ($5.00)
MP686	Using Reduced Herbicide Rates for Weed Control in Soybeans ($1.00)
G4251	Cotton Weed Control ($0.75)
G4851	Atrazine: Best Management Practices and Alternatives in Missouri ($0.75)
G4856	Aquatic Weed Control in Missouri ($1.00)
G4871	Waterhemp Management in Missouri ($0.50)
G4872	Johnsongrass Control
G4875	Control of Perennial Broadleaf Weeds in Missouri Field Crops ($0.75)
NCR614	Early Spring Weeds of No-Till Production

State: NORTH CAROLINA

Prepared by: David Monks, Joe Neal, Fred Yelverton, and Alan York

Internet URL: http://cipm.ncsu.edu/ent/ncpmip/

Order from: Dr. Fred Yelverton or Dr. A. C. York, Crop Science Department, Box 7620, North Carolina State University, Raleigh, NC 27695-7620
[1] Dr. J. C. Neal or Dr. D. W. Monks, Department of Horticulture, Box 7609, North Carolina State University, Raleigh, NC 27695-7609
[2] Communication Services, N. C. State University, 3210 Faucette Dr., Box 7603, Raleigh, NC 27695-7603
[3] Dr. David Ritchie, Department of Horticulture, Box 7609, North Carolina State University, Raleigh, NC 27695-7609
[4] HADSS, c/o AgRenaissance Software LLC, P. O. Box 68007, Raleigh, NC 27613

Number	Title
PUBLICATIONS	
AG-37[1]	Agricultural Chemicals for North Carolina Apples
AG-146[1]	Peach and Nectarine Spray Schedule
AG-187	Tobacco Information - 2004
AG-208	Identifying Seedling and Mature Weeds in Southeastern United States ($7.00)
AG-331	2004 Peanut Information
AG-348	Turfgrass Pest Management Manual ($7.00)
AG-408	Pest Control for Professional Turfgrass Managers 2004
AG-417	2004 Cotton Information
AG-427[1]	Weed Control Suggestions for Christmas Trees, Woody Ornamentals and Flowers ($7.50)
AG-437	Weed Management in Small Ponds
AG-438	Weed Control in Irrigation Water Supplies
AG-442	Using Activated Charcoal to Inactivate Agricultural Chemicals Spills
AG-449	Hydrilla, A Rapidly Spreading Aquatic Weed in North Carolina
AG-456	Using Grass Carp for Aquatic Weed Management
AG-572[2]	Integrated Orchard Management Guide for Commercial Apples in the Southeast
AG-580	Small Grain Production Guide
AG-594	North Carolina Corn Production Guide
B-414	Stock-Poisoning Plants of North Carolina ($5.00)
-----	North Carolina Agricultural Chemicals Manual ($22.00-Revised yearly)
-----[3]	Southern Peach, Nectarine, and Plum Pest Management and Cultural Guide
INFORMATION LEAFLETS	
HIL205B[1]	Weed Control Options for Strawberries on Plastic
HIL325[1]	Peach Orchard Weed Management
HIL380	Orchard Floor Management in Pecans
HIL449	Weed Management in Conifer Seedbeds
HIL570	Greenhouse Weed Management
HIL643[1]	Weed Control for Bulbs in the Landscape
HIL644	Weed Management in Annual Color Beds
HIL647	Controlling Yellow Nutsedge in Landscape Plantings
HIL648	Postemergence, Nonselective Herbicides for Landscapes and Nurseries
HIL649	Weed Management in Conifer Seedbeds and Transplant Beds
HIL8101[1]	Weed Control in Vegetable Gardens

HIL900	Musk Thistle
HIL901	Canada Thistle
HIL902	Mugwort
HIL903	Mulberry Weed
HIL904	Florida Betony
HIL905	Japanese Stiltgrass
—[4]	North Carolina HADSS ($95)

State: OKLAHOMA

Prepared By: Case Medlin

Internet URL: http://agweb.okstate.edu/pearl/

Videotapes: Agricultural Communications, Room 111, Public Information Building, Oklahoma State University, Stillwater, OK 74078

Publications: Central Mailing Services, Publishing and Printing, Oklahoma State University, Stillwater, OK 74078

Number	Title
CIRCULAR	
E-832	OSU Extension Agent's Handbook of Insect, Plant Disease, and Weed Control
E-943	Alfalfa Harvest Management Discussions with Cost-Benefit Analysis
E-948	Aerial Pesticide Drift Management
E-949	Alfalfa Stand Establishment Questions and Answers
B-812	Hogpotato: Its Biology, Competition, and Control
F-2089	Alfalfa Stand Establishment
F-2586	Wheat for Pasture
F-2587	Bermudagrass for Grazing or Hay
F-2850	Eastern Redcedar and Its Control
F-2868	Eastern Redcedar Ecology and Management
F-2873	Ecology and Management of Western Ragweed on Rangeland
F-2874	Ecology and Management of Sericea Lespedeza
F-2776	Thistles in Oklahoma and Their Identification
F-2869	Management Strategies for Rangeland and Introduced Pastures
F-2875	Intensive Early Stocking
F-7318	Integrated Control of Musk Thistle in Oklahoma
FS-2774	Cheat Control in Winter Wheat
FS-9998	Clearfield Wheat Production Systems in Oklahoma

State: SOUTH CAROLINA

Prepared By: Bert McCarty, Ed Murdock, and Jason Norsworthy

Internet URL: http://www.clemson.edu/public/

Order From: Dr. E. C. Murdock, Pee Dee Res. & Ext. Center, 2200 Pocket Road, Florence, SC 29501-9706
[1] Bulletin Room, Room 82, Poole Agricultural Center, Clemson University, Clemson, SC 29634-0311

Number	Title
CIRCULAR	
463	Small Grain Production Guidelines for South Carolina
569	South Carolina Tobacco Grower's Guide
588	Peanut Production Guide for South Carolina
669	Canola Production in South Carolina
697	Turf Herbicide Families and Their Characteristics
698	Designing and Maintaining Bermudagrass Sports Fields in the United States
699	2004 Pest Control Recommendations for Professional Turfgrass Managers
702	Sod Production in the Southern United States
707	Southern Lawns
-----[1]	2003 Pest Management Handbook ($25.00)
BULLETINS	
150	Weeds of Southern Turfgrasses
LEAFLETS	
Forage No. 6	Weed Control in Bermudagrass
Forage No. 9	Weed Control in Tall Fescue
Forage No. 17	Weed Management in Perennial Pastures and Hay Fields

State: TENNESSEE

Prepared By: Darren K. Robinson and Larry Steckel

Internet URL: http://www.utextension.utk.edu/weedcontrol/weedcontrol.html

Order From: Extension Mailing Room, P.0. Box 1071, University of Tennessee, Knoxville, TN 37901

Number	Title
PUBLICATIONS	
956	Managing Lawn Weeds: A Guide for Tennessee Homeowners
1197	Commercial Fruit Spray Schedules
1226	Weed Management in Ornamental Nursery Crops
1282	Commercial Vegetable Disease, Insect and Weed Control
1521	Hay Crop and Pasture Weed Management
1538	Chemical Vegetation Management on Noncropland
1539	Weed Management Recommendations for Professional Turfgrass Managers
1580	2004 Weed Control Manual for Tennessee Field Crops
1659	Weeds in Ornamental Plantings: A Management Plan for Tennessee Homeowners
1758	Weed Management in Annuals, Perennials and Herbaceous Ground Covers: Nursery Production and Professional Grounds Maintenance

State: TEXAS

Prepared By: Dr. Paul A. Baumann

Internet URL: http://tcebookstore.org/

Order From: Dr. Paul A. Baumann, Extension Weed Specialist, 349 Soil & Crop Sciences, Texas A&M University, College Station, TX 77843-2474

Number	Title
B-1466	Chemical Weed and Brush Control - Suggestions for Rangeland
B-5038	Suggestions for Weed Control in Pastures and Forage Crops
B-5039	Suggestions for Weed Control in Cotton
B-5042	Suggestions for Weed Control in Corn
B-5045	Suggestions for Weed Control in Sorghum
B-6010	Suggestions for Weed Control in Peanuts
B-6139	Weed Control Recommendations in Wheat
L-1708	Wild Oat Control in Texas
L-2254	Common Weeds in Corn and Grain Sorghum
L-2301	Common Weeds in Cotton
L-2302	Common Weeds in West Texas Cotton
L-2339	Field Bindweed Control in the Texas High Plains
L-2436	Silverleaf Nightshade Control in Cotton in West Texas
L-5102	Perennial Weed Control During Fallow Periods in the Texas High Plains
B-6081	Herbicides: How They Work and The Symptoms They Cause
B-6079S	Como identificar malezas: Las estructuras de la planta son la clave
B-6079	Weed Identification: Using Plant Structures as a Key
L-5205	Reducing Herbicides in Surface Waters-Best Management Practices
L-5204	Some Facts About Atrazine
L-5324	Protecting the Environment-Using Integrated Weed Management in Lawns

State: VIRGINIA

Prepared By: Scott Hagood

Internet URL: gopher://ext.vt.edu:70/11/vce-data

Order From: Virginia Polytechnic Institute and State University, Extension Distribution Center, Landsdowne St., Blacksburg, VA 24061

Number	Title
PUBLICATIONS	
456-016	Pest Management Guide for Field Crops
456-017	Pest Management Guide for Horticultural and Forest Crops
456-018	Pest Management Guide for Home Grounds and Animals

Revised annually ($20.00 per copy or all three for $55)

WEED SURVEY – SOUTHERN STATES

2004

Grass Crops Subsection

(Corn; Grain Sorghum, Hay, Pastures, and Rangelands; Rice; Small Grains; Sugarcane; Turf; Wheat)

Theodore M. Webster
Chairperson

Information in this report is provided by the following individuals:

Alabama	John Everest	Mike Patterson
Florida	Barry J. Brecke J. Bryan Unruh C. G. Chambliss	A. Bennett A.S. Blount J. J. Mullahey
Georgia	A. Stanley Culpepper Eric P. Prostko	Tim R. Murphy R. Dewey Lee
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Puerto Rico	Maria de L. Lugo	Nelson Semidey
Tennessee	Scott McElroy	
Texas	Paul Baumann	Todd Baughman
Virginia	Shawn Askew	

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Corn.

	States		
Ranking	Alabama	Florida	Georgia
Ten Most Common Weeds			
1	Broadleaf signalgrass	Crabgrasses	Crabgrasses
2	Crabgrasses	Goosegrass	Texas panicum
3	Morningglories	Florida pusley	Morningglories
4	Florida pusley	Texas panicum	Pigweeds
5	Pigweeds	Sicklepod	Sicklepod
6	Sicklepod	Florida beggarweed	Common cocklebur
7	Johnsongrass	Morningglories	Johnsongrass
8	Fall panicum	Pigweeds	Florida beggarweed
9	Common cocklebur	Common cocklebur	Yellow nutsedge
10	Nutsedges	Nutsedges	Common bermudagrass
Ten Most Troublesome Weeds			
1	Texas panicum	Texas panicum	Texas panicum
2	Morningglories	Florida beggarweed	Morningglories
3	Sicklepod	Sicklepod	Pigweeds
4	Fall panicum	Nutsedges	Sicklepod
5	Johnsongrass	Morningglories	Nutsedges
6	Common cocklebur	Common cocklebur	Florida beggarweed
7	Broadleaf signalgrass	Pigweeds	Crabgrasses
8	Pigweeds	Goosegrass	Johnsongrass
9	Smooth crabgrass	Crabgrasses	Pennsylvania smartweed
10	Nutsedges	Wild radish	

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Corn (continued).

	States		
Ranking	Kentucky	Louisiana	Mississippi
Ten Most Common Weeds			
1	Smooth pigweed	Johnsongrass	Broadleaf signalgrass
2	Giant foxtail	Broadleaf signalgrass	Annual morningglories
3	Large crabgrass	Crabgrasses	Southern crabgrass
4	Johnsongrass	Morningglories	Common cocklebur
5	Ivyleaf morningglory	Itchgrass	Johnsongrass
6	Common cocklebur	Nutsedges	Sicklepod
7	Giant ragweed	Barnyardgrass	Purple nutsedge
8	Honeyvine milkweed	Pigweeds	Pigweeds
9	Fall panicum	Hemp sesbania	Pennsylvania smartweed
10	Yellow nutsedge	Sicklepod	Goosegrass
Ten Most Troublesome Weeds			
1	Honeyvine milkweed	Morningglories	Broadleaf signalgrass
2	Broadleaf signalgrass	Johnsongrass	Annual morningglories
3	Burcucumber	Itchgrass	Common cocklebur
4	Trumpetcreeper	Nutsedges	Common bermudagrass
5	Giant ragweed	Swinecress	Horsenettle
6	Johnsongrass	Culteaf eveningprimrose	Purple nutsedge
7	Common pokeweed	Ryegrass spp.	Sicklepod
8	Ivyleaf morningglory	Curly dock	Palmer amaranth
9	Yellow nutsedge	Sicklepod	Southern crabgrass
10	Musk thistle	Hemp sesbania	Yellow nutsedge

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Corn (continued).

	States		
Ranking	North Carolina	Oklahoma	Puerto Rico
Ten Most Common Weeds			
1	Large crabgrass	Palmer amaranth	Johnsongrass
2	Broadleaf signalgrass	Johnsongrass	Crabgrasses
3	*Amaranthus* spp.	Velvetleaf	Red sprangletop
4	Common lambsquarters	Common waterhemp	Itchgrass
5	Annual morningglories	Kochia	Alexandergrass
6	Sicklepod	Common cocklebur	Goosegrass
7	Fall panicum	Morningglories	Junglerice
8	Common ragweed	Common lambsquarters	Horse purslane
9	Common cocklebur	Barnyardgrass	Pigweeds
10	Johnsongrass	Large crabgrass	Wild poinsettia
Ten Most Troublesome Weeds			
1	Annual morningglories	Common waterhemp	Itchgrass
2	Burcucumber	Palmer amaranth	Johnsongrass
3	Common milkweed	Johnsongrass	Nutsedges
4	Hemp dogbane	Field bindweed	Bermudagrass
5	Carolina horsenettle	Yellow nutsedge	Crabgrasses
6	Common bermudagrass	Morningglories	Goosegrass
7	Broadleaf signalgrass	Kochia	Junglerice
8	Texas panicum	Field sandbur	Alexandergrass
9	Purple nutsedge	Shattercane	Wild poinsettia
10	Fall panicum	Common cocklebur	Red sprangletop

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Corn (continued).

Ranking	State Texas
Ten Most Common Weeds	
1	Pigweeds
2	Johnsongrass
3	Sunflower
4	Morningglories
5	Barnyardgrass
6	Browntop panicum
7	Texas panicum
8	Velvetleaf
9	Crabgrasses
10	Kochia
Ten Most Troublesome Weeds	
1	Morningglories
2	Field bindweed
3	Texas panicum
4	Johnsongrass
5	Crabgrass
6	Pigweeds
7	Field bindweed
8	Silverleaf nightshade
9	Russian Thistle
10	Sunflower

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Grain sorghum.

	States		
Ranking	Alabama	Florida	Georgia
Ten Most Common Weeds			
1	Crabgrasses	Crabgrasses	Crabgrasses
2	Morningglories	Goosegrass	Texas panicum
3	Common cocklebur	Texas panicum	Morningglories
4	Johnsongrass	Morningglories	Pigweeds
5	Sicklepod	Common cocklebur	Sicklepod
6	Pigweeds	Sicklepod	Common cocklebur
7	Prickly sida	Pigweeds	Johnsongrass
8	Florida pusley	Florida beggarweed	Florida beggarweed
9	Nutsedges	Johnsongrass	Nutsedges
10	Broadleaf signalgrass	Nutsedges	Bermudagrass
Ten Most Troublesome Weeds			
1	Johnsongrass	Crabgrasses	Texas panicum
2	Broadleaf signalgrass	Texas panicum	Johnsongrass
3	Sicklepod	Goosegrass	Morningglories
4	Morningglories	Sicklepod	Crabgrasses
5	Common cocklebur	Pigweeds	Bermudagrass
6	Crabgrasses	Morningglories	Common cocklebur
7	Pigweeds	Nutsedges	Pigweeds
8	Nutsedges	Florida pusley	Sicklepod
9	Texas panicum	Florida beggarweed	Nutsedges
10	Fall panicum	Common cocklebur	Florida beggarweed

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Grain sorghum (continued).

	States		
Ranking	Louisiana	Mississippi	North Carolina
Ten Most Common Weeds			
1	Crabgrasses	Broadleaf signalgrass	Large crabgrass
2	Broadleaf signalgrass	Southern crabgrass	Broadleaf signalgrass
3	Johnsongrass	Pitted morningglory	*Amaranthus* spp.
4	Barnyardgrass	Common cocklebur	Common lambsquarters
5	Morningglories	Sicklepod	Annual morningglories
6	Bermudagrass	Pigweeds	Sicklepod
7	Pigweeds	Common bermudagrass	Fall panicum
8	Goosegrass	Barnyardgrass	Common ragweed
9	Nutsedges	Johnsongrass	Common cocklebur
10	Sicklepod	Pennsylvania smartweed	Johnsongrass
Ten Most Troublesome Weeds			
1	Johnsongrass	Johnsongrass	Johnsongrass
2	Crabgrasses	Broadleaf signalgrass	Broadleaf signalgrass
3	Broadleaf signalgrass	Common bermudagrass	Large crabgrass
4	Barnyardgrass	Annual morningglories	Common bermudagrass
5	Morningglories	Common cocklebur	Annual morningglories
6	Bermudagrass	Purple nutsedge	Sicklepod
7	Pigweeds	Barnyardgrass	Goosegrass
8	Goosegrass	Palmer amaranth	Fall panicum
9	Itchgrass	Honeyvine milkweed	*Amaranthus* spp.
10	Nutsedges	Southern crabgrass	Carolina Horsenettle

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Grain sorghum (continued).

	States		
Ranking	Oklahoma	Puerto Rico	Texas
Ten Most Common Weeds			
1	Pigweeds	Johnsongrass	Pigweeds
2	Large crabgrass	Large crabgrass	Sunflower
3	Johnsongrass	Red sprangletop	Johnsongrass
4	Shattercane	Itchgrass	Morningglories
5	Common cocklebur	Alexandergrass	Browntop panicum
6	Fall panicum	Goosegrass	Barnyardgrass
7	Texas panicum	Junglerice	Field bindweed
8	Kochia	Horse purslane	Witchgrass
9	Morningglories	Pigweeds	Crabgrass
10	Common lambsquarters	Wild poinsettia	Field sandbur
Ten Most Troublesome Weeds			
1	Johnsongrass	Itchgrass	Johnsongrass
2	Shattercane	Johnsongrass	Texas panicum
3	Pigweeds	Bermudagrass	Sunflower
4	Clammy groundcherry	Crabgrasses	Field bindweed
5	Field bindweed	Goosegrass	Morningglories
6	Large crabgrass	Nutsedges	Witchgrass
7	Yellow foxtail	Junglerice	Pigweeds
8	Field sandbur	Alexandergrass	Silverleaf nightshade
9	Barnyardgrass	Wild poinsettia	Russian thistle
10	Common cocklebur	Red sprangletop	Kochia

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Hay, Pastures, and Rangelands.

