PREFACE

These PROCEEDINGS of the 58th Annual Meeting of the Southern Weed Science Society contain papers and abstract of presentations made at the annual meeting. 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 2005 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.

William K. Vencill, Editor
Southern Weed Science Society
www.swss.ws

CD Contents for 2005

CD Contents for 2005

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 spacingbefore 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.

2005 Distinguished Service Award-Academia

Joe E. Street

Joe grew up on a dairy farm in North Mississippi and attended Mississippi State University where he received a B.S. degree with distinction in 1970 and M.S. in 1972 in Plant Pathology. After completing his Masters, Joe was commissioned as a Second Lieutenant in the U.S. Army Chemical Corps where he served for three and one-half years. He holds the rank of Lieutenant Colonel (retired) in the Mississippi Army National Guard. Joe entered graduate school at Auburn University in 1976 and received his Ph.D. in Agronomy (Weed Science) in 1980 under the direction of Dr. Gale Buchanan.

Dr. Street joined the staff of the Mississippi Agricultural and Forestry Experiment Station at Stoneville, MS in 1980 as an Assistant Plant Physiologist. His primary research emphasis was control of problem weeds in rice. Joe served as Rice Research Coordinator for MSU and Liaison to the Mississippi Rice Promotion Board. In addition to his research responsibilities, Joe assumed the duties as Extension Rice Specialist in 1997. In 2004, Joe was named Head of the North Mississippi Research and Extension Center in Verona, with branch locations in Holly Springs, Pontotoc, and Prairie. Dr. Street became a member of SWSS in 1976 as a graduate student at Auburn. Upon graduation and employment at MSU, he co-hosted the first weed contest to be held at a non-industry location. He has served SWSS on numerous committees including weed contest, awards, research, finance, program, public relations, and long range planning. Dr. Street was elected to the Board of Directors in 1990 as a member at large-academia. He was elected Editor in 1993 for a three-year term. As Editor, Joe was instrumental in moving SWSS into the electronic age with electronic submission of abstracts. In 1996, Dr. Street was elected WSSA representative and in 1999 he was elected vice president and moved through the offices of president elect, president and past president. He continues to serve SWSS as a member of the Long Range Planning Committee.

In addition to service to SWSS, Joe was an organizer and one of three incorporators of the Mississippi Weed Science Society and has served as president of that society. He served on the WSSA Board of Directors and as Associate Editor of Weed Technology. He has served as secretary and president of the Rice Technical Working Group, an international organization of rice industry personnel. He serves on the Board of Directors of several organizations and he is a member of Gideon's International and a Deacon in his church.

Dr. Street's awards include the Sigma Xi Research Award, WSSA Outstanding Graduate Student Award, SWSS Outstanding Young Weed Scientist Award, Mississippi Weed Science Society Research Award, Distinguished Service Award, and Education Award, Rice Researcher of the Year-2000, and RTWG Distinguished Service Award.

2005 Distinguished Service Award-Industry

Harold Ray Smith

Harold Ray Smith was reared on a small family farm near Keiser, Arkansas. During his high school years he was active in the Future Farmers of America, serving as president of the local chapter. Ray received his Associate of Science degree at Arkansas Tech College, his B.S. and M.S. degree at the University of Arkansas. During his undergraduate studies he served as President of the Agronomy Club and was a member of Alpha Zeta and the Farm House Fraternity. He joined the weed science staff at the University of Arkansas and completed his M.S. under Dr. R.E. Frans in 1968.

In 1968, Ray joined the Diamond Shamrock Corp. as a Field Research and Development Representative in Memphis, TN. He served in this position for 14 years responsible for several states. He also worked in the Peoples Republic of China, Brazil and South Africa. In 1981, Ray became Field Research and Development Manager for SDS Biotech/Diamond Shamrock Corporation in Painesville, Ohio. In 1985, he accepted a position with Ciba-Geigy Corp. in College Station, Texas. In 2000, he started his own company, Biological Research Services, Inc.

Ray has been a member of SWSS for 29 years and has served on several committees. He has served as a member and President of the SWSS Endowment Foundation Board of Trustees, 1999-2003. He is confounder of the Texas Plant Protection Conference and has served as President and as Chairman of its Board of Directors. He is a charter member and served as President of the Southern Disease Workers. He has served on the Finance, Nominating and Editorial Committees of the American Peanut Research and Education Society.

During his career Ray has given numerous presentations at the SSWD, APRES, SWSS, Beltwide Cotton Conference, and state conferences. In his spare time he became Founder and Head Coach of the College Station Tackle Youth Football League.

Ray is married to Sandra Born and they have three children, Bradley 20, a junior at TAME, Cody 16 and Wesley 11.

2005 Outstanding Educator Award

John W. Wilcut

John W. Wilcut, a native of Missouri, grew up in a small town in central Illinois. He received his B.S. and M.S. degrees in Botany from Eastern Illinois University at Charleston. In 1986 he completed his Ph.D. in Weed Science-Plant Physiology at Auburn University under the direction of Dr. Bryan Truelove and Dr. Donald E. Davis. He then worked as a post-doctoral research associate in the Agronomy and Soils Department for Dr. Glen Wehtje. John was an extension weed specialist at the Tidewater Agricultural Research and Extension Center, VPI&SU from 1987 to 1990. He was with the University of Georgia at the Coastal Plain Experiment Station in Tifton from 1990 to 1994 as an assistant and then associate professor. He joined the faculty in the Crop Science Department at North Carolina State University in 1994 where he currently is a professor with a research/teaching appointment.

John has developed a comprehensive research program at NCSU that integrates herbicide/crop physiology, weed biology/ecology, and weed management for development of weed management systems that maintain and improve crop quality and profitability while enhancing environmental quality. He is nationally and internationally recognized for his research on cotton and peanut weed management, ecological interactions, and physiology. John has authored or co-authored 153 refereed journal articles, 10 bulletins/reports, and >370abstracts. He has served or is serving as chair/co-chair for 23 graduate students. He currently advises 5 Ph.D. and one M.S students. He has also served or is serving on 26 graduate student advisory committees. His students have excelled in student paper, poster, and weed contests. Four M.S. students have won the Outstanding M.S. Graduate Student Award at the SWSS and three other graduate students have received the Outstanding Graduate Student award from the WSSA. Other graduate student awards include the Gerald O. Mott Meritorious Outstanding Graduate Student Award from the Crop Science of America and the 1st George Washington Carver Graduate Student Award from the National Peanut Board. He teaches CS 414 Weed Science, which is considered among the hardest undergraduate classes in the Crop Science Department, and regularly is one of the highest ranked classes in the department.

Dr. Wilcut has served on numerous committees, chaired and moderated sessions, organized symposia, and judged papers and posters for the SWSS. He has also served WSSA on numerous committees, section chair, and reviewer for Weed Technology and Weed Science, abstract editor, associate editor for Weed Technology, and Editor for Weed Technology since 2002. John has received the Outstanding Young Weed Scientist Award from the SWSS and WSSA, Weed Scientist of the Year-2003 from the SWSS, the DowAgroSciences Award for Excellence in Research from the American Peanut Research and Education Society, and is a Fellow of the WSSA. He is most proud of his wife of nearly 30 years, Cathy, and their two children, Jared and Caitlyn. He also feels blessed to have had cancer and very fortunate to be a cancer survivor of 16 months and counting.

2005 Weed Scientist of the Year

R. M. Hayes

Robert M. Hayes, Professor of Plant Sciences, University of