	States		
Ranking	Alabama	Alabama	Alabama
Ten Most Common Weeds	Alfalfa	Hay	Pasture
1	Chickweeds	Crabgrasses	Dogfennel
2	Henbit	Bahiagrass	Broomsedge
3	Annual ryegrass	Smutgrass	Thistles
4	Crabgrasses	*Rubus* spp.	Buttercups
5	Curly dock	Carolina horsenettle	Horseweed
6	Wild mustard	Pigweeds	*Rubus* spp.
7	Wild radish	Dogfennel	Crabgrasses
8	Bittercresses	Horseweed	Curly dock
9	Buttercups	Red sorrel	Little barley
10	Pigweeds	Field sandbur	Carolina horsenettle
Ten Most Troublesome Weeds	Alfalfa	Hay	Pasture
1	Buttercups	Carolina horsenettle	Prickly pears
2	Pigweeds	*Rubus* spp.	Carolina horsenettle
3	Wild radish	Pigweeds	Smutgrass
4	Wild mustard	Smutgrass	Dogfennel
5	Crabgrasses	Bahiagrass	*Rubus* spp.
6	Henbit	Dogfennel	Broomsedge
7	Curly dock	Horseweed	Curly dock
8	Thistles	Red sorrel	Thistles
9	Bermudagrass	Crabgrasses	Vervains
10	Chickweeds	Field sandbur	Horseweed

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Hay, Pastures, and Rangelands (continued).

	States		
Ranking	Florida	Georgia	Kentucky
Ten Most Common Weeds			
1	Carpetgrass	Crabgrasses	Crabgrasses
2	Sandburs	*Amaranthus* spp.	Musk thistle
3	Smutgrass	Thistles	Tall ironweed
4	Briars	Carolina horsenettle	Buttercups
5	Vaseygrass	Bahiagrass	Foxtails
6	Dogfennel	Buttercups	Spiny amaranth
7	Tropical soda apple	Dogfennel	Chicory
8	Southern waxmyrtle	*Rubus* spp.	Broomsedge
9	Common bermudagrass	Bitter sneezeweed	Curly dock
10	Annual sedge	Broomsedge	Common cocklebur
Ten Most Troublesome Weeds			
1	Sandburs	Carolina horsenettle	Tall ironweed
2	Smutgrass	Thistles	Musk thistle
3	Tropical soda apple	Bahiagrass	Spiny amaranth
4	Dogfennel	Johnsongrass	Purpletop
5	Southern waxmyrtle	Crabgrasses	Multiflora rose
6	Briars	Smutgrass	Blackberries
7	Thistles	Field sandbur	Buckbrush
8	Cogongrass	*Rubus* spp.	Broomsedge
9	Pricklypears	Dogfennel	Eastern red cedar
10	Horseweed	Nutsedges	Horsenettle

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Hay, Pastures, and Rangelands (continued).

	States		
Ranking	Louisianna	Mississippi	North Carolina
Ten Most Common Weeds			
1	Crabgrasses	Broadleaf signalgrass	Carolina horsenettle
2	Broadleaf signalgrass	Dallisgrass	Large crabgrass
3	Foxtails	Rootknot foxtail	Curly dock
4	Curly dock	Southern crabgrass	Buttercups (hairy, bulbous)
5	Wooly croton	Carolina horsenettle	Wild radish/mustard
6	Dogfennel	Dogfennel	*Paspalum* spp. (Bahiagrass, Vaseygrass, Dallisgrass)
7	Spiny amaranth	Spiny amaranth	Italian ryegrass
8	Smutgrass	Thistles	Pigweeds (spiny amaranth, redroot pigweed)
9	*Rubus* spp.	Blackberry	Orchardgrass
10	Buttercups	Broomsedge	Broadleaf signalgrass
Ten Most Troublesome Weeds			
1	Smutgrass	Rootknot foxtail	Carolina horsenettle
2	Bahiagrass	Broomsedge	Large crabgrass
3	Foxtails	Carolina horsenettle	*Paspalum* spp. (Bahiagrass, Vaseygrass, Dallisgrass)
4	Bluestem/Broomsedge	Boneset	Orchardgrass
5	Buttercups	Dallisgrass	Broadleaf signalgrass
6	Southern waxmyrtle	Dogfennel	*Rubus* spp. (dewberry, blackberry)
7	Spiny amaranth	Spiny amaranth	Curly dock
8	Multiflora rose	Thistles	Buttercups (hairy, bulbous)
9	Vaseygrass	Perilla mint	Wild radish/mustard
10	Chinese tallow	Smutgrass	Italian ryegrass

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Hay, Pastures, and Rangelands (continued).

	States		
Ranking	Oklahoma	Puerto Rico	Texas
Ten Most Common Weeds			
1	Eastern red cedar	Tall albizia	Wooly croton
2	Western ragweed	Cortadera (*Paspalum millegrana*)	Annual broomweed
3	Common broomweed	Cortadero (*Paspalum virgatum*)	Western ragweed
4	Louisiana broomweed	Casha	Ryegrass
5	Woolly croton	Giant milkweed	Field sandbur
6	Common milkweed	Mesquite	Bitter sneezeweed
7	Sericea lespedeza	Thorny sensitive plant	Marshelder
8	Sandburs	Catclaw mimosa	Bahiagrass
9	Carolina horsenettle	Climbing mimosa	Johnsongrass
10	Shinnery oak	Wire weed	Crabgrass
Ten Most Troublesome Weeds			
1	Sericea lespedeza	Tall albizia	K.R. bluestem
2	Sandburs	Cortadera (*Paspalum millegrana*)	Texas bullnettle
3	Common milkweed	Casha	Carolina horsenettle
4	Carolina horsenettle	Mesquite	Marshelder
5	Wavyleaf thistle	Climbing mimosa	Dallisgrass
6	Ironweed	Cortadero (*Paspalum virgatum*)	Field sandbur
7	Shinnery oak	Catclaw mimosa	Smutgrass
8	Silverleaf nightshade	Venezuela grass	Rice flatsedge
9	Buckbrush	Giant milkweed	Vaseygrass
10	Mesquite	Wire weed	Crabgrass

Table 4. The Southern States 10 Most Common and Troublesome Weeds in Rice.

	States		
Ranking	Florida	Louisiana	Mississippi
Ten Most Common Weeds			
1	Purple nutsedge	*Echinochloa* spp.	Barnyardgrass
2	Texasweed	Red rice	Hemp sesbania
3	Yellow nutsedge	*Leptochloa* spp.	Pitted morningglory
4	Alligatorweed	Ducksalad	Palmleaf morningglory
5	Fall panicum	Alligatorweed	Red rice
6	Sprangletops	Hemp sesbania	Ducksalad
7	Barnyardgrass	Annual sedges	Purple ammania
8	Dayflowers	*Commelina* spp.	Amazon sprangletop
9	Spiny amaranth	*Aeschynomene* spp.	Broadleaf signalgrass
10	Goosegrass	Eclipta	Yellow nutsedge
Ten Most Troublesome Weeds			
1	Purple nutsedge	Red rice	Barnyardgrass
2	Yellow nutsedge	*Paspalum* spp.	Palmleaf morningglory
3	Texasweed	*Leptochloa* spp.	Pitted morningglory
4	Alligatorweed	*Cyperus* spp.	Red rice
5	Sprangletops	Alligatorweed	Amazon sprangletop
6	Primrose willow	Texasweed	Ducksalad
7	Dayflowers	Ducksalad	Purple ammania
8	Fall panicum	*Commelina* spp.	Yellow nutsedge
9	Barnyardgrass	Picklerweed	Broadleaf signalgrass
10	Goosegrass	*Sagittaria* spp.	Hemp sesbania

Table 5. The Southern States 10 Most Common and Troublesome Weeds in Small Grains.

	States		
Ranking	Alabama	Florida	Georgia
Ten Most Common Weeds			
1	Mustards	Cutleaf eveningprimrose	Wild radish
2	Annual ryegrass	Virginia pepperweed	Henbit
3	Cutleaf eveningprimrose	Italian ryegrass	Cutleaf eveningprimrose
4	Henbit	Wild radish	Italian ryegrass
5	Wild radish	Carpetweed	Chickweeds
6	Chickweeds	Corn spurry	Wild garlic/onion
7	Wild garlic	Cudweeds	Swinecress
8	Virginia pepperweed	Curly dock	Vetch spp.
9	Curly dock	Wild garlic	Little barley
10	Little barley	Henbit	Curly dock
Ten Most Troublesome Weeds			
1	Annual ryegrass	Wild radish	Italian ryegrass
2	Wild mustard	Wild garlic	Wild radish
3	Wild radish	Curly dock	Wild garlic
4	Wild garlic	Corn spurry	Henbit
5	Henbit	Cutleaf eveningprimrose	Chickweeds
6	Curly dock	Virginia pepperweed	Swinecress
7	Cutleaf eveningprimrose	Italian ryegrass	Curly dock
8	Cheat	Henbit	Cutleaf eveningprimrose
9	Little barley	Carpetweed	Little barley
10	Virginia pepperweed	Cudweeds	Vetch spp.

Table 5. The Southern States 10 Most Common and Troublesome Weeds in Small Grains (continued).

	States		
Ranking	North Carolina	Oklahoma	Texas
Ten Most Common Weeds			
1	Common chickweed	Cheat	Henbit
2	Henbit	Feral ryegrass	Flixweed/Tansy mustard
3	Italian ryegrass	Common chickweed	Wild oat
4	Wild garlic	Henbit	*Bromus* spp.
5	Wild mustard	Cutleaf eveningprimrose	Annual ryegrass
6	Wild radish	Mustards	Corn gromwell
7	Mouseear chickweed	Field bindweed	Cutleaf eveningprimrose
8	Knawel	Wild oat	Pepperweed
9	Cornflower	Jointed goatgrass	Kochia
10	Shepherdspurse	Italian ryegrass	Prickly lettuce
Ten Most Troublesome Weeds			
1	Italian ryegrass	Feral ryegrass	Field bindweed
2	Wild garlic	Italian ryegrass	Annual ryegrass
3	Henbit	Cheat	Jointed goatgrass
4	Knawel	Jointed goatgrass	Wild oat
5	Mouseear chickweed	Downy brome	Kochia
6	Wild radish	Japanese brome	*Bromus* spp.
7	Curly dock	Rescuegrass	Cutleaf eveningprimrose
8	Speedwells	Wild oat	Corn gromwell
9	Common chickweed	Field bindweed	Pepperweed
10	Corn gromwell	Mustards	Red horned poppy

Table 6. The Southern States 10 Most Common and Troublesome Weeds in Sugarcane.

	States		
Ranking	Florida	Louisiana	Puerto Rico
Ten Most Common Weeds			
1	Fall panicum	Johnsongrass	Nutsedges
2	Spiny amaranth	Bermudagrass	Crabgrasses
3	Nutsedges (purple and yellow)	Itchgrass	Itchgrass
4	Goosegrass	Red morningglory	Guineagrass
5	Alligatorweed	Pitted morningglory	Johnsongrass
6	*Sorghum almum*	Entireleaf morningglory	Junglerice
7	Guineagrass	Nutsedges	Wild poinsettia
8	Alexandergrass	Browntop panicum	Pigweeds
9	Broadleaf panicum	Italian ryegrass	Morningglories
10	Napiergrass	Clovers	Bermudagrass
Ten Most Troublesome Weeds			
1	Guineagrass	Johnsongrass	Itchgrass
2	Nutsedges (purple and yellow)	Bermudagrass	Johnsongrass
3	*Napiergrass*	Itchgrass	Guineagrass
4	Fall panicum	Red morningglory	Alexandergrass
5	*Sorghum almum*	Pitted morningglory	Goosegrass
6	Alligatorweed	Entireleaf morningglory	Bermudagrass
7	Balsam apple	Nutsedges	Crabgrasses
8	Alexandergrass	Browntop panicum	Purple nutsedge
9	Paragrass	Italian ryegrass	Paragrass
10	Bermudagrass	Clovers	Red sprangletop

Table 7. The Southern States 10 Most Common and Troublesome Weeds in Turf.

	States		
Ranking	Alabama	Florida	Georgia
Ten Most Common Weeds			
1	Annual bluegrass	Crabgrasses	Crabgrasses
2	Crabgrasses	Goosegrass	Annual bluegrass
3	Goosegrass	Pennyworts	Henbit
4	Spurges	*Cyperus* spp.	Common chickweed
5	Henbit	Dayflowers	Dallisgrass
6	Nutsedges	Annual bluegrass	Goosegrass
7	Wild garlic	Bull paspalum	Common lespedeza
8	Chickweeds	Virginia buttonweed	Nutsedges
9	Dandelion	Sandburs	Wild garlic
10	Lawn burweed	Tropical signalgrass	Bahiagrass
Ten Most Troublesome Weeds			
1	Virginia buttonweed	Crabgrasses	Virginia buttonweed
2	Torpedograss	Pennyworts	Nutsedges
3	Ground ivy	*Cyperus* spp.	Dallisgrass
4	Dallisgrass	Torpedograss	Violets
5	Nutsedges	Goosegrass	Annual bluegrass
6	Tufted lovegrass	Annual bluegrass	Doveweed
7	Wild violet	Tropical signalgrass	*Phyllanthus* spp.
8	Florida betony	*Phyllanthus* spp.	Wild garlic
9	Goosegrass	Sandburs	Bermudagrass
10	Wild garlic	Virginia buttonweed	Florida betony

Table 7. The Southern States 10 Most Common and Troublesome Weeds in Turf (continued).

	States		
Ranking	Kentucky	Louisiana	Mississippi
Ten Most Common Weeds			
1	Large crabgrass	Crabgrasses	Southern crabgrass
2	Dandelion	Virgina buttonweed	Annual bluegrass
3	Broadleaf plantain	Dallisgrass	Common chickweed
4	White clover	Goosegrass	Henbit
5	Common chickweed	Nutsedges	Dallisgrass
6	Wild violet	Bermudagrass	Goosegrass
7	Wild garlic	White clover	Virginia buttonweed
8	Nimblewill	Bahiagrass	Prostrate spurge
9	Dallisgrass	Lawn burweed	Wild garlic
10	Yellow nutsedge	Dandelion	Common dandelion
Ten Most Troublesome Weeds			
1	Annual bluegrass	Virginia buttonweed	Virginia buttonweed
2	Wild violet	Dallisgrass	Common bermudagrass
3	Nimblewill	Bermudagrass	Dallisgrass
4	Virginia buttonweed	Torpedograss	Prostrate spurge
5	Star-of-Bethlehem	Doveweed	*Phyllanthus* spp.
6	Dallisgrass	Goosegrass	Goosegrass
7	Bermudagrass	Annual bluegrass	Wild garlic
8	Common lespedeza	Nutsedges	Purple nutsedge
9	Yellow nutsedge	Lawn burweed	Torpedograss
10	White clover	Green kyllinga	Annual bluegrass

Table 7. The Southern States 10 Most Common and Troublesome Weeds in Turf (continued).

	States		
Ranking	North Carolina	Oklahoma	Puerto Rico
Ten Most Common Weeds			
1	Annual bluegrass	Smooth crabgrass	Bermudagrass
2	Crabgrasses (smooth, large)	Common chickweed	Sour paspalum
3	Chickweeds (common, mouseear)	Dandelion	Sensitive plant
4	Henbit	Prostrate knotweed	Garden spurge
5	Goosegrass	Prostrate spurge	Tall fringe rush
6	Dallisgrass	Yellow nutsedge	Green kyllinga
7	Clovers (white, hop)	Henbit	Goosegrass
8	Dandelion	Yellow woodsorrel	Nutsedges
9	Wild garlic	Annual bluegrass	Florida beggarweed
10	Cudweeds	*Bromus* spp.	Fingergrass
Ten Most Troublesome Weeds			
1	Annual bluegrass	Virginia buttonweed	Nutsedges
2	Dallisgrass	Tufted hairgrass	Bermudagrass
3	*Kyllinga* spp. (green, false-green)	Common violet	Sour paspalum
4	Crabgrasses (smooth, large)	Dallisgrass	Tall fringe rush
5	Goosegrass	Annual bluegrass	Green kyllinga
6	Virginia buttonweed	Plains bluestem	Sensitive plant
7	Purple nutsedge	Slender aster	Goosegrass
8	Violets (common blue, field pansy)	Field sandbur	Florida beggarweed
9	Henbit	Common bermudagrass	Garden spurge
10	Wild garlic	Star-of-Bethlehem	Fingergrass

Table 7. The Southern States 10 Most Common and Troublesome Weeds in Turf (continued).

	States		
Ranking	Tennessee	Texas	Virginia
Ten Most Common Weeds			
1	Bermudagrass	Dandelion	Large and smooth crabgrass
2	Dallisgrass	Annual bluegrass	White clover
3	White clover	Sow thistle	Dandelion
4	Crabgrasses	Crabgrasses	Annual bluegrass
5	Annual bluegrass	Chickweeds	Buckhorn and broadleaf plantains
6	Goosegrass	Henbit	Common chickweed
7	Wild garlic	Khakiweed	Mouseear chickweed
8	Virginia buttonweed	Prostrate spurge	Henbit and purple deadnettle
9	Henbit/deadnettle	Nutsedges	Black medic
10	Common chickweed	Goosegrass	Yellow woodsorrel
Ten Most Troublesome Weeds			
1	Dallisgrass	Virginia buttonweed	Nimblewill
2	Annual bluegrass	Dichondra	Bermudagrass
3	Virginia buttonweed	Nutsedges	Violets
4	Nimblewill	Khakiweed	Virginia buttonweed
5	Bermudagrass	Slender aster	Dallisgrass
6	Purple nutsedge	Bahiagrass	Common lespedeza
7	Wild garlic	K. R. bluestem	Quackgrass
8	Tufted lovegrass	Dandelion	Roughstalk bluegrass
9	Goosegrass	Dallisgrass	*Cyperus* and *Kyllinga* sedges
10	Broadleaf signalgrass	Goosegrass	Goosegrass

Table 8. The Southern States 10 Most Common and Troublesome Weeds in Wheat.

	States		
Ranking	Alabama	Florida	Kentucky
Ten Most Common Weeds			
1	Mustards	Cutleaf eveningprimrose	Wild garlic
2	Annual ryegrass	Virginia pepperweed	Common chickweed
3	Cutleaf eveningprimrose	Italian ryegrass	Purple deadnettle
4	Wild radish	Wild radish	Henbit
5	Henbit	Carpetweed	Shepherdspurse
6	Chickweeds	Corn spurry	Common ragweed
7	Wild garlic	Cudweeds	Marestail
8	Virginia pepperweed	Curly dock	Italian ryegrass
9	Curly dock	Wild garlic	Philadelphia fleabane
10	Little barley	Henbit	Mouseear chickweed
Ten Most Troublesome Weeds			
1	Wild garlic	Wild radish	Italian ryegrass
2	Mustards	Wild garlic	Hairy chess
3	Wild radish	Curly dock	Cheat
4	Annual ryegrass	Corn spurry	Wild garlic
5	Chickweeds	Cutleaf eveningprimrose	Star-of-Bethlehem
6	Henbit	Virginia pepperweed	Curly dock
7	Little barley	Italian ryegrass	Cornflower
8	Curly dock	Henbit	Musk thistle
9	Virginia pepperweed	Carpetweed	Speedwells
10	Cutleaf eveningprimrose	Cudweeds	Annual bluegrass

Table 8. The Southern States 10 Most Common and Troublesome Weeds in Wheat (continued).

	States		
Ranking	Louisiana	North Carolina	Oklahoma
Ten Most Common Weeds			
1	Henbit	Common chickweed	Cheat
2	Chickweeds	Henbit	Feral ryegrass
3	Annual bluegrass	Italian ryegrass	Common chickweed
4	Ryegrasses	Wild garlic	Henbit
5	Curly dock	Wild mustard	Cutleaf eveningprimrose
6	Buttercups	Wild radish	Mustards
7	Shepherdspurse	Mouseear chickweed	Field bindweed
8	Carolina foxtail	Knawel	Wild oat
9	Wild garlic	Cornflower	Jointed goatgrass
10	Mustards	Shepherdspurse	Italian ryegrass
Ten Most Troublesome Weeds			
1	Ryegrasses	Italian ryegrass	Feral ryegrass
2	Curly dock	Wild garlic	Italian ryegrass
3	Carolina geranium	Henbit	Cheat
4	Wild garlic	Knawel	Jointed goatgrass
5	Little barley	Mouseear chickweed	Downy brome
6	Pennsylvania smartweed	Wild radish	Japanese brome
7	Horseweed	Curly dock	Rescuegrass
8	Cutleaf eveningprimrose	Speedwells	Wild oat
9	Bittercresses	Common chickweed	Field bindweed
10	*	Corn gromwell	Mustards

Table 8. The Southern States 10 Most Common and Troublesome Weeds in Wheat (continued).

	State
Ranking	Texas
Ten Most Common Weeds	
1	Henbit
2	Flixweed/Tansy mustard
3	Wild oat
4	*Bromus* spp.
5	Annual ryegrass
6	Corn gromwell
7	Cutleaf eveningprimrose
8	Pepperweed
9	Kochia
10	Prickly lettuce
Ten Most Troublesome Weeds	
1	Field bindweed
2	Annual ryegrass
3	Jointed goatgrass
4	Wild oat
5	Kochia
6	*Bromus* spp.
7	Cutleaf eveningprimrose
8	Corn gromwell
9	Pepperweed
10	Red horned poppy

Economic Losses Due to Weeds in Southern States

Grass Crops, Turf, Range, and Pastures

Eric P. Webster, Section Chair

The following estimates are based on the knowledge and experience of those individuals or other specialist within the state with whom they conferred.

Table 1. 2003 Estimated Losses Due to Weeds in **Alabama.**

	Corn	Grain Sorghum	Wheat	Oats
Cost of Herbicides				
a. Acres	210	7	53	14
b. Cost/A	18.00	7.00	5.00	3.00
c. Value	3,780	49	265	42
Loss in Yield				
a. Acres	100	7	53	14
b. Cost/A	20.00	14.00	5.00	6.00
c. Value	2,000	98	265	84
Loss in Quality				
a. Acres	50	4	53	9
b. Cost/A	4.00	5.00	3.00	6.00
c. Value	200	20	159	54
Loss in Extra Land Preparation and Cultivation				
a. Acres	150	7	30	9
b. Cost/A	5.00	7.00	3.00	4.00
c. Value	750	49	90	36
Loss in Increase Cost of Harvesting				
a. Acres	125	5	20	10
b. Cost/A	4.00	5.00	3.00	4.00
c. Value	500	25	60	40
Total Losses	7,230	241	839	256

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: John Everest

Table 1(continued). 2003 Estimated Losses Due to Weeds in **Alabama.**

	Alfalfa	Hay	Pastures	Turf
Cost of Herbicides				
a. Acres	10	250	200	500
b. Cost/A	15.00	10.00	8.00	28.00
c. Value	150	2,500	1,600	1,4000
Loss in Yield				
a. Acres	7	140	250	N/A
b. Cost/A	45.00	35.00	25.00	N/A
c. Value	315	4,900	6,250	N/A
Loss in Quality				
a. Acres	5	140	20	100
b. Cost/A	45.00	30.00	20.00	300.00
c. Value	225	4,200	400	30,000
Loss in Extra Land Preparation and Cultivation				
a. Acres	4	N/A	N/A	10
b. Cost/A	5.00	N/A	N/A	100.00
c. Value	20	N/A	N/A	1,000
Loss in Increase Cost of Harvesting				
a. Acres	N/A	N/A	N/A	10
b. Cost/A	N/A	N/A	N/A	20.00
c. Value	N/A	N/A	N/A	200
Total Losses	710	11,600	820	45,200

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: John Everest

Table 2. 2003 Estimated Losses Due to Weeds in **Arkansas.**

	Corn	Grain Sorghum	Wheat	Rice
Cost of Herbicides				
a. Acres	171	230	900	1500
b. Cost/A	20.00	10.00	5.00	40.00
c. Value	3,420	2,300	4,500	60,000
Loss in Yield				
a. Acres	150	130	200	300
b. Cost/A	20.00	14.00	20	100
c. Value	3,000	1,820	4,000	3,000
Loss in Quality				
a. Acres	50	100	200	400
b. Cost/A	4.00	5.00	1.00	4.00
c. Value	200	5,000	200	1,600
Loss in Extra Land Preparation and Cultivation				
a. Acres	150	50	150	N/A
b. Cost/A	5.00	7.00	5.00	N/A
c. Value	750	350	750	N/A
Loss in Increase Cost of Harvesting				
a. Acres	125	50	100	400
b. Cost/A	4.00	5.00	7.00	5.00
c. Value	500	250	700	2,000
Total Losses	7,870	9,720	10,150	66,600

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: Bob Scott

Table 2 (continued). 2003 Estimated Losses Due to Weeds in **Arkansas.**		
	Hay	Pasture
Cost of Herbicides		
a. Acres	2000	2400
b. Cost/A	10.00	8.00
c. Value	20,000	19,200
Loss in Yield		
a. Acres	500	400
b. Cost/A	35.00	20.00
c. Value	17,500	8,000
Loss in Quality		
a. Acres	280	100
b. Cost/A	30.00	20.00
c. Value	8,400	2,000
Loss in Extra Land Preparation and Cultivation		
a. Acres	N/A	N/A
b. Cost/A	N/A	N/A
c. Value	N/A	N/A
Loss in Increase Cost of Harvesting		
a. Acres	N/A	N/A
b. Cost/A	N/A	N/A
c. Value	N/A	N/A
Total Losses	45,900	29,200

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: Bob Scott

Table 3. 2003 Estimated Losses Due to Weeds in **Florida.**

	Field Corn	Sweet Corn	Grain Sorghum	Sugarcane	Wheat
Cost of Herbicides					
a. Acres	85	44	5	426	8
b. Cost/A	20.00	15.00	10.00	18.00	4.00
c. Value	1,700	660	50	7,668	32
Loss in Yield					
a. Acres	60	11	5	456	20
b. Cost/A	32.00	275.00	10.00	42.00	5.00
c. Value	1,920	3,025	50	19,152	100
Loss in Quality					
a. Acres	5	11	5	N/A	20
b. Cost/A	3.00	275.00	2.50	N/A	2.00
c. Value	15	3,025	12.5	N/A	40
Loss in Extra Land Preparation and Cultivation					
a. Acres	80	22	5	350	25
b. Cost/A	5.00	10.00	2.50	25.00	3.00
c. Value	400	250	12.5	8,750	45
Loss in Land Value					
a. Acres	5	N/A	2	350	N/A
b. Cost/A	10.00	N/A	10.00	11.00	N/A
c. Value	50	N/A	20	3,850	N/A
Loss in Increase Cost of Harvesting					
a. Acres	80	4	5	75	20
b. Cost/A	3.50	12.00	2.25	25.00	3.00
c. Value	280	48	11.25	1875	60
Total Losses	4,365	6,978	156.25	426	277

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Authors: Barry Brecke and Andy Bennett

Table 4. 2003 Estimated Losses Due to Weeds in **Georgia.**

	Field Corn	Grain Sorghum	Wheat	Other Cereals	Alfalfa
Cost of Herbicides					
a. Acres	350	50	225	70	10
b. Cost/A	18.00	8.00	5.60	2.60	15.00
c. Value	6,300	400	1,260	182	150
Loss in Yield					
a. Acres	270	40	112	35	5
b. Cost/A	24.00	15.00	9.00	6.00	50.00
c. Value	6,480	600	1,002	210	250
Loss in Quality					
a. Acres	53	10	22.5	16	5
b. Cost/A	4.00	7.50	8.80	4.50	50.00
c. Value	212	75	198	72	250
Loss in Extra Land Preparation and Cultivation					
a. Acres	320	50	N/A	N/A	2
b. Cost/A	8.00	7.00	N/A	N/A	5.00
c. Value	2,560	350	N/A	N/A	10
Loss in Increase Cost of Harvesting					
a. Acres	140	27	50	16	N/A
b. Cost/A	3.00	3.00	1.50	1.50	N/A
c. Value	420	81	75	24	N/A
Total Losses	15,972	1,506	2,541	488	660

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Authors: Tim Murphy, Stanley Culpepper, and Eric Prostko

Table 4 (continued). 2003 Estimated Losses Due to Weeds in **Georgia.**			
	Hay	Pasture	Turf
Cost of Herbicides			
a. Acres	400	400	600
b. Cost/A	12.00	10.00	30.00
c. Value	4,800	4,000	18,000
Loss in Yield			
a. Acres	200	200	0.15
b. Cost/A	35.00	25.00	8000
c. Value	7,000	5,000	1,200
Loss in Quality			
a. Acres	250	N/A	200
b. Cost/A	30.00	N/A	300.00
c. Value	7,500	N/A	60,000
Loss in Extra Land Preparation and Cultivation			
a. Acres	N/A	N/A	4
b. Cost/A	N/A	N/A	15.00
c. Value	N/A	N/A	60
Loss in Land Value			
a. Acres	N/A	N/A	15
b. Cost/A	N/A	N/A	125.00
c. Value	N/A	N/A	1,875
Loss in Increase Cost of Harvesting			
a. Acres	N/A	N/A	15
b. Cost/A	N/A	N/A	20.00
c. Value	N/A	N/A	300
Total Losses	19,300	9,000	81,435

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Authors: Tim Murphy, Stanley Culpepper, and Eric Prostko

Table 5. 2003 Estimated Losses Due to Weeds in **Kentucky.**

	Field Corn	Grain Sorghum	Wheat	Pastures/Hay
Cost of Herbicides				
a. Acres	1200	12	350	500
b. Cost/A	30.00	15.00	10.00	10.00
c. Value	36,000	180	3,500	5,000
Loss in Yield				
a. Acres	250	2	80	300
b. Cost/A	30.00	14.00	8.00	12.00
c. Value	7,500	28	640	3,600
Loss in Quality				
a. Acres	20	N/A	20	600
b. Cost/A	2.00	N/A	2.00	10.00
c. Value	40	N/A	40	6,000
Loss in Extra Land Preparation and Cultivation				
a. Acres	250	2	100	N/A
b. Cost/A	6.00	6.00	6.00	N/A
c. Value	1,500	12	600	N/A
Loss in Increase Cost of Harvesting				
a. Acres	150	1	50	N/A
b. Cost/A	2.00	2.00	2.00	N/A
c. Value	300	2	100	N/A
Total Losses	45,340	222	4,880	14,600

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Authors: J. D. Green and J. R. Martin

Table 6. 2003 Estimated Losses Due to Weeds in **Louisiana**

	Field Corn	Grain Sorghum	Rice	Pasture	Turf	Sugarcane
Cost of Herbicides						
a. Acres	500	185	445	3,000	3.8	500
b. Cost/A	16.00	8.00	40.00	4.50	35.00	60.00
c. Value	8,000	1,480	17,800	13,500	133	30,000
Loss in Yield						
a. Acres	3	10	10	3	0.38	5
b. Cost/A	372.00	247.00	460.00	75.00	3,555.00	1,400.00
c. Value	1,118	2,470	4,600	225	1,349	7,000
Loss in Quality						
a. Acres	N/A	N/A	33	25	0.57	50
b. Cost/A	N/A	N/A	18.00	75.00	3,146.00	50.00
c. Value	N/A	N/A	604	1,875	1,793	2,500
Loss in Extra Land Preparation and Cultivation						
a. Acres	75	28	12	6	N/A	100
b. Cost/A	9.00	9.00	10.00	50.00	N/A	50
c. Value	675	252	N/A	300	N/A	5,000
Loss in Increase Cost of Harvesting						
a. Acres	45	30	40	N/A	N/A	10
b. Cost/A	20.00	20.00	20.00	N/A	N/A	7.00
c. Value	900	600	800	N/A	N/A	70
Total Losses	10,693	4,800	23,924	15,900	3,275	44,500

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Authors: Steve Kelly, Eric Webster, Jim Griffin, David Lanclos, Johnny Saichuk, and Ed Twidwell

Table 7. 2003 Estimated Losses Due to Weeds in **Mississippi**.

	Corn	Grain Sorghum	Wheat	Rice
Cost of Herbicides				
a. Acres	550	83	125	255
b. Cost/A	18.00	8.00	5.00	42.00
c. Value	9,900	664	625	10,710
Loss in Yield				
a. Acres	175	30	53	85
b. Cost/A	24.00	14.00	9.00	100.00
c. Value	4,200	420	477	8,500
Loss in Quality				
a. Acres	50	14	18	50
b. Cost/A	4.00	7.00	7.00	5.00
c. Value	200	98	126	2,500
Loss in Extra Land Preparation and Cultivation				
a. Acres	350	45	30	8
b. Cost/A	8.00	7.00	3.00	12.00
c. Value	2,800	315	90	72
Loss in Increase Cost of Harvesting				
a. Acres	275	40	45	40
b. Cost/A	4.00	4.00	1.75	25.00
c. Value	1,100	160	79	1,000
Total Losses	18,200	1,657	1,397	22,782

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: J. D. Byrd, Jr.

Table 7 (continued). 2003 Estimated Losses Due to Weeds in **Mississippi**.			
	Hay	Pastures	Turf
Cost of Herbicides			
a. Acres	750	2,000	2,500
b. Cost/A	12.00	10.00	30.00
c. Value	9,000	20,000	75,000
Loss in Yield			
a. Acres	300	750	5
b. Cost/A	35.00	15.0	7,000
c. Value	10,500	11,250	35,000
Loss in Quality			
a. Acres	300	N/A	250
b. Cost/A	35.00	N/A	300.00
c. Value	10,500	N/A	75,000
Loss in Extra Land Preparation and Cultivation			
a. Acres	8	N/A	5
b. Cost/A	5.00	N/A	13.00
c. Value	40	N/A	65
Loss in Increase Cost of Harvesting			
a. Acres	N/A	N/A	20
b. Cost/A	N/A	N/A	30.00
c. Value	N/A	N/A	600
Total Losses	30,040	31,250	185,665

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: J. D. Byrd, Jr.

Table 8. 2003 Estimated Losses Due to Weeds in **Missouri**				
	Field Corn	Grain Sorghum	Rice	Wheat
Cost of Herbicides				
a. Acres	2,500	200	200	800
b. Cost/A	25.00	25.00	35.00	10.00
c. Value	62,500	5,000	7,000	8,000
Loss in Yield				
a. Acres	375	30	30	80
b. Cost/A	45	35	45	10
c. Value	16,875	1,050	1,350	800
Loss in Quality				
a. Acres	N/A	N/A	N/A	120
b. Cost/A	N/A	N/A	N/A	25.00
c. Value	N/A	N/A	N/A	3,000
Loss in Extra Land Preparation and Cultivation				
a. Acres	N/A	N/A	N/A	N/A
b. Cost/A	N/A	N/A	N/A	N/A
c. Value	N/A	N/A	N/A	N/A
Loss in Increase Cost of Harvesting				
a. Acres	375	30	30	80
b. Cost/A	10.00	10.00	10	10
c. Value	3750	300	300	800
Total Losses	83,125	6,350	8,650	12,600

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: Andy Kendig

Table 9. 2003 Estimated Losses Due to Weeds in **Oklahoma.**

	Corn	Grain Sorghum	Wheat	Pasture/Range	Oats	Alfalfa
Cost of Herbicides						
a. Acres	210	400	4,000	5,000	35	350
b. Cost/A	26.00	12.00	9.00	7.00	4.00	12.00
c. Value	5,460	4,800	36,000	35,000	140	4,200
Loss in Yield						
a. Acres	150	250	500	2,000	15	100
b. Cost/A	20.00	14.00	15.00	2.00	8.00	15.00
c. Value	3,000	3,500	7,500	4,000	120	1,500
Loss in Quality						
a. Acres	30	80	1,500	2,500	5	250
b. Cost/A	4.00	5.00	10.00	4.00	8.00	20
c. Value	120	400	15,000	10,000	40	5,000
Loss in Extra Land Preparation and Cultivation						
a. Acres	40	80	900	N/A	5	N/A
b. Cost/A	8.00	8.00	4.00	N/A	4.00	N/A
c. Value	320	640	3,600	N/A	20	N/A
Loss in Land Value						
a. Acres	10	5	100	500	N/A	N/A
b. Cost/A	100	75	50	50	N/A	N/A
c. Value	1,000	375	5,000	25,000	N/A	N/A
Loss in Increase Cost of Harvesting						
a. Acres	70	2	200	N/A	2	N/A
b. Cost/A	3.00	3.00	3.00	N/A	3.00	N/A
c. Value	210	6	600	N/A	6	N/A
Total Losses	10,110	9,721	67,700	74,000	326	10,700

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Author: Case R. Medlin

Table 10. 2003 Estimated Losses Due to Weeds in **Texas**

	Field Corn	Grain Sorghum	Rice	Wheat	Hay	Turf
Cost of Herbicides						
a. Acres	2,000	3,500	172	5,600	5,200	3,500
b. Cost/A	12.00	9.00	40	6.00	6.00	20.00
c. Value	24,000	31,500	8,000	33,600	31,200	70,000
Loss in Yield						
a. Acres	500	1,750	17.2	560	1,000	N/A
b. Cost/A	40.00	30.00	100.00	20.00	25.00	N/A
c. Value	20,000	52,500	1,720	11,200	25,000	N/A
Loss in Quality						
a. Acres	N/A	N/A	N/A	N/A	N/A	N/A
b. Cost/A	N/A	N/A	N/A	N/A	N/A	N/A
c. Value	N/A	N/A	N/A	N/A	N/A	N/A
Loss in Extra Land Preparation and Cultivation						
a. Acres	N/A	N/A	N/A	N/A	N/A	N/A
b. Cost/A	N/A	N/A	N/A	N/A	N/A	N/A
c. Value	N/A	N/A	N/A	N/A	N/A	N/A
Loss in Increase Cost of Harvesting						
a. Acres	N/A	N/A	N/A	N/A	N/A	N/A
b. Cost/A	N/A	N/A	N/A	N/A	N/A	N/A
c. Value	N/A	N/A	N/A	N/A	N/A	N/A
Total Losses	44,000	84,000	9,720	44,800	56,200	70,000

Acres = no. X 1000; Cost/A = $/A; Value = Acres X Cost/A X 1000.

Contributing Authors: P. Bauman and T. A. Baughman

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Herbicide Names and Manufacturers

Common or Code Name	Trade Name	Chemical Name	Manufacturer
A			
Acetochlor	Harness Surpass Micro-Tech	2-chloro-*N*-(ethoxymethyl) *N*-(2-ethyl-6-methylphenyl) acetamide	Monsanto Dow AgroSciences Monsanto
Acifluorfen	Ultra Blazer	5-[2-chloro-4-(trifluoromethyl)phenoxy] -2-nitro-benzoic acid	BASF
Acifluorfen + bentzaon	Storm	see acifluorfen and bentazon	BASF
Alachlor	Lasso, Partner	2-chlor-*N*-(2,6-diethyl-phenyl)-*N*- (methoxymethyl) acetamide	Monsanto
Ametryn	Evik	*N*-ethyl-*N*-(1-methylethyl)-6- (methylthio)-1,3,5-triazine-2,4-diamine	Syngenta
Asulam	Asulox	methyl[(4-aminophenyl) sulfonyl] carbamate	Bayer Crop Sciences
Atrizine	Aatrex /others	6-chloro-N-ethyl-*N*-(1-methylethyl)- 1,3,5-triazine-2,4-diamine	Syngenta / others
Azafenidin	Milestone	2-[2,4-dichloro-5-(2-propynyl-oxy_phen)	DuPont Ag Products
AEF 130060			Dow AgroSciences
B			
BAS 625H	Aura	2-[1-2-(4-chlorophenoyx) propoxyimino) -butyl]3-oxo-5-thian-3-ylcyclohex-1-enol	BASF
BAY FOE5043	Axiom	*N*-(4-fluorophenyl)-*N*-(1-methyl-ethyl) -2-[[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yl] oxy]acetamide	Bayer Crop Science
BAY MKH 6561		methyl 2-[[[(4,5-dihydro-4-methyl-5-oxo- 3-propoxy-1H-1,2,4-triazole-1-yl) carbonyl]amino]sulfonyl]benzoate, sodium salt	Bayer Crop Science
Benefin	Balan	*N*-butyl-*N*-ethyl-*N*-2,6-dinotro-4- (trifluoromethyl)benzeneamine	Dow AgroSciences
Bensulfuron	Londax	2-[[[[[4,6-dimethoxy-2-pyrimidiny) amino]sulfonyl]methyl]benzoic acid	DuPont Ag Products
Bentazon	Basagran	3-(1-methylethyl)-(1*H*)-2,1,3- benzothidiazin-4(3*H*)-one 2,2-dioxide	BASF, Micro Flo

Bispyribac-sodium	Regiment	Sodium2,6-bis[(4,6-dimethozypyrimidin-2-yl)oxy]benzoate	Valent USA
Bromacil	Hyvar X	5-bromo-6-methyl-3-(1-methylpropyl) -2,4(1*H*,3*H*) pyrimidinedione	DuPont Ag Products
Bromoxynil	Buctril, Bronate	3,5-dibromo-4-hydroxy-benzonitrile	Bayer Crop Science
Butroxydim	Falcon	2-[1-(ethoxyimino)propyl]-3-hydroxy-5-[2,4,6-trimethyl-3-(1-oxobutyl)phenyl] -2-cyclohexen-1-one	
C			
Carfentrazone	Aim, Shark	∝2-dichloro-5-[4-difluoro-methyl)-4,5-dihydro-3-methyl-5-oxo-1*H*-1,2,4-triazol -1-yl]-4-fluoro-benzenepropanoic acid	FMC
CGA-362622	Envoke		Syngenta
Chlorimuron	Classic	2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl) amino]carbonyl]amino]sulfonyl]benzoic acid	DuPont Ag Products
Chlorimuron + sulfentrazone	Canopy Extra	see chlorimuron and sulfentrazone	DuPont Ag Products
Chlorimuron + metribuzin	Canopy XL	see chlorimuron and sulfentrazone	DuPont Ag Products
Chlorimuron + thifensulfuron	Synchrony	see chlorimuron and sulfentrazone	DuPont Ag Products
Chlorsulfuron	Glean	2-chloro-*N*-[[(4-methoxy-6-methyl) -1,3,5,-triazin-2-yl)amino]carbonyl] benzene-sulfonamide	DuPont Ag Products
Chlorsulfuron + metsulfuron	Finesse	see chlosulfuron and metsulfuron	DuPont Ag Products
Clethodium	Select, Envoy	(*E*,*E*)-±-2-[1-[[3-chloro-2-propenyl) oxy]imino]propyl]-5-[2-ethylthio) propyl]-3-hydroxy-2-cyclohexen-1-one	Valent USA
Clomazone	Command	2-[(2-chlorophenyl)methyl]-4,4 -dimethyl-3-isoxazoli-dinone	FMC
Clopyralid	Lontrel Stinger	3,6-dichloro-2-pyridine-carboxylic acid	Dow AgroSciences
Cloransulam	FirstRate Amplify	3-chloro-2-[[5-ethoxy-7-fluoro[1,2,4] triazolo[1,5-*c*]pyrimidin-2yl)sulfonyl] amino]benzoic acid	Dow AgroSciences Monsanto

Chloransulam + flumetsulam	Frontrow	see cloransulam and flumetsulam	Dow AgroSciences
Cyanazine	Bladex CyPro	2-[[4-chloro-6-(ethylamino)-1,3,5,-triazin -2-yl]amino]-2-methylpropanenitrile	DuPont Ag Products Griffin
Cyhalofop		2-[4-(4-cyano-2-fluorophenoxy)phenoxy] propanoic acid	Dow AgroSciences
D			
2,4-D	Several	2,4-dichlorophenoxy)acetic acid	Several
2,4-D + MCPP + dicamba	Trimec Classic	see 2,4-D and MCPP and dicamba	PBI Gordon
2,4-DB	Butoxone Butyrac	4-(2,4-dichlorophenoxy) butanoic acid	Bayer Crop Science Bayer Crop Science
DCPA	Dacthal	dimethyl 2,3,5,6-tetra-chloro-1,4-benzenedicarboxylate	Amvac
Dicamba	Banvel Clarity Vanquish	3,6-dichloro-2-methoxy-benzoic acid	MicrofFlo BASF Syngenta
Dicamba + diflufenzopyr	Distinct	see dicamba and diflufenzopyr	BASF
Dicamba + diflufenzopyr + nicosulfuron	Celebrity Plus	see dicamba and difluzenopyr and nicosulfuron	BASF
Dicamba + 2,4-D	Weedmaster	see dicamba + 2,4-D	BASF
Dichlobenil	Casoron	2.6-dichlorobenzonitrile	Uniroyal
Dichlorprop (2,4-DP)	Several	(±)-(2,4-dichlorophenoxy)propanoic acid	Bayer Crop Science
Diclofop	Hoelon	(±)-(2,4-dichloro-phenoxy)phenoxy] propanoic acid	Bayer Crop Science
Diclosulam	Strongarm	*N*-(2,6-dichloropheyyl)-5-ethoxy -7-fluoro [1,2,4]triazolo[1,5-*c*]pyrimidine -2-sulfonamide	Dow AgroSciences
Dimethenamid	Frontier	2-chloro-*N*-[1-methyl-2-methoxy)ethyl]-*N* -(2,4-dimethyl-thien-3-yl)-acetamide	BASF
Dimethenamid-P	Outlook	(S)-2-chloro-N[(1-methyl-2-methoxy)ethyl] -N-(2,4-dimethyl-thien-3-yl)-acetamide	BASF
Diquat	Reglone, Reward	6,7-dihydrodipyrido[1,2-∝:2',1'-*c*] pyrazinediium ion	Syngenta

Dithiopyr	Dimension	*S*,*S*-dimethyl 2-(difluoro-methyl)-4-(2-methylpropyl)-6-(trifloromethyl)-3,5-pyridine-dicarbothioate	Rohm & Haas
Diuron	Karmex Direx	*N'*-(3,4-dichlorophenyl)-*N*,*N*-dimethylurea	Griffin Griffin
E			
Endothall	Endothal	7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid	Pennwalt
Ethalfluralin	Sonalan, Curbit	*N*-ethyl-*N*-(2-methyl-2-propenyl)-2,6-dinitro-4-(tri-fluoromethyl)benzenamine	Dow AgroSciences
Ethofumesate	Prograss	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl-methanesulfonate	Bayer Crop Science
F			
Fenoxaprop	Option, Bugle	(±)-2-[4-[(6-chloro-2-bezoxazoly)oxy] phenoxy] propanoic acid	Bayer Crop Science
Fluzazifop-P	Fusilade DX	(*R*)-2-[4-[[5-(trifluoro-methyl)-2pyridinyl] oxy]phenoxy]propanoic acid	Syngenta
Fluazifop + fenoxaprop	Fusion	see fluazifop and fenoxaprop	Syngenta
Flufenacet + metribuzin + atrazine		*N*-(4-Fluorophenyl)-*N*-(1-methylethyl)-2-[[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yl]-oxy]acetamide and metribuzin and atrazine	Bayer Crop Science
Flumetsulam	Broadstrike	N-(2,6-difluorophenyl)-5-methyl[1,2,4] triazolo[1,5-∝] pyrimidine-2-sulfonamide	Dow AgroSciences
Flumetsulam + clorpyralid	Hornet	see flumetsulam and clopyralid	Dow AgroSciences
Flumetsulam + clopyralid +2,4-D	Scorpion III	see flumetsulam and clopyralid and 2,4-D	Dow AgroSciences
Flumetsulam + metolachlor	Dual	see flumetsulam and metolachlor	Dow AgroSciences
Flumiclorac	Resource	[2-chloro-4-fluoro-5-(1,3,4,5,6,7-hexahydro-1,3-dioxo-2*H*-isoindol-2-yl) phenoxy]acetic acid	Valent USA
Flumioxazin	Valor, V-53482	2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2*H*-1,4-benzoxazin-6-yl]-4,5,6,7-tetrahydro-1*H*-isoindole-1,3,(2*H)*-dione	Valent USA
Fluometuron	Cotoran Meturon	*N*,*N*-dimethyl-*N'*-[3-(tri-fluoromethyl) phenyl]urea	Griffin Griffin

Fluoroxypyr	Vista	4-amino-3,5-dichloro-6-fluoro-2-pyridyloxyacetic acid	Dow AgroSciences
Fluthiaceat methyl	Action		Syngenta
	Appeal		KI USA
Fomesafen	Reflex	5-[2-chloro-4-(trifluoro-methyl)phenoxy] -*N*-(methyl-) sulfonyl)-2-nitrobenzamide	Syngenta
Fosamine	Krenite	ethyl hydrogen (aminocarbonyl)-phosphonate	DuPont
G			
Glufosinate	Liberty	2-amino-4-hydroxymethyl phosphinyl)butanoic acid	Bayer Crop Science
	Rely		Bayer Crop Science
	Ignite		Bayer Crop Science
Glyphosate	Roundup Ultra	N-(phosphonomethyl)glycine	
	Max		Monsanto
	Accord, Rodeo		Dow AgroSciences
	D-Pak		Monsanto
	Roundup Original		Monsanto
	Roundup Ultra Dry		Monsanto
	Touchdown		Syngenta
H			
Halosulfuron	Permit	methyl 5-[[4,6-dimethoxy-2-pyrimidinyl] amino]carbonylamino-sulfonyl] -3-chloro -1-methyl-1-*H*- pyrazole -4-carboxylate	Monsanto
	Sempra		
Hexazinone	Velpar	3-cyclohexyl-6-(dimethyl-amino)-1-methyl- 1,3,5-triazine-2,4(1*H*,3*H*)-dione	DuPont AgProducts
I			
Imazamethabenz	Assert	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl) -5-oxo-1*H*-imidazol-2yl]-4(and 5)-methyl-benzoic acid (3:2)	BASF
Imazamox	Raptor	2-[4,5-dihydro-4methyl-4-(1-methylethyl)-5 -oxo-1*H*-imidazol-2yl]-5-(methoxy-methyl)-3-pyridinecarboxylic acid	BASF
Imazapic	Cadre	(±)-2-[4,5-dihydro-4-methyl-4-4(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl] -5-methyl-3-pyridine-carboxylic acid	BASF
	Plateau		
Imazapyr	Arsenal	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl) -5-oxo-1*H*-imidazol-2-yl]-3-pyridinecarboxylic acid	BASF
	Chopper		BASF
	Stalker		BASF
	Habitat		BASF

Imazaquin	Scepter Image	2-[4,5-dihydro-4-methyl-4-(1-methylethy) -5-oxo-1*H*-imidazol-2-yl)-3-ethyl-3-quinoline-carboxylic acid	BASF BASF
Imazaquin + glyphosate	Backdraft	see imazaquin and glyphosate	BASF
Imazethapyr	Pursuit NewPath	2-[4,5-dihydro-4methyl-4-(1-methylethyl) -5-oxo-1*H*-imidazol-2yl]-5-ethyl-3 -pyridinecarboxylic acid	BASF BASF
Imazethapyr + glyphosate	Extreme	see imazethapyr and glyphosate	BASF
Imazethapyr + imazapyr	Event	see imazethapyr and imazapyr	BASF
Isoxaben	Gallery	*N*-[3-(1-ethyl-1-methyl-propyl)-5-isoxazoyl] -2,6-dimethyl-benzamide	Dow AgroSciences
Isoxaben + oryzalin	Snapshot DF	see isoxoben and oryzalin	Dow AgroSciences
Isoxoben + trifluralin	Snapshot TG	see isoxoben and trifluralin	Dow AgroSciences
Isoxaflutole	Balance	5-cyclopropyl-4-(2-methyl-sulphonyl -4-trifluoromethyl-)benzoyl)isoxazole	Bayer Crop Science
L			
Lactofen	Cobra	(±)-2-ethoxy-1-methyl-2-oxoethyl-5-[2-chloro-4-(trifluoromethyl)phenoxy] -2-nitrobenzoate	Valent USA
M			
MCPA	Several	(4-chloro-2-methyphenoxy acetic acid)	Several
Mecoprop	Several	(±)-2-(4-chloro-2-methyl-phenoxy) propanoic acid	Several
Mesosulfuron	Osprey		Bayer Crop Science
Mesotrione	Callisto	2-[4-methylsulfonyl-2-nitrobenzoyl]-1,3-cyclohezanedione	Syngenta
Mesotrione + metolachlor	Camix	see mesotrione and metolachlor	Syngenta
Mesotrione + metolachlor + atrazine	Lumax	see mesotrione and metolachlor and atrazine	Syngenta
Metham	Vapam	methylcarbamodithioic acid	Amvac

Methyl bromide	Bromo-gas	bromomethane	Great Lakes
Metolachlor	Dual Magnum Pennant	2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1)-methylethyl)acetamide	Syngenta Syngenta
Metolachlor + atrizine	Bicep	see metolachlor and atrazine	Syngenta
Metribuzin	Sencor	4-amino-6-(1-dimethyl-ethyl)-3-(methylthio)-1,2,4 triazin -5(4*H*)-one	Bayer Crop Science
Metribuzin + metolachlor	Turbo	see metribuzin and metolachlor	Bayer Crop Science
Metribuzin + trifluralin	Salute	see metribuzin and trifluralin	Bayer Crop Science
Metsulfuron	Ally Escort	2-[[[[(4-methoxy-6-methyl-1,3,5-triazin -2-yl)amino] sulfonyl]benzoic acid	DuPont Ag Products DuPont Ag Products
Molinate	Ordram	*S*-ethyl hexahydro-1*H*-azepine-1-carbothioate	Syngenta
MSMA	Several	monosodium salt of methyl-arsenic acid	Several
N			
Napropamide	Devrinol	*N*-*N*-diethyl-2-(1-naphthalen-yloxy) propanamide	Syngenta
Nicosulfuron	Accent	2-[[[[4,6-dimethoxy-2-pyrimidinyl-amino] carbonyl]amino]sulfonyl]-*N*,*N*-dimethyl -3-pyridinecarboxamide	DuPont Ag Products
Nicosulfuron + rimsulfuron + atrazine	Basis Gold	see nicosolfuron and rimsulfuron and atrazine	DuPont Ag Products
Nicosulfuron + rimsulfuron +	Steadfast	see nicosulfuron and rimsulfuron	DuPont Ag Products
Norflurazon	Zorial, Solicam, Evital	4-chloro-5-methylamino)-2-(3-(trifluoromethyl)phenyl) -3(2*H*)-pyridazinone	Syngenta Syngenta
O			
Oryzalin	Surflan	4-(dipropylamino)-3,5-dinitrobenzenesulfonamide	Dow AgroSciences
Oxadiazon	Ronstar	3-[2,4-dichloro-5-(1-methyl-ethoxy)phenyl] -5-(1,1-)dimethyl-ethyl)-1,3,4-oxadiazol -2-(3*H*)-one	Bayer Crop Sciences
Oxadiazon + prodiamine	Regalstar	see oxadiazon and prodiamine	Regal Chemical Company

Oxasulfuron	Expert	2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino] carbonyl]amino]sulfonyl]benzoic acid	Syngenta
Oxyfluorfen	Goal	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4 -trifluoro-methyl)benzene	Rohm & Haas
Oxyfluorfen + oryzalin	Rout	see oxyfluorfen and oryzalin	The Scotts Company
Oxyfluorfen + oxadiazon	Regal	see oxyfluorfen and ozadiazon	Regal Chemical Company
Oxyfluorfen + pendimethalin	Ornamental Herbicide II	see oxyfluorfen and pendimethalin	The Scotts Company
P			
Paraquat	Gramoxone Max Gramoxone Extra, Starfire Cyclone	1,1'-dimethyl-4,4'-bi-pyridinium ion	Syngenta
Pelargonic Acid	Scythe	nonanoic acid	Mycogen
Pendimethalin	Prowl Pendulum Pentagon Lesco PRE-M Corral	N-(1-ethylpropyl)-3,4-dimethyl-2,6 -dinitrobenzeneamine	BASF BASF BASF Lesco The Scotts Company
Pendimethalin + imazaquin	Squadron	see pendimethalin+imazaquin	BASF
Pendimethalin + imazaquin + imazethapyr	Steel	see pendimethalin+imazaquin+imazethapyr	BASF
Pendimethalin + trifluralin	Tri-Scept	see pendimethalin+trifluralin	BASF
Picloram	Tordon	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid	Dow AgroSciences
Picloram + 2,4-D	Grazon P+D		
Primisulfuron	Beacon	primisulfuron + 3,6-dichloro -2-methoxybenzoic acid	Syngenta
Primisulfuron + dicamba	NorthStar	see primisulfuron and dicamba	Syngenta
Prodiamine	Barricade Factor	2,4-dinitro-N^3,N^3-dipropyl-6-(trifluoromethyl) -1,3-benezenediamine	Syngenta

Prohexadione		3,5-dioxo-4-(1-oxopropyl) cyclohexanecarboxylic acid	BASF
Prometryn	Caparol Cotton Pro	*N*,*N*'-bis(1-methylethyl)-6-(methylthio) -1,3,5-triazine-2,4-diamine	Syngenta Griffin
Propanil	Stam, Stampede	*N*-(3,4-dichlorophenyl) propanamide	Rohm & Haas
Prosulfuron	Peak	1-(4-methoxy-6-methyl-triazin2-yl)-3-[2-(3,3,3-)trifluoropropyl)phenyl-sulfony]urea	Syngenta
Prosulfuron + Primisulfuron	Exceed Spirit	see prosulfuron and primisulfuron	Syngenta Syngenta
Pyridate	Tough	*O*-(6-chloro-3-phenyl-4-pyridazinyl)*S*-octyl-carbonothioate	Syngenta
Pyrithiobac	Staple	2-chloro-6-[(4,6-dimethoxy-2-pyrimidiny) thio]benzoic acid	DuPont Ag Products
Pyrithiobac + glyphosate	Staple Plus	see pyrithiobac and glyphosate	DuPont Ag Products
Q			
Quinclorac	Facet Drive Paramount	3,7-dichloro-8-quinoline-carboxylic acid	BASF BASF BASF
Quizalofop	Assure II	(±)-2-[4-[(6-chloro-2-quinoxalinyl)oxy] phenoxy]propanoic acid	DuPont Ag Products
R			
Rimsulfuron	Titus, Matrix	N-[[4,6-dimethoxy-2-pyrimidinyl)amino] carbonyl]-3-(ethylsulfonyl)-2-pyridine-sulfonamide	DuPont Ag Products
Rimsulfuron + thifensulfuron	Basis	see rimsulfuron and thifensuluron	DuPont Ag Products
S			
Sethoxydim	Poast, Poast Plus Vantage	2-[1-(ethoxyamino)-butyl]-5-[2-(ethylthio) propyl]-3-hydroxy-2-cyclohexen-1-one	BASF
Simazine	Princep	6-chloro-*N*,*N*'-diethyl-1,3,5-triazine -2,4-diamine	Syngenta
Sulfentrazone	Authority Spartan	N-[2,4-dichloro-5-[4-difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1*H*-1,2,4-triazol -1-yl]phenyl]methanesulfonamide	FMC

Sulfentrazone + clomazone	Authority One-Pass	see sulfentrazone and clomazone	FMC
Sulfometuron	Oust	2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino] carbonyl]amino]sulfonyl]benzoic acid	DuPont Ag Products
Sulfosulfuron	Monitor Maverick Outrider	1-(4,6-dimehoxypyrimidin-2-yl)-3-[(ethanesulfonyl-imidazo) [1,2-a]-pyridine-3-yl)sulfonyl]urea	Monsanto
T-Z			
Tebuthiuron	Spike	*N*-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol l-2-yl]-*N*,*N'*dimethylurea	Dow AgroSciences
Terbacil	Sinbar	5-chloro-3-(1,1-dimethyl-ethyl)-6-methyl-2,4 (1*H*,3*H*)-pyrimidinedione	DuPont Ag Products
Thiafluamide + metribuzin	Axiom	see thiafluamide and metribuzin	Bayer Crop Science
Thiazopyr	Dimension Spindle, Visor	methyl 2-(difluoromethyl)-5-(4,5-dihydro-2 -thiazolyl)-4- (2-methylpropyl)-6-(trifluoromethyl)-3-pyridinecarboxylatea	Rohm & Haas Rohm & Haas
Thifensulfuron	Harmony GT		DuPont Ag Products
Thifensulfuron + tribenuron	Harmony Extra	see thifensulfuron and tribenuron	DuPont Ag Products
Triasulfuron	Amber	2-(2-chloroethoxy)-*N*-[[(4-methoxy-6-methyl-1,3,5-)triazin-2-yl)amino]carbonyl]benezene-sulfonamide	Syngenta
Triasulfuron + dicamba	Rave	2-(2-chloroethoxy)-N-[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide and dicamba	Syngenta
Tribenuron	Express	2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) methylamino]carbonyl]amino]sulfonyl] benzoic acid	DuPont Ag Products
Triclopyr	Garlon Grandstand	[3,5,6-trichloro-2-pyridinyl)oxy]acetic acid	Dow AgroSciences Dow AgroSciences
Triclopyr + clopyralid	Redeem R&P	see triclopyr and clopyralid	Dow Agro Sciences
Trifloxysulfuron	Envoke		Syngenta
Trifluralin	Treflan Trifluralin	2,6-dinitro-*N*-*N*-dipropyl-4-(trifluoromethyl) benzeneamine	Dow AgroSciences Dow / Others

Trinexapac-ethyl	Primo	ethyl 4-(cyclopropylhydroxymethylene)-	Syngenta
	Palisade	3,5-dioxocyclohexanecar=boxylate	Syngenta

REGISTRANTS FOR 2004 ANNUAL MEETING

A

Adcock, Tim
Diligence Technologies
219 Red Field Dr
Jackson TN 38305
Tel. 731/661-0396
Fax. 731/661-9981
timadcock@charter.net

Akin, Ron
Monsanto Company
1213 Pleasant Valley Rd
Union City TN 38261
Tel. 731/885-7727
Fax. 731/886-0826
ron.akin@monsanto.com

Alford, Bobby
Helena Chemical Co
7664 Moose Rd
Memphis TN 38120
Tel. 901/752-4402
alfordb@helenachemical.com

Alford, Jason
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
Fax. 479/575-3975
jlafor@uark.edu

Allred, Miriam
USDA APHIS PPQ
2159 Henry Hill Dr 100B
Jackson MS 39204
Tel. 601/922-1417
Fax. 601/922-7648
miriam.l.allred@aphis.usda.gov

Ampim, Peter
Miss State Univ
500 Louisville St #37
Starkville MS 39759
Tel. 662/338-2311
Fax. 662/338-8742
paa24@pss.msstate.edu

Ashley, Jimmy
AshGrow Crop Mgmt
11913 Simsbury Place
Glen Allen VA 23059
Tel. 804/747-7148
Fax. 804/747-7249
jeashley@ashgrow.com

Askew, Shawn
Virginia Tech
435 Old Glade Rd
Blacksburg VA 24061
Tel. 540/231-5807
Fax. 540/231-5755
saskew@vt.edu

Atwell, Sam
BASF Corporation
329 Wilburn Rd
Michigan City MS 38647
Tel. 662/551-8228
Fax. 662/224-9164
atwells@basf.com

Avila, Luis
Texas A&M University
2474 TAMU
College Station TX 77843
Tel. 979/845-5384
lavila@ag.tamu.edu

B

Bailey, Andy
Univ of Kentucky
Res & Education Ctr
Princeton KY 42445
Tel. 270/365-7541
Fax. 270/365-2667
abailey@uky.edu

Bailey, Daniel
The Pictsweet Company
Ten Pictsweet Dr
Bells TN 38006
Tel. 731/663-6414
dbailey@pictsweet.com

Baldwin, Ford
Pratical Weed Consultant
412 Webber Ln
Austin AR 72007
Tel. 501/681-3413
Fax. 501/843-6478
ford@weedconsultants.com

Banks, J C
Oklahoma State Univer
16721 Hwy 283
Altus OK 73521
Tel. 580/482-2120
Fax. 580/482-0208
jcb@osu.altus.ok.us

Banks, Philip A
Marathon-Ag & Eniviron
2649 Navajo Rd
Las Cruses NM 8807
marathonag@zianet.com

Bararpour, Mohammad T
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3957
Fax. 479/575-3975
mbararpo@uark.edu

Barber, Tom
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Barker, Whitnee
Virginia Tech
435 Old Glade Rd
Blacksburg VA 24061
Tel. 540/231-5835
Fax. 540/231-5755
wbarker@vt.edu

Barrentine, James L
Univ of Arkansas
115 Plant Sciences
Fayetteville AR 72701
Tel. 479/575-5715
Fax. 479/575-7465
jbarrentine@uark.edu

Barron, Melissa C
University of Florida
2360 SW Archjer Rd #605
Gainesville FL 32608
Tel. 352/336-6999
melissacarole@hotmail.com

Batts, Roger B
North Carolina State Univ
Box 7609
Raleigh NC 27695
Tel. 919/515-1668
Fax. 919/513-7726
roger_batts@ncsu.edu

Baughman, Todd A
Texas A&M Res & Extn Ctr
PO Box 2159
Vernon TX 76385
Tel. 940/552-9941
Fax. 940/553-4657
ta-baughman@tamu.edu

Baumann, Paul A
Soil & Crop Sciences
Texas A&M University
College Station TX 77843
Tel. 979/845-4880
Fax. 979/845-0604
p-baumann@tamu.edu

Bean, Brent
Texas A&M University
6500 Amarillo blvd
Amerillo TX 79106
Tel. 806/677-5600
b-bean@tamu.edu

Beam, Josh
Virginia Tech
435 Old Galde Rd
Blacksburg VA 24061
Tel. 540/231-3360
Fax. 540/231-5755
jbeam@vt.edu

Bean, James J
BASF Corporation
904 Lancelot Ln
Collerville TN 38017
Tel. 901/853-1444
beanj@basf.com

Belcher, Jason
Auburn University
201 Fuchess Hall
Auburn AL 36849
Tel. 334/844-4100
Fax. 334/844-3945
belchjl@auburn.edu

Bennett, Andrew
University of Florida
3200 E Palm Beach Rd
Belle Glade FL 33430
Tel. 561/993-1555
bennett@ufl.edu

Besler, Brent
Crop Dee Res & Consult
1318 E Main
Brownfield TX 79316
Tel. 806/637-9467
bbesler@cropdocs.com

Black, David
Syngenta Crop Protection
110 Fieldcrest Dr
Searcy AR 72143
Tel. 501/305-4365
Fax. 501/305-4354

Blair, Mitchell
Virginia Tech Forestry
228 Cheatham Hall
Blacksburg VA 24061
Tel. 540/961-2088
Fax. 540/231-3330
miblair@ut.edu

Blazier, Michael A
LSU AgCenter
11959 Hwy 9
Homer LA 71040
Tel. 318/927-2578
Fax. 318/927-9505
mblazier@agcenter.lsu.edu

Bond, Jason A
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
jabond@uark.edu

Bowman, Roger
Helena Chemical
7664 Moore Rd
Memphis TN 38120
bowmanr@helenachemical.com

Boyd, John
Univ of Arkansas Extn
PO Box 391
Little Rock AR 72203
Tel. 501/671-2224
Fax. 501/671-2252
jboyd@uaex.edu

Boyette, C Douglas
USDA-ARS
PO Box 350
Stoneville MS 38776
Tel. 662/686-5217
Fax. 662/686-5222
dboyette@ars.usda.gov

Boyles, Mark
11414 E 68th St
Ripley OK 74062
Tel. 918/372-4688
psone@provalue.net

Braden, Zach
Texas Expt Station
Rt 3 Box 219
Lubbock TX 79403
Tel. 806/746-6101
Fax. 806/746-6528
zhbraden@ag.tamu.edu

Bradley, Kevin
University of Missouri
206A Waters Hall
Columbia MO 65211
Tel. 573/882-4039
bradleyke@missouri.edu

Branson, Jeff
103 Rankon
Dumas AR 71639
Tel. 870/830-5234
jbranson@uaex.edu

Braun, John
FMC Corporation
920 Spingwood Ln
Wylie TX 75098
Tel. 972/429-7291
john_braun@fmc.com

Brecke, Barry J
West Florida Res & Edu C
5988 Hwy 90 Bldg 4900
Milton FL 32853
Tel. 850/983-5216
Fax. 850/983-5774
bjbe@mail.ifas.ufl.edu

Breeden, Donald E
University of Kentucky
1405 Veterans Dr
Lexington KY 40546
Tel. 859/253-9881
donald.breeden@uky.edu

Breeden, Greg
Univ of TN 252 Ellington
2431 Joe Johnson Dr
Knoxville TN 37996
Tel. 865/974-7324

Breen, John
Dow AgroSciences
207 Swiss Lake Dr
Cary NC 27513
Tel. 919/467-6800
Fax. 919/467-6831
breen@dow.com

Breland, Jerry
Plum Creek Timber
1793 Hwy 15 N
Richton MS 39476
Tel. 601/788-5544
Fax. 601/788-9325
jerry.breland@plumcreek.com

Brewer, Chad
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
Fax. 479/575-3975
cbrewer@uark.edu

Brommer, Chad
Emory University
1510 Clifton Rdy
Atlanta GA 30322
Tel. 404/727-4075
clb.4@hotmail.com

Brown, Blake
Milan Experiment Station
6205 Ellington Dr
Milan TN 38358
Tel. 731/686-7362
bbrown12@utk.edu

Brown, Philip
Clemson University
320 Sloan St Apt 9
Clemson SC 29631
Tel. 864/656-3533
philipb@clemson.edu

Bryson, Charles T
USDA-ARS SWSRU
PO Box 350
Stoneville MS 38776
Tel. 662/686-5259
Fax. 662/686-5422
cbryson@ars.usda.gov

Buckelew, Juliana
North Carolina State Univ
Box 7609
Raleigh NC 27695
Tel. 919/515-3178
Fax. 919/515-7747
jkbuckel@unity.ncsu.edu

Buehring, Nathan
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Buehring, Normie
North Miss R&E Ctr
PO Box 1690
Verona MS 38899
Tel. 662/566-2201
Fax. 662/566-2257
buehring@ra.msstate.edu

Buker, Richard
University of Florida
700 Experiment Station
Lake Alfred FL 33850
Tel. 863/956-1151
Fax. 863/956-4631
rsb@crec.ufl.edu

Bullock, Fitzroy
Tennessee State Univ
3500 John Berritt Blvd
Nashville TN 37209
Tel. 615/903-5449
Fax. 615/963-5833
fbullock@tnstate.edu

Bunkers, Greg
Monsanto Company
912 Orrvillewood Ln
Wildwood MO 63005
Tel. 636/737-7647
greg.j.bunkers@monsanto.com

Burgos, Nilda R
University of Arkansas
1336 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3984
Fax. 479/575-3975
mburgos@uark.edu

Burke, Ian C
North Carolina State Univ
4407 Williams Hall
Raleigh NC 27695
Tel. 919/515-5654
Fax. 919/515-5315
icburke@unity.ncsu.edu

Burnell, Keith
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Burns, Brian
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Burton, Michael G
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-2860
Fax. 919/515-5315
mike_burton@ncsu.edu

Butler, Twain
Texas A&M Univesity
1229 N Hwy 281
Stephenville TX 76401
Tel. 254/968-4144
Fax. 254/965-3759
t-butler@tamu.edu

Byrd, John
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-4537
Fax. 662/325-8742
jbryd@pss.msstate.edu

C

Capo-Chichi, Ludovic
Auburn University
202 Funches Hall
Auburn AL 36849
Tel. 334/844-3939
Fax. 334/844-3945

Carey, Frank
Valent USA
8577 Cordes Circle
Germantown TN 38139
Tel. 901/753-6113
Fax. 901/753-0239
frank.carey@valent.com

Castillo, Tate
University of Missouri
619 Ward Ave
Caruthersville MO 63830
Tel. 573/333-0258
castillot@missouri.edu

Chamberlin, Joe
Valent USA
2386 Clower St #E100B
Snellville GA 30078
Tel. 770/985-0303
Fax. 925/817-5097
jcham@valent.com

Chancy, Henry M
University of Arkansas
PO Box 388
DeValls Bluff AR 72041
Tel. 870/998-2614
Fax. 870/998-7051
hchancy@uaex.edu

Chander, Brian R
LSU Ag Center
PO Box 129
Clinton LA 70722
Tel. 225/683-3101

Chandler, Mike
Texas A&M University
2474 TAMU
College Station TX 77843
Tel. 979/845-8736
Fax. 979/845-0456
jm-chandler@tamu.edu

Chase, Carlene A
Univ of Florida - Hort
PO Box 110690
Gainesville FL 32611
Tel. 352/392-1928
Fax. 352/392-5653
cach@ifas.ufl.edu

Clason, Terry
USDA NRCS
3737 Government St
Alexandria LA 71302
Tel. 317/473-7804
Fax. 318/473-7616
terry.clason@la.usda.gov

Clewis, Scott B
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-5655
Fax. 919/515-5315
scott_clewis@ncsu.edu

Coleman, Russell
Delta Res & Extn Ctr
PO Box 197
Stoneville MS 38776
Tel. 662/686-9311
coleman@drec.msstate.edu

Collins, Amanda
Univ of Florida
2330 SW Williston Rd2612
Gainesville FL 32608
Tel. 352/335-2952
amandapc@ufl.edu

Collins, Robin
Univeristy of Florida
1000 SW 62nd Blvd
Gainesville FL 32607
Tel. 850/529-5724
Fax. 850/983-5774
robincol@ufl.edu

Copes, Dan B
LSU AgCenter
43 Crothers Dr
Tallulah LA 71282
Tel. 318/766-4607
Fax. 318/766-4278
dcopes@agctr.lsu.edu

Corbin, Beth
USDA Forest Service
PO Box 227
Stoneville MS 38776
Tel. 662/686-3165
Fax. 662/686-3175
bethcorbin@fs.fed.us

Corbin, Billy
Valent USA
PO Box 5008
Greenville MS 38704
Tel. 662/390-4406
Fax. 662/335-6302
bcirb@valent.com

Corkern, Chris
Monsanto Company
PO Box 388
Stoneville MS 38776
Tel. 662/378-1021
Fax. 662/378-1033
chris.b.corkern@monsanto.com

Craig, Charlie
Craig Farms
PO Box 129
Friars Point MS 38631
Tel. 662/383-2358
ccraig@gmi.net

Craig, Chism
West TN Expt Sta
605 Airways Blvd
Jackson TN 38301
Tel. 731/394-1684
cccraig@utk.edu

Cranmer, John
Valent USA Corporation
110 Iowa Ln Suite 201
Cary NC 27511
Tel. 919/467-6293
Fax. 919/481-3599
jcran@valent.com

Croon, Kent A
Monsanto Company C3SF
800 N Lindbergh Blvd
St Louis MO 63167
Tel. 314/694-6730
Fax. 314/694-2687
kent.a.croon@monsanto.com

Crumby, Tom
FMC Corpration
PO Box 479
Bolton MS 39041
Tel. 601/866-9945
Fax. 601/866-9946
tom_rumby@fmc.com

Cuarezma, Jorge
Monsanto Company
23 Harpstone Place
The Woodlands TX 77382
Tel. 936/273-5888

Culpepper, A Stanley
University of Georgia
PO Box 1209
Tifton GA 31793
Tel. 229/386-3194
stanley@arches.uga.edu

Cummings, Hennen
13110 Six Forks Rd
Raleigh NC 27614
Tel. 919/515-5654
henne_cummings@ncsu.edu

Czarnota, Mark A
University of Georgia
1109 Experiment St
Griffin GA 30223
Tel. 770/228-7398
Fax. 770/412-4764
mac@griffin.uga.edu

D

Dahl, Gregory
Agriliance LLC
PO Box 64089 MS#348
St Paul MN 55164
Tel. 651/451-4942
Fax. 651/451-5559
gkdahl@agriliance.com

DeFelice, Michael
Pioneer Hi-Bred Int'l
PO Box 1150
Johnston IA 50131
michael.defelice@pioneer.com

Dill, Gerry
Monsanto Company
800 N Lindbergh Blvd
St Louis MO 63167
Tel. 314/694-3650
gerald.m.dill@monsanto.com

Dillon, Troy
Lonoke Co Extn Office
PO Box 357
Lonoke AR 72086
Tel. 501/676-3124
Fax. 501/676-7841
twdillon@uaex.edu

Dixon, Gregg A
Monsanto Agronomy Center
25920 Monsanto Rd
Loxley AL 36551
Tel. 251/964-6236
Fax. 251/964-5801
gregg.a.dixon@monsanto.com

Dobbs, Robert
Miss State Univ
PO Box 1690
Verona MS 38879
Tel. 662/566-2201
Fax. 662/566-2257
rdobbs@ra.msstate.edu

Dodds, Darrin
Miss State Univ
Box 9555
Miss State MS 39762

Doran, David L
Bayer CropScience
5112 Trenton Dr
Pace FL 32571
dave.doran@bayercropscience.com

Dotray, Peter
Texas Tech University
Box 42122 Agron & Hort
Lubbock TX 79409
Tel. 806/742-1634
Fax. 806/742-0988
peter.dotray@ttu.edu

Driver, Jacquelyn
Syngenta Crop Protection
110 Twisted Oak Ln
Crawford TX 76638
Tel. 254/848-5650
Fax. 254/848-7333
jackie.driver@syngenta.com

Driver, Tony L
Syngenta Crop Protection
110 Twisted Oak Ln
Crawford TX 76638
Tel. 254/848-5553
Fax. 254/848-7333
tony.driver@syngenta.com

Duke, Stephen O
Univof Mississippi
School of Pharmacy
University MS 38677
Tel. 662/915-1036
Fax. 662/914-1035
sduke@olemiss.edu

Dunand, Richard T
Rice Research Station
1373 Caffey
Rayne LA 70578
Tel. 337/788-7531
Fax. 337/788-7553
rdunand@agcenter.lsu.edu

E

Earl, Jeffrey
University of Arkansas
PO Box 3468
Monticello AR 71655
Tel. 870/460-1552
Fax. 870/460-1092
earl@uamont.edu

Earnest, Larry
SE Branch Expt Sta
PO Box 155
Rohwer AR 71666
Tel. 870/644-3101
Fax. 870/644-3612
earnest@seark.edu

Easley, Jake
Miss State Univ
Box 9555
Miss State MS 39762

Ebelhar, Chris
The Pictsweet Company
Tec Pictsweet Dr
Bells TN 38006
Tel. 731/663-6414
cebelhar@pictsweet.com

Edwards, Scott L
Miss State Univ
Box 9690
Miss State MS 39762
Tel. 662/325-2384
Fax. 662/325-8726
sle4@ra.msstate.edu

Ellis, Drew
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
atellis@uark.edu

Ellis, Jeff
Bayer CropScience
206 Kennedy Flat Rd
Leland MS 38756
Tel. 662/686-5323
jeffrey.ellis@bayercropscience.com

Elmore, Greg
Monsanto Company
636 Highland Glen Dr
Ballwin MO 63021
Tel. 314/694-4379
greg.a.elmore@monsanto.com

Emerson, Joby
The Pictsweet Company
Ten Pictsweet Dr
Bells TN 38006
Tel. 731/663-6414
jemerson@pictsweet.com

Estes, Alan
Clemson University
E 142 P & A Bldg
Clemson SC 29631
aestes@clemson.edu

Etheredge, Luke M
LSU AgCenter
307 Meadow Bend Dr
Baton Rouge LA 70820
Tel. 225/578-1767
Fax. 225/578-4673
lethredge@agcenter.lsu.edu

Everitt, John
Texas agric Sxpt Sta
Rt 3 Box 219
Lubbock TX 79401
Tel. 806/746-6101
Fax. 806/746-6528
jd-everitt@tamu.edu

Everman, Wesley
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-5654
wjeverma@ncsu.edu

Ezell, Andrew W
Miss State Univ
Box 9681
Miss State MS 39762
Tel. 662/325-1688
Fax. 662/325-8726
aezell@cfr.msstate.edu

Ezell, Paula
University of Missouri
114 Kyle Dr
Portageville MO 63873
Tel. 573/379-5939
ezellp@missouri.edu

F

Faircloth, Wilson
Auburn University
263 Funchess Hall
Auburn AL 36849
Tel. 334/844-3911
Fax. 334/844-6945
wilson.faircloth@auburn.edu

Farris, Rodney
Oklahoma State Univ
368 Ag Hall
Stillwater OK 74078
Tel. 405/744-9628
Fax. 405/744-5269
frodney@mail.pss.okstate.edu

Fast, Brandon J
Oklahoma State Univ
272 Ag Hall
Stillwater OK 74078
bfast an@yahoo.com

Ferguson, Greg
Monsanto Company
108 Bayberry Ln
Madison MS 39110
Tel. 601/898-8408
gregory.p.ferguson@monsanto.com

Ferrell, Jay
University of Florida
305 Newall Hall
Gainesville FL 30326

Fisher, Jake
University of Missouri
Box 160
Portageville MO 63873
fishert@missouri.edu

Flanigan, Helen
DuPont Ag Products
1477 S Frnaklin Rd
Greenwood IN 46143
Tel. 317/862-0578
Fax. 317/862-0578
helen.a.flanigan@usa.dupont.com

Fletcher, April
US Fish & Wildlife
PO Box 1306
Albuquerque NM 87103
Tel. 505/248-6632
april_fletcher@tws.gov

G

Ganann, Larry W
Monsanto Company
124 Morningside
Marion AR 72364
Tel. 870/739-4431
Fax. 870/739-3286
larry.w.ganann@monsanto.com

Garbett, William S
International Paper
PO Box 1391
Savannah GA 31402
Tel. 912/238-6122
bill.garbett@ipaper.com

Garr, John A
Garrco Products Inc
PO Box 619
Converse IN 46919
Tel. 765/395-3441
Fax. 413/235-5154
mrfoam1@earthlink.net

Garrett, Trevor F
Pontotoc Expt Station
8320 Hwy 15 South
Pontotoc MS 38863
Tel. 662/489-4621
Fax. 662/489-6011
tfg1@ra.msstate.edu

Garris, Sam
Bayer CropScience
99 Little Big Mound Rd
Bentonia MS 39040
Tel. 662/755-9952
Fax. 662/755-8566
samuel.garris@bayercorpscience.com

Gealy, David
USDA ARS DB NRRC
PO Box 1090
Stuttgart AR 72160
Tel. 870/672-9300
Fax. 870/673-7581
dgealy@spa.ars.usda.gov

Gianessi, Leonard
Croplife Foundation
1156 15th St NW #400
Washington DC 20005
Tel. 202/872-3865
Fax. 202/463-0474
lgianessi@croplifefoundation.org

Givens, Wade
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742
wgivens@gri.msstate.edu

Glasgow, Les
Syngenta Crop Protection
7145 58th Ave
Vero Beach FL 32967
Tel. 772/567-5218
Fax. 772/567-5229
les.glasgow@syngenta.com

Godley, John Lee
R&D Research Farm Inc
7033 Highway 103
Washington LA 70589
Tel. 337/585-7455
Fax. 337/585-1006
rdfarm@bellsouth.net

Goldmon, Dewayne L
Monsanto Company
1207 W Pleasant Dr
Pine Bluff AR 71603
Tel. 870/535-2367
Fax. 870/535-0436
dewayne.l.goodmon@monsanto.com

Gordon, Earl
USDA ARS SWSRU
PO Box 350
Stoneville MS 38776
Tel. 662/686-5662
Fax. 662/686-5422
egordon@ars.usda.gov

Gordon, Roy
Monsanto Company
4006 Old Leland Rd
Leland MS 38756
Tel. 662/378-1021
Fax. 662/378-1033
roy.l.gordon@monsanto.com

Graham, James C
Monsanto Company
12381 Country Glen Ln
St Louis MO 63141
Tel. 314/694-2209
Fax. 314/469-5951
jcgrah@charter.net

Gray, Cody J
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-4588
Fax. 662/325-8743
cjg41@pss.msstate.edu

Green, J D
University of Kentucky
413 Plant Science Bldg
Lexington KY 40546
Tel. 859/257-4898
jdgreen@uky.edu

Grey, Timothy L
University of Georgia
115 Coastal Way
Tifton GA 31783
Tel. 229/386-7239
Fax. 229/686-7293
tgrey@tifton.uga.edu

Grichar, W James
Texas A&M University
PO Box 755
Yoakum TX 77995
Tel. 361/293-8815
Fax. 361/358-4930
w-grichar@tamu.edu

Griffin, Brent
UACES
PO Box 407
Des Arc AR 72040
Tel. 870/206-4204
Fax. 870/256-1614
cbgriffin@uaex.edu

Griffin, James L
LSU Agonomy
104 Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1768
Fax. 225/578-4673
jgriffin@agcenter.lsu.edu

Griffin, Matt
Louisiana State Univ
104 MB Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1189
Fax. 225/578-4673
rgriffin@agcenter.lsu.edu

Grove, Melvin
ISK BioScience
2237 Haden Rd
Houston TX 77015
Tel. 713/393-3750
Fax. 713/393-3751
grovem@iskbc.com

Groves, Frank
134 South Chester
Monticello AR 71655
Tel. 870/644-3101
Fax. 870/644-3612
fgroves@uark.edu

Grymes, Charles
Syngenta Crop Protection
Rt 2 Box 214
Idalou TX 79329

Guice, Brad
BASF Corporation
PO Box 790
Winnsboro LA 71295
Tel. 318/435-3621
Fax. 318/435-6665
guicej@basf.com

Guy, Charlie
G&H Associates
PO Box 97
Tillar AR 71670
Tel. 870/392-2009
Fax. 870/392-2009
cbguygh@ipa.net

H

Hackman, George
Kumiai America
2830 Wilcox
Leland MS 38756
Tel. 662/822-0437
george@kithem-usa.com

Hadden, James
Syngenta Crop Protection
97 William Gibb Rd
Tifton GA 31794

Hainds, Mark J
Longleaf Alliance
5457 Harts Bridge Rd
Andalusia AL 36420
Tel. 334/427-1029
Fax. 334/427-1030

Haines, David
Monsanto Company
516 Forrest Park Circle
Franklin TN 37064
Tel. 615/595-0807
Fax. 615/591-5251
rdhaines@aol.com

Hand, Shane
Bayer CropScience
PO Box 12014
Res Tria Park NC 27709
Tel. 919/549-2287
Fax. 919/549-3952
shane.hand@bayercropscience.com

Hans, Sarah
NC State Univ
150 Loop Rd
Clayton NC 27520
Tel. 919/515-5654
srhans@ncsu.edu

Harden, John S
BASF Corporation
5909 Rock Canyon
Relaigh NC 27613
Tel. 919/547-2019
Fax. 919/547-2910
hardenj@basf.com

Harrison, Mark
Miss State Univ
PO Box 1690
Verona MS 38879
Tel. 662/566-2201
Fax. 662/566-2257
mph31@ra.msstate.edu

Harrison, Steve
Syngenta Crop Protection
8000 Cenerview Pkwy 501
Cordova TN 38018
Tel. 901/751-5206
Fax. 901/751-5223
steve.harrison@syngenta.com

Hayes, Robert
West TN Expt Sta
605 Airways Blvd
Jackson TN 38301
Tel. 731/425-4769
rhayes1@utk.edu

Heap, Todd
Shoffner Farm Research
191 Jackson 136
Newport AR 72112
Tel. 870/744-8237
Fax. 870/744-3314
rth@shoffneragresearch.com

Heering, David C
Monsanto Company C3SF
800 N Lindbergh Blvd
St Louis MO 63167
Tel. 314/694-6698
Fax. 314/694-2687
david.c.heering@monsanto.com

Henderson, Charles M
Valent USA
PO Box 5008
Greenville MS 38704
Tel. 662/378-8361

Henry, Gerald
North Carolina State Univ
Box 8720
Raleigh NC 27695
Tel. 919/515-5654
gmhenry@unity.ncsu.edu

Hinklin, Britton
University of Missouri
2184 County Hwy 305
Portageville MO 63873
Tel. 573/379-5431
hinklinb@missouri.edu

Hoagland, Robert E
USDA ARS SWSRU
PO Box 350
Stoneville MS 38776
Tel. 662/686-5210
Fax. 662/686-5422
rhoagland@ars.usda.gov

Holloway, James C
Syngenta Crop Protection
1840 Lance Dr
Greenville MS 38701
Tel. 662/332-9844
Fax. 662/332-9844
james.holloway@syngenta.com

Hopkins, Alan
Bayer CropScience
13 Summer Hill
Greenbrier AR 72058
Tel. 501/679-4075
Fax. 501/679-4075
alan.hopkins@bayercropscience.com

Hubbard, Ray
Clemson University
206 Ag Service Ctr
Clemson SC 29631
lhbbrd@clemson.edu

Hutto, Kenneth C
Miss State Univ
Box 9555
Miss State MS 39762

I

Ihrig, Robert A
Monsanto Company
570 Rebels Rd
Collierville TN 38017
Tel. 901/375-5645
Fax. 901/375-5675
robert.a.ihrig@monsanto.com

Iverson, Richard D
FMC Corporation
105 Heart Pine Dr
Cary NC 27511
Tel. 215/299-6656
Fax. 215/299-6100
rick_iverson@fmc.com

J

Jain, Rakesh
Syngenta Crop Protection
7145 - 58th Ave
Vero Beach FL 32967
Tel. 772/567-5218
Fax. 772/567-5229
rakesh.jain@syngenta.com

Jennings, Katherine
North Carolina State Univ
Box 7609
Raleigh NC 27695
Tel. 919/515-2650
katie_jennings@ncsu.edu

Johnson, Wiley C
Coastal Plain Expt Sta
PO Box 748
Tifton GA 31793
Tel. 229/386-3172
Fax. 229/386-3437
cjohnson@tifton.usda.gov

Jones, Curtis A
Louisiana State Univ
104 M B Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1767
Fax. 225/578-4673
cjones@agcenter.lsu.edu

Jones, Elizabeth
Delta Res & Extn Ctr
PO Box 197
Stoneville MS 39762
Tel. 662/686-3228
Fax. 662/686-7336
ejones@drec.msstate.edu

Jordan, David
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-4068
Fax. 919/515-3332
david_jordan@ncsu.edu

Joy, Brandon
Texas Agric Expt Sta
Rt 3 Box 219
Lubbock TX 79403
Tel. 806/746-6101
Fax. 806/746-6528
bljoy@ag.tamu.edu

Judice, Wilson E
LSU Ag Center
104 M B Sturgis
Baton Rouge LA 70803
Tel. 225/578-1767
Fax. 225/578-4673
wjudice@agctr.lsu.edu

K

Kammerer, Steven
Syngenta Crop Protection
100 Rivers Edge Rd N
St Augustine FL 32092
Tel. 904/829-9581
steve.krmmerer@syngenta.com

Keeling, Wayne
Texas Agric Expt Sta
Rt 3 Box 219
Lubbock TX 79401
Tel. 806/746-6101
w-keeling@tamu.edu

Keese, Renee J
Syngenta Crop Protection
984 Arrowwood Dr
Carmel IN 46033
Tel. 317/846-8812
Fax. 317/846-8832
renee.keese@syngenta.com

Kelley, Frank
Oklahoma State Univ
368 Ag Hall
Stillwater OK 74078
Tel. 405/624-7063
fkelley@okstate.edu

Kelley, Jason
University of Arkansas
2301 S University
Little Rock AR 72203
Tel. 501/671-2164
jkelley@uaex.edu

Kelley, Monica
University of Arkansas
PO Box 3508
Monticello AR 71656
Tel. 870/460-1091
Fax. 870/460-1415
kelleym@uamont.edu

Kelly, Steve
LSU AgCenter
21213 Macon Ridge Rd
Winnsboro LA 71295
Tel. 318/435-2908
Fax. 318/435-2902
skelly@agcenter.lsu.edu

Kendig, Andy
Univ of Missouri Delta
PO Box 160
Portageville MO 63873
Tel. 573/379-0499
Fax. 573/379-5431
kendigj@missouri.edu

Kennerly, Steve
Plum Creek Timber
7265 A1A Unit A-8
St Augustine FL 32080
Tel. 386/325-0453

Kenty, Michael M
Helena Chemical Company
424 Quail Crest Dr
Collierville TN 38017
Tel. 901/853-6525
Fax. 901/853-5622
mmkenty@aol.com

Kincade, Robert
Valent USA
1823 Lake Manor
Greenville MS 38701
Tel. 662/390-4400
bkinc@valent.com

King, Steve R
Glade Road Research Ctr
VPI&SU
Blacksburg VA 24060
Tel. 540/231-2463
Fax. 540/231-5755
stking@vt.edu

Kirkpatrick, Matt
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Kline, Bill
Dow AgroSciences
2716 Saxon Dr
Duluth GA 30096
Tel. 770/623-6818
wnkline@dow.com

Knowe, Steve
1842 Southcliff Dr
Maryville TN 37803
Tel. 865/977-4003
steve.knowe@att.net

Kobayashi, Hiromu
Nissan Chemical America
1291 Cumberland Ave D
W Lafayette IN 47906
Tel. 765/497-1161
Fax. 765/497-7917
kobayashi@nissan.wintek.com

Koger, Trey
USDA-ARS
PO Box 350
Stoneville MS 38776
Tel. 662/686-5290
Fax. 662/686-5422
ckoger@ars.usda.gov

Koscelny, Jeffrey A
Monsanto Company
645 Castlebrook Dr
St Peters MO 63376
Tel. 314/694-6716
Fax. 314/694-2687
jeffrey.koscelny@monsanto.com

Kottapalli, Satish V
Dexter 311 B
257 S Gay St
Auburn AL 36830
Tel. 334/663-5672
kottasv@auburn.edu

Krutz, Larry J
Texas A&M University
2474 TAMU
College Station TX 77843
Tel. 979/845-5384
Fax. 979/845-0456
lkrutz@ag.tamu.edu

Kurtz, Mark
Miss State Univ
PO Box 197
Stoneville MS 38776
Tel. 662/686-3227
Fax. 662/686-7336
mekurtz@drec.msstate.edu

L

Lanclos, David
Dean Lee Research Sta
8105 Tom Bowman Dr
Alexandria LA 71302
Tel. 318/473-6530
Fax. 318/473-6535
dlanclos@agcenter.lsu.edu

Lassiter, Ralph B
Dow AgroSciences
10 Cherry Creek Cove
Little Rock AR 72212
Tel. 501/223-0381
Fax. 501/223-2088
rblassiter@dow.com

Lauer, Dwight K
Silvics Analytic
12314 Lullington Dr
Richmond VA 23233
Tel. 804/754-8868
dklauer@att.net

Leon, Chris
Louisiana State Univ
104 MB Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1189
Fax. 225/578-4673
cleon@agcenter.lsu.edu

Levy, Ron
LSU
157 Cherokee
Crowley LA 70526
Tel. 337/788-8821
Fax. 337/788-8816
rlevy@agctr.lsu.edu

Lickfeldt, Darin
Dow AgroSciences
125 Sagamore Ct
Fayetteville GA 30214
Tel. 770/969-2375
Fax. 770/969-5674
dwlickfeldt@dow.com

Link, Michael L
DuPont Company
891 Walker Rd
Bryon GA 31008

Little, Steve
The Pictsweet Company
Ten Pictsweet Dr
Bells TN 38006
Tel. 731/663-6414
slittle@pictsweet.com

Livingston, Stephen D
Texas Coop Extn
17940 CR 1726
Odem TX 78370
Tel. 361/265-9201
Fax. 361/265-9434

Locke, Martin
National Sed Lab
PO Box 1157
Oxford MS 38655
Tel. 662/232-2908
Fax. 662/232-2988
mlocke@ars.usda.gov

Luper, Charles
Oklahoma State Univ
127 NRC
Stillwater OK 74078
Tel. 405/744-5808
Fax. 405/744-6039
luper@okstate.edu

Lyon, LeAnna
Texas Agric Expt Sta
Rt 3 Box 219
Lubbock TX 79403
Tel. 806/746-6101
Fax. 806/746-6528
l-lyon@tamu.edu

M

MacDonald, Greg
University of Florida
PO Box 100500
Gainesville FL 32611
Tel. 352/392-1811
Fax. 352/391-1840
gemac@ifas.ufl.edu

MacRae, Andrew
North Carolina State Univ
Box 7609
Raleigh NC 27695
Tel. 919/349-9370
Fax. 919/513-7226
awmacrae@unity.ncsu.edu

Madsen, John D
Georesources Institute
Box 9652
Miss State MS 39762
Tel. 662/325-2428
Fax. 662/325-7692
jmadsen@gri.msstate.edu

Main, Chris
Univ of TN 252 Ellington
2431 Joe Johnson Dr
Knoxville TN 37996
Tel. 865/974-2883
cmain@utk.edu

Main, Jeffrey L
Pontotoc Expt Station
8320 Hwy 15 South
Pontotoc MS 38863
Tel. 662/489-4621
Fax. 662/489-6011
jmain@ra.msstate.edu

Malik, Mayank S
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
Fax. 479/575-3975
msmlo@uarke.du

Marshall, Michael W
University of Kentucky
1405 Veterans Dr
Lexington KY 40546
marshal@uky.edu

Martin, James R
University of Kentucky
PO Box 469 Agronomy
Princeton KY 42445
Tel. 270/365-7541
Fax. 270/365-2660
jamartin@uky.edu

Martin, Scott H
Syngenta Crop Protection
778 Mitcham Orchard Rd
Ruston LA 71270
Tel. 318/251-9412
Fax. 318/255-0064
scott.martin@syngenta.com

Mascarenhas, Victor
Syngenta Crop Protection
118 Kennedy Flat Rd
Leland MS 38756
Tel. 662/686-5760
Fax. 662/686-9859
victor.mascarenhas@syngenta.com

Massey, Joe
Miss State Univ
Box 9555
MIss State MS 39762
Tel. 662/325-4725
Fax. 662/325-8742
jmassey@pss.msstate.edu

Matocha, Matthew E
Texas Agric Extn Service
3406 Rinfeather #1401
Bryan TX 77801
Tel. 979/845-0817
Fax. 979/845-0604
mematoch@ag.tamu.edu

McAlpine, Jimmy R
USDA-ARS
PO Box 350
Stoneville MS 38776
Tel. 662/686-5253
Fax. 662/686-5222
jmcalpine@ars.usda.gov

McCauley, Raymond K
Clemson University
6718 University Station
Clemson SC 29632
Tel. 803/468-6286
mccauleyturf@yahoo.com

McClelland, Marilyn
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-8779
Fax. 479/575-3975
mmcclell@uark.edu

McCormick, Marty
Texas A&M University
Rt 3 Box 219
Lubbock TX 79403
Tel. 806/742-2812
Fax. 806/742-0774
kmmccormick@ag.tamu.edu

McDaniel, Jack R
Nichine America Inc
Box 40
Oak Ridge LA 71264
Tel. 318/614-1231
jmedaniel@nichine.net

McElroy, Scott
Univ of TN 252 Ellington
2431 Joe Johnson Dr
Knoxville TN 37996
Tel. 865/974-7324
mcelroy@utk.edu

McKemie, Tom
BASF Corporation
5104 Indigo Way
Raleigh NC 27613
Tel. 919/846-6687
Fax. 919/846-6687
mckemit@basf-corp.com

McLean, Henry
Syngenta Crop Protection
3392 Fallswood Ct
Colfax NC 27235
Tel. 336/632-7246
henry.mclean@syngenta.com

McMullan, Patrick
Agrobiology Research
Box 57-7777 Walnut Grove
Memphis TN 38120

McQueen, Melissa
Gowan Company
370 S Main St
Yuma AZ 85364
Tel. 928/580-4840
Fax. 928/373-1841
mmcgqeen@gowanco.com

Meehan, Jay
Clemson University
277 Poole Agric Ctr
Clemson SC 29634
Tel. 864/656-2607
Fax. 864/656-3443
jaymeechan@hotmail.com

Meier, Jason
Univ of Ark SEREC
PO Box 3508
Monticello AR 71656
Tel. 870/460-1091
Fax. 870/460-1415
meier@uamont.edu

Meins, Kirk
Lonoke Co Extn Office
PO Box 357
Lonoke AR 72086
Tel. 501/676-3124
Fax. 501/676-4874
kmeins@uaex.edu

Michel, Jeff
Bayer Environmental Serv
1072 Lake Baldwin Ln
Orlando FL 32814
Tel. 407/896-2746
jeff.miochel@bayercropscience.com

Miller, Donnie
LSU AgCenter
PO Box 438
St Joseph LA 71366
Tel. 317/766-4607
Fax. 317/766-4278
dmiller@agctr.lsu.edu

Miller, James H
USDA Forest Service
520 Devall Dr
Auburn AL 36849
Tel. 334/826-8700
Fax. 334/821-0037
jmiller01@fs.fed.us

Mills, J Anthony
Monsanto Company
1472 Pecan Ridge Dr
Collierville TN 3817
Tel. 662/719-5258
Fax. 901/854-9998
anthony.mills@monsanto.com

Minton, Bradford W
Syngenta Crop Protection
20130 Lake Spring Ct
Cypress TX 77433

Mitchell, Joe M
BASF Corporation
10016 Colonnade Dr
Tampa FL 33647
Fax. 813/991-5507
mitchejm@basf.com

Mitchell, Rusty
FMC Corporation
PO Box 678
Louisville MS 39339
Tel. 662/773-6697
Fax. 662/773-6674
rusty_mitchell@fmc.com

Mixson, Dan
DuPont Ag Products
4771 Bayou Blvd C-298
Pensacola FL 32503

Mixson, Wayne
The Scott Company
PO Box 2187
Apopka FL 32704
Tel. 407/889-4200
Fax. 407/889-2201
wayne.mixson@scotts.com

Monks, David
North Carolina State Univ
Box 7609
Raleigh NC 27695
Tel. 919/515-5370
Fax. 919/515-7747
david_monks@ncsu.edu

Montgomery, Doug
Oklahoma State Univ
260 Ag Hall
Stillwater OK 74078
Tel. 405/624-7538
dmontgo@okstate.edu

Montgomery, Robert F
Monsanto Comany
2211 N Old Troy Rd
Union City TN 38261

Moore, Fred
Texas Agirc Extn Service
1309 Remington Ct
College Station TX 77845
Tel. 979/845-0817
Fax. 979/845-0604
f-moore@tamu.edu

Mosdell, Dean
Syngenta Crop Protection
501-I S Reino Rd #183
Newbury Park CA 91320
Tel. 805/480-0514
Fax. 805/480-0524
dean.mosdell@syngenta.com

Mudge, Chris
Louisiana State Univ
104 MB Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1189
Fax. 225/578-4673
cmudge@agcenter.lsu.edu

Mueller, Tom
Univ of TN 252 Ellington
2431 Joe Johnson Dr
Knoxville TN 37996
Tel. 865/974-8805
Fax. 865/974-5635
tmueller@utk.edu

Mullahey, Jeff
University of Florida
5988 Swy 90 Bldg 4900
Milton FL 32583
Tel. 850/983-5216
wfgator@ufl.edu

Murdock, Shae
Monsanto Company
3202 104th St
Lubbock TX 79423
Tel. 806/145-2460
Fax. 806/745-2466
shea.w.murdock@monsanto.com

Murphree, Trent
Seeds West
37860 Smith-Enke Rd
Maricopa AZ 85239
Tel. 520/568-2273
Fax. 520/568-2556
tmurph@ag.arizona.edu

Murphy, Tim
University of Georgia
1109 Experiment St
Griffin GA 30223
Tel. 770/228-7300
Fax. 770/229-3215
tmurphy@uga/edu

Murray, Don S
Oklahoma State Univ
Agronomy Dept
Stillwater OK 74078
Tel. 405/744-6420
Fax. 405/744-5269
dmurray@okstate.edu

Muzyk, Ken
Gowan
408 Larrie Ellen Way
Brandon FL 33511
Tel. 813/657-5171
Fax. 813/684-8404
kmuzyk@gowan.com

N

Nelson, Larry
Clemson University
168 Will Owens Dr
Central SC 29630
Tel. 864/656-4866
lnelson@clemson.edu

Nichols, Robert L
Cotton Incorporated
6399 Weston Pkwy
Cary NC 27513
Tel. 919/678-2371
Fax. 919/678-2233
bnichols@cottoninc.com

Nichols, Steve P
Miss State Univ
PO Box 197
Stoneville MS 38776
Tel. 662/686-3238
Fax. 662/686-3334
snichols@drec.msstate.edu

Norsworthy, Jason K
Clemson University
277 Poole Agric Ctr
Clemson SC 29634
Tel. 864/656-2607
Fax. 864/656-3443
jnorswo@clemson.edu

O

O'Barr, John H
Soil & Crop Science Dept
Texas A&M University
College Station TX 77843
Tel. 979/845-5384
Fax. 979/845-0456
john obarr@tamu.edu

Odle, William
Valent USA Corp
1701 Gateway Blvd #385
Richardson TX 75080
Tel. 972/664-1716

Oliveira, Marcos
Clemson University
277 Poole Agric Ctr
Clemson SC 29634
Tel. 864/625-2607
Fax. 864/656-3443
molivei@clemson.edu

Oliver, Lawrence R
18964 Melanie Rd
Springdale AR 72764
Tel. 479/575-3976
Fax. 479/575-3975
oliver@uark.edu

Ottis, Brian
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-6611
Fax. 479/575-3975
bottis@uark.edu

P

Palmer, Eric
Syngenta Crop Protection
118 Kennedy Flat Rd
Leland MS 38756
Tel. 518/851-2122
Fax. 518/851-9790
eric.palmer@syngenta.com

Parker, Astrid
Bayer Environmental
981 NC 42 East
Clayton NC 27612
Tel. 919/553-4651
Fax. 919/553-8434
asrid.parker@bayercropscience.com

Parker, Robert
NC State Univ
4909-6H Dana Dr
Raleigh NC 27606
Tel. 919/515-2865
robbie_parker@ncsu.edu

Patterson, Michael G
Auburn University
108 Extension Hall
Auburn AL 36849
mpatterson@aces.edu

Pawlak, John
Valent USA
539 S Creyts
Lansing MI 48917
Tel. 517/321-7340
john.pawlak@valent.com

Pearrow, Nathan
Lonoke Co Extn Office
PO Box 357
Lonoke AR 72086
Tel. 501/676-3124
Fax. 501/676-7847
npearrow@uaex.edu

Pearson, Charles
Syngenta Crop Protection
8000 Centerview Pk #501
Cordova TN 38018
Tel. 901/751-5208
Fax. 901/751-5224
charles.pearson@syngenta.com

Peeper, Thomas F
Oklahoma State Univ
Plant & Soil Sciences
Stillwater OK 74078
Tel. 405/744-9589
Fax. 405/744-5269
peepert@okstate.edu

Perkins, Keith
Univ of Arkansas
1306 Earl Verser Rd
Lonoke AR 72086
Tel. 501/676-3124
kperkins@uaex.edu

Perkins, Russ
Bayer CropScience
Box 146
Idalou TX 79379
Tel. 806/892-2002
Fax. 806/892-3611
ross.perkins@bayercropscience.com

Perry, Kevin
Valent USA Corp
1898 West U S 40
Grenfield IN 46140
Tel. 317/467-4942
kevin.perry@valent.com

Peyton, Bryan
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Pinnell-Alison, Carol L
LSU AGCenter
214 Macon Ridge Rd
Winnsboro LA 71295
Tel. 318/435-7551
Fax. 318/435-8216
cpinnell-alison@agcenter.lsu.edu

Pitts, Jerry R
DuPont Co
22407N Lake Village Dr
Katy TX 77450
Tel. 281/693-3375
Fax. 281/693-3615
jerry.r.pitts@dupont.us.com

Pool, Nicholas
University of Florida
404 NW 19th St
Gainesville FL 32603
Tel. 352/284-7887
nicholaspool@hotmail.com

Porpiglia, Peter
Kumiai America
11 Martine Ave #970
White Plains NY 10606
Tel. 914/682-8934
Fax. 914/682-9050
peter@kichem-usa.com

Porterfield, Dunk
Syngenta Crop Protection
101 Glen Alpine Circle
Cary NC 27513
Tel. 919/380-1812
Fax. 919/380-1816
dunk.porterfield@syngenta.com

Poston, Daniel
Delta Res & Extn Ctr
PO Box 197
Stoneville MS 38776
Tel. 662/686-9311
Fax. 662/686-7336
dposton@drec.msstate.edu

Price, Andrew
USDA ARS
411 S Donahur Dr
Auburn AL 36832
Tel. 334/844-4741
priceaj@auburn.edu

Prinster, Mark
5536 Yeager Ridge Dr
Douglasville GA 31035
Tel. 770/949-4125
prinsturf@aol.com

Prostko, Eric
Rural Development Ctr
PO Box 1209
Tifton GA 31793
Tel. 229/386-3194
Fax. 229/386-7308
eprostko@uga.edu

Puri, Atul
University of Florida
PO Box 110500
Gainesville FL 32611
Tel. 352/392-1823
atul779@ufl.edu

Q

Quicke, Harry
BASF Corporation
234 Pine Hills Ave
Auburn AL 36830
Tel. 334/821-8801
quickeh@basf.com

R

Ralston, Jennifer
Monsanto Company C3N
800 N Lindbergh Blvd
St Louis MO 63167
Tel. 314/694-8214
Fax. 314/694-4940
jennifer.l.ralston@monsanto.com

Ramsey, Craig
University of Florida
5560 Andromeda Dr
Milton FL 32570
Tel. 850/982-3960
cramsey@ufl.edu

Rankins, Alfred
Miss State University
Box 9555
Miss State MS 39762
Tel. 662/325-3341
Fax. 662/325-8742
arankins@pss.msstate.edu

Ratliff, Randall L
Syngenta Crop Protection
PO Box 18300
Greensboro NC 27419
Tel. 336/632-3922
Fax. 336/547-0632
randy.ratliff@syngenta.com

Rawls, Eric K
Syngenta Crop Protection
7145 - 58th Ave
Vero Beach FL 32967
Tel. 772/567-5218
Fax. 772/567-5227
eric.rawls@syngenta.com

Reddy, Krishna N
USDA ARS
PO Box 350
Stoneville MS 38776
Tel. 662/686-5298
Fax. 662/686-5422
kreddy@ars.usda.gov

Reed, Joe
FMC Corporation
5061 Oaklawn Dr
N Little Rock AR 72116
Tel. 561/758-5324
Fax. 561/758-5324

Reynolds, Daniel B
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-0519
Fax. 662/325-8742
dreynolds@pss.msstate.edu

Rhodes, Alvin R
BASF Corporation
137 Cypress Lake Blvd S
Madison MS 39110
Tel. 601/853-1417
Fax. 601/853-8488
rhodesa@basf.com

Rhodes, Neil
Univ of TN 252 Ellington
2431 Joe Johnson Dr
Knoxville TN 37996
Tel. 865/974-8837
nrhodes@utk.edu

Rich, Gregory J
Valent USA Corporation
8577 Cordes Circle
Germantown TN 38139
Tel. 901/753-0208
Fax. 901/753-0239
grich@valent.com

Richburg, John S
Dow AgroSciences
753 Hwy 438
Greenville MS 38701
Tel. 662/379-8990
Fax. 662/379-8990
jsrichburg@dow.com

Rick, Susan
E I DuPont
2021 Gardnerbrook Dr
Raleigh NC 27606
Tel. 919/854-0806
Fax. 919/854-0806
susan.k.rick@usa.dupont.com

Robinson, Bridget
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/513-4197
Fax. 919/515-5855
bridget_robinson@ncsu.edu

Robinson, Darren
Univ of TN 252 Ellington
2431 Joe Johnson Dr
Knoxville TN 37996
Tel. 865/974-7999
drobins5@utk.edu

Rodgers, Charlie
Seeds West
37860 W Smith-Emke Rd
Maricopa AZ 85039
Tel. 520/568-2273
Fax. 520/568-2556
crodgers@ag.arizoan.edu

Rogers, C Brent
UPO 702
150 University Blvd
Morehead KY 40351
Tel. 606/783-2660
Fax. 606/783-5067
b.rogers@moreheadstate.edu

Sandbrink, Joe J
Mosnato Company C3SF
800 N Lindbergh Blvd
St Louis MO 63167
Tel. 314/694-1200
Fax. 314/694-2687
joe.j.sandbrink@monsanto.com

S

Sanders, Dearl
LSU AgCenter
4419 Idleuild Rd
Clinton LA 70722
Tel. 225/683-5848
dsanders@agctr.lsu.edu

Sanders, Jason
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Sapmongthong, Thatsaka
Universityof Kentucky
1405 Veterans Dr
Lexington KY 40546
Tel. 859/323-9628
tsapha@uky.edu

Savage, Kenneth E
Mid-South Agric Service
2382 Hinkley Rd
Proctor AR 72376

Scasta, John D
Texas A&M University
2474 TAMU
College Station TX 77843
Tel. 979/845-8736

Scherder, Eric
AgriGold
Rt 1 Box 203
St FrancisvilIL 62460
Tel. 800/262-7333
eric.scherder@agrigold.com

Schmidt, Bob
SWSS
1508 W University
Champaign IL 61821
Tel. 217/352-4212
Fax. 217/352-4241
raschwssa@aol.com

Schraer, Marty
Syngenta Crop Protection
1210 S Fifth Ave
Cleveland MS 38732
Tel. 662/686-5765
Fax. 662/686-9859
marty.schraer@syngenta.com

Schwarzlose, Gary L
Bayer CropScience
1331 Rolling Creek
Spring Branch TX 78070
Tel. 830/885-4287
Fax. 830/885-7382
gary.schwarzlose@bayercropscience.com

Sciumbato, Audie
Texas A&M University
2484 TAMU
College Station TX 77843
Tel. 979/845-4629
Fax. 979/845-0456
audie@tamu.edu

Scott, Robert C
Univ of Ark Coop Extn
2001 Hwy 70 East
Lonoke AR 72086
Tel. 501/676-3124
Fax. 501/676-7847
bscott@uaex.edu

Senseman, Scott
Texas A&M University
2472 TAMU
College Station TX 77843
Tel. 979/845-5375
Fax. 979/845-0456
s-senseman@tamu.edu

Shankle, Mark W
Pontotoc Expt Station
8320 Hwy 15 South
Pontotoc MS 38863
Tel. 662/489-4621
Fax. 662/489-6011
shankle@ra.msstate.edu

Shaw, David R
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-9575
Fax. 662/325-9578
dshaw@gri.msstate.edu

Shaw, Richard
Bayer CropScience
PO Box 475
Smithville MO 64089
Tel. 816/242-0365
richard.shaw@bayercropscience.com

Sherrick, Stew
Monsanto Company
60 Arrow Pointe
Youngsville NC 27596
Tel. 919/556-7124
Fax. 919/556-7124
stewart.l.sherrick@monsanto.com

Shilling, Donn G
University of Georgia
3111 Miller Plant Sci
Athens GA 30602
Tel. 906/542-0900
Fax. 706/542-2914
dgs@uga.edu

Shiver, Barry
University of Georgia
Warnell School of Forest
Athens GA 30602
Tel. 706/542-3099
Fax. 706/542-8356

Shivrain, Vinod
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
Fax. 479/575-3975
vks4@uark.edu

Siebert, Jonathan
Louisiana State Univ
104 M B Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1299
Fax. 225/578-1403
jsiebert@agcenter.lsu.edu

Simmons, Jason
Western Kentucky Univ
6924 Horrell Rd
Owensboro KY 42301
Tel. 270/229-4960
simmonspigfarm@hotmail.com

Singh, Megh
University of Florida
700 Experiment Sta Rd
Lake Alfred FL 33850
Tel. 863/956-1151
Fax. 863/956-4631
msingh@crec.ifas.ufl.edu

Singh, Samunder
University of Florida
700 Experiment Sta Rd
Lake Alfred FL 33850
Tel. 863/956-1151
Fax. 863/956-4631
samunder@lal.ufl.edu

Singh, Shilpy
2337 SW Archer Rd #1108
Gainesville FL 32608
Tel. 352/871-4587
shilpy@ufl.edu

Slack, Charles H
University of Kentucky
415 Plant Science Bldg
Lexington KY 40546
Tel. 859/257-5020
cslack@uky.edu

Smith, H Ray
Biological Res Service
4601 Spyglass
College Station TX 77845
Tel. 979/574-3666
rsmithbrs@cox-internet.com

Smith, Kenneth L
University of Arkansas
PO Box 3508
Monticello AR 7165
Tel. 870/460-1091
Fax. 870/460-1415
smithken@uamont.edu

Snipes, Charles E
MSU-DREC
PO Box 197
Stoneville MS 38776
Tel. 662/686-9311
Fax. 662/686-3334
csnipes@drec.msstate.edu

Sparks, Oscar
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
Fax. 479/575-3975
osparks@uark.edu

Spinks, Ben
Miss State Univ
PO Box 9555
Miss State MS 39762
Tel. 662/325-2311

Stall, William M
Universityof Florida
1243 Fifield Hall
Gainesville FL 32611
Tel. 352/392-2134
Fax. 362/392-5653
wms@ifas.ufl.edu

Stapleton, Gregory
BASF Corporation
916 Flicker Dr
Dyersburg TN 38024
Tel. 731/589-2629
Fax. 731/286-6988
staplegs@basf.com

Steckel, Larry
West TN Expt Station
605 Airways Blvd
Jackson TN 38301
Tel. 731/425-4705
lsteckel@utk.edu

Steele, Greg
Dept of Soil & Crop Sci
Texas A&M University
College Station TX 77843
Tel. 979/845-8696
Fax. 979/845-0456
gsteele@tamu.edu

Stewart, Alexander
LSU AgCenter
8105 Tom Bowman Dr
Alexandia LA 71302
Tel. 315/473-6522
Fax. 318/473-6536
sstewart@agcenter.lsu.edu

Strachan, W Fred
Bayer CropScience
1301 South 5th Ave
Cleveland MS 38732
Tel. 662/686-9323
Fax. 662/686-9888
fred.strachan@bayercropscience.com

Strahan, Ronald E
Louisiana State Univ
104 Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-4070
Fax. 225/578-1403
rstranhan@agcenter.lsu.edu

Street, Joe
Miss State Univ
PO Box 1690
Verona MS 38879
Tel. 662/566-2201
jstreet@ext.msstate.edu

T

Tagert, Mary Love
Miss State Univ
Box 9555
Miss State MS 39762

Talbert, Ronald E
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-2657
Fax. 479/575-3975
rtalbert@uark.edu

Talley, Craig
Oklahoma State Univ
Agronomy Dept
Stillwater OK 74078
Tel. 405/624-7057
Fax. 405/744-5269
mct@mail.pss.okstate.edu

Taylor, Jim
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Taylor, Rob S
Pontotoc Expt Station
8320 Hwy 15 South
Pontotoc MS 38863
Tel. 662/489-4621
Fax. 662/489-6011
rst20@pss.msstate.edu

Teem, David H
Auburn University
250 Funchess Hall
Auburn Univ AL 36849
Tel. 334/844-3981
Fax. 334/844-3945
teemdav@auburn.edu

Test, Gary
University of Florida
700 Experiment Sta Rd
Lake Alfred FL 33850
Tel. 863/956-1151
Fax. 863/956-4631
gkt@lal.ufl.edu

Teuton, Travis
Univ of TN 252 Ellington
2431 Joe Johnson Dr
Knoxville TN 37996
Tel. 865/974-7324
tteuton@utk.edu

Thomas, David
Syngenta Crop Protection
608 Kratz Rd
Monticello IL 61856
Tel. 217/762-4152
Fax. 217/762-5733
dave.thomas@syngenta.com

Thomas, Walter E
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-5654
Fax. 919/515-5315
wethomas@unity.ncsu.edu

Thompson, Angela
West TN Expt Sta
605 Airways Blvd
Jackson TN 38301
Tel. 731/425-4706
athompson@utk.edu

Tingle, Chris
U of A Coop Extn Service
2301 S University Ave
Little Rock AR 72204
Tel. 501/671-2278
Fax. 501/671-2297
ctingle@uaex.edu

Totten, Wesley
Clemson University
E-142 Poole & Ag Bldg
Clemson SC 29631
Tel. 864/656-6365
ftotten@clemson.edu

Tredaway Ducar, Joyce A
Berry College
PO Box 5003
Mt Berry GA 30149
Tel. 706/368-6938
Fax. 706/236-2223
jducar@berry.edu

Tucker, Brian J
Clemson University
142 E P & A Bldg
Clemson SC 29633
Tel. 864/656-6365
voxindeserto@yahoo.com

Turner, Jay
Micro Flo Company
8050 Meadow Creek Cove
Olive Branch MS 38654
Tel. 662/890-7553
Fax. 662/890-7543
jay.turner@microflocompany.com

U

Underwood, Allen
Helena Chemical
7664 Moore Rd
Memphis TN 38120
Tel. 901/752-4401
Fax. 901/756-9947
underwooda@helenachemical.com

Unruh, J Bryan
University of Florida
5988 Hwy 90 W Bldg 4900
Milton FL 32583
Tel. 850/995-3720
Fax. 850/995-3723
jbu@ulf.edu

V

Vencill, William
University of Georgia
3111 Miller Plant Scienc
Athens GA 30602
Tel. 706/542-3117
Fax. 706/542-0914
wvencill@uga.edu

Vidrine, P Roy
Dee Lee Research Sta
8105 E Campus Ave
Alexandria LA 71302

Vodrazka, Keith
Bayer CropScience
9673 Shade Green Cove
Lakeland TN 38002
Tel. 901/338-1796
Fax. 901/384-0317
keith.vodrazka@bayercropscience.com

Voth, Richard D
Monsanto Company E3NA
800 N Lindbergh Blvd
St Louis MO 63167
Tel. 314/694-7589
richard.d.voth@monsanto.com

W

Walden, Blaine R
University of Georgia
4315 Lexington Rd #3C
Athens GA 30605
Tel. 706/296-9725
brwaledn@uga.edu

Walker, Eric R
University of Arkansas
1366 W Altheimer Dr
Fayetteville AR 72704
Tel. 479/575-3955
Fax. 479/575-3975
erwalke@uark.edu

Walker, Harold
Auburn University
210 Funchess Hall
Auburn AL 36849
Tel. 334/844-3974
Fax. 334/844-3945
walkerh@auburn.edu

Wallace, Russell W
Texas Ag Res & Extn Ctr
Rt 3 Box 213 AA
Lubbock TX 79403
Tel. 806/746-4052
Fax. 806/746-4057
rwallace@ag.tamuedu

Walls, Carroll E
UAP Timberland
3300 Foxcroft Rd
Little Rock AR 72227
Tel. 501/227-5675
Fax. 501/227-8459
cwalls7760@aol.com

Walton, Jason
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Walton, Larry
Dow AgroSciences
693 Walton Rd SW
Tupelo MS 38804
Tel. 662/862-3544
Fax. 662/862-3504
lwalton@dow.com

Waltz, Clint
C&SS Redding Bldg
1109 Experiemnt St
Griffin GA 30223
Tel. 770/228-7300
Fax. 770/412-4774
cwaltz@uga.edu

Warren, Leon S
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-5651
Fax. 919/515-5315
leon_warren@ncsu.edu

Watkins, Bobby
BASF Corporation
2220 Amelia Lane
Starkville MS 39759

Weaver, Mark
USDA ARS SWSRU
141 Experiment Station
Stoneville MS 38776
Tel. 662/686-9957
mweaver@ars.usda.gov

Webster, Eric
Louisiana State Univ
104 MB Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1189
Fax. 225/578-5976
ewebster@agcenter.lsu.edu

Webster, Ted
USDA ARS
PO Box 748
Tifton GA 31794
Tel. 229/386-3363
Fax. 229/386-3437
twebster@tifton,usda.gov

Wehtje, Glenn
Auburn University
233 Funchess Hall
Auburn Univ AL 36849
Tel. 334/844-3993
Fax. 334/844-3945
gwehtje@acesag.auburn.edu

Welch, Jeff B
Univ of AR Coop Extn
Box 357
Lonoke AR 72086
Tel. 501/676-3124
Fax. 501/676-7847

Wells, Jerry W
Syngenta Crop Protection
PO Box 18300
Greensboro NC 27419
Tel. 336/632-6324
Fax. 336/292-6374
jerry.wells@syngenta.com

Wells, Wayne
Misss State Univ
PO Box 9555
Miss State MS 39762
Tel. 662/325-2331
Fax. 662/325-8742
wwells@ext.msstate.edu

Whaley, Cory M
26558 Kaye Rd
Seaford DE 19977
Tel. 540/231-7604
cwhaley@vt.edu

White, Clint M
University of Florida
5988 Hwy 90 W Bldg 4900
Milton FL 32583
Tel. 850/995-3720
Fax. 850/995-3723
cmwhite@mailifas.ufl.edu

Whitehead, James
Makhtshum Agon
302 Deer Run North
Oxford MS 38655
Tel. 662/513-4333
Fax. 662/236-6716
james.whitehead1@worldnet.att.net

Whitehead, Keith
LSU AgCenter
350 Louisiana St
Roxie MS 39661
Tel. 225/683-5848
awhitehead@agctr.lsu.edu

Wiese, Ann
Bayer
5017 Andover
Plano TX 75023
Tel. 972/633-9176
Fax. 972/633-9176
ann.wiese@bayercropscience.com

Wilcut, John
North Carolina State Univ
Box 7620
Raleigh NC 27695
Fax. 919/515-5315
john_wilcut@ncsu.edu

Wiley, Gerald L
Makhteshin - Agan
22401 Hwy 31 S
Underwood IN 47177
Tel. 812/294-3095
Fax. 812/294-4282
gwiley@manainc.com

Wilkerson, Gail G
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-5816
Fax. 919/515-5855
gail_wilkerson@ncsu.edu

Wilkerson, Tessie
Monsanto Company
4006 Old Leland Rd
Leland MS 38756
Tel. 662/378-1021
Fax. 662/378-1033
tessie.h.wilkerson@monsanto.com

Williams, Bill J
LSU AgCenter
Hwy 605 N
St Joseph LA 71366
Tel. 318/766-4609
Fax. 318/766-4278
bwilliams@agctr.lsu.edu

Williams, Rick
University of Florida
5588 Hwy 90
Milton FL 32571
Tel. 850/983-5217
williams@ifas.ufl.edu

Williams, Steve
DuPont
200 Palmers Ct
Madison MS 39110
Tel. 601/853-6637
c.s.williams-1@usa.dupont.com

Williamson, Dennis H
Monsanto Company
90 Dalton St
Charleston SC 29492
Tel. 843/697-1907
Fax. 846/278-0866
dennis.h.williamson@monsanto.com

Willian, Todd
Western Kentucky Univ
1 Big Red Way
Bowling Green KY 42101
Tel. 270/745-5969
Fax. 270/745-5972
todd.willian@wku.edu

Willingham, Sam
University of Florida
304 Newell Hall
Gainesville FL 32611
Tel. 352/392-7512
Fax. 352/392-1840
sam25@ufl.edu

Willis, John
Oklahoma State Univ
272 D Ag Hall
Stillwater OK 74074
Tel. 405/612-7257
johnbw@mail.pss.okstate.edu

Willis, Thomas G
Clemson University
E142 Poole & Ag bldg
Clemson SC 29631
Tel. 864/656-6365
twillis@clemson.edu

Wills, Gene
Delta Res & Extn Ctr
PO Box 197
Stoneville MS 38776
Tel. 662/686-3228
Fax. 662/686-7336
gwills@drec.msstate.edu

Wilson, Alan
Boise Cascade Corp
PO Box 1060
DeRidder LA 70634
Tel. 337/462-4646
alanwilson@boisepaper.com

Wilson, Henry P
Virginia Tech
33446 Research Dr
Painter VA 23420
Tel. 757/414-0724
Fax. 757/414-0730
hwilson@vt.edu

Wilson, Sam
Loveland
117 Tealight Ln
Cary NC 27513
Tel. 803/413-7824
Fax. 803/419-6660
sam.wilson@uap.com

Wilson, Jr, David G
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-2865
davie_wilson@ncsu.edu

Witt, William W
Univ of KY 411 Plant Sci
1405Veterans Dr
Lexington KY 40546
Tel. 859/257-5020
FAX. 859/257-7874
wwitt@uky.edu

Wright, Scott
Miss State Univ
Box 9555
Miss State MS 39762
Tel. 662/325-2311
Fax. 662/325-8742

Wyse-Pester, Dawn
Monsanto Company C3SF
800 N Lindburgh Blvd
St Louis MO 63167
Tel. 314/694-4092
dawn.y.wyse-pester@monsonto.com

Y
Yeiser, Jimmie L
S F Austin State Univ
PO Box 6109
Nacogdoches TX 75962
Tel. 936/468-3301
Fax. 936/468-2489
jyeiser@sfasu.edu

York, Alan
North Carolina State Univ
Box 7620
Raleigh NC 27695
Tel. 919/515-5643
Fax. 919/515-5315
alan_york@ncsu.edu

Youmans, Cletus D
BASF Corporation
1875 Viar Rd
Dyersburg TN 38024
Tel. 731/445-8880
Fax. 731/287-1788
youmanc@basf.com

Z
Zablotowicz, Bob
USDA ARS SWSRU
PO Box 350
Stoneville MS 38776
Tel. 662/686-5260
Fax. 662/686-5262
rzibklitiwucz@ar.usda.gov

Zawierucha, Joe
BASF Corporation
26 Davis Dr
Res Tria Park NC 27709
Tel. 919/547-2095
zawierj@basf.com

Zhang, Wei
Louisiana State Univ
104 MB Sturgis Hall
Baton Rouge LA 70803
Tel. 225/578-1189
Fax. 225/578-4673
wzhang@agcenter.lsu.edu

SUSTAINING MEMBERS 2004

ALMACO Company
99 M Street
Nevada, IA 50201

BASF Corporation
7 Cameroons Place
Durham, NC 27703

Bayer Crop Science
PO Box 4913
Kansas City, MO 64120

Bellspray Inc dba R&D Sprayers
PO Box 269
Opelousas, LA 70571

Brewer International
PO Box 6006
Vero Beach, FL 32961

Burch Company
1611 Industrial Dr.
N. Wilkesboro, NC 28697

Dow AgroSciences
314 N. Maple Glade Circle
The Woodlands, TX 77832

DuPont Ag Products
2021 Gardnerbook Dr.
Raleigh, NC 27606

Farm Press Publications
PO Box 1420
Clarksdale, MS 38614

Farmers Supply Cooperative
PO Box 9009
Greenwood, MS 38930

FMC Corporation
1735 Market Street
Philadelphia, PA 19103

Gandy Corporation
528 Gandrud Rd.
Owatonna, MN 55060

Gylling Data Management, Inc.
405 Martin Blvd.
Brookings, SD 57006

Helena Chemical Company
225 Schilling Blvd., Suite 300
Collierville, TN 38017

Louisiana Agric Consultants
5 Carl Circle
Vidalia, LA 71373

Marathon Ag/Environment
2649 Navajo Rd
Las Cruces, NM 88007

Monsanto Company
1609 Iredell Dr.
Raleigh, NC 27608

PBI/Gordon Corporation
PO Box 014090
Kansas City, MO 64101-0090

Regal Chemical Company
PO Box 900
Alpharetta, GA 30239

Robertson Bonded Warehouse
4206 Locust Ave.
Lubbock, TX 79404

SSI Maxim Company, Inc.
PO Box 1954
Kilgore, TX 75662

Syngenta Crop Protection
8000 Centerview Pkwy, Suite 501
Cordova, TN 38018

Tennessee Farmers Coop
PO Box 3003
LaVergne, TN 37086

Thomson Publications
PO Box 9335
Fresno, CA 93791

UAP Timberland LLC
PO Box 557
Monticello, AR 71655

Valent USA Corporation
PO Box 5008
Greenville, MS 38704

Waldrum Specialties Inc.
4050 A Skyron Dr.
Doyelstown, PA 18901

Weed Systems Equipment Inc.
260 Commercial Circle
Keystone Heights, FL 32656

Weeds, Inc.
250 Bodley Rd.
Aston, PA 19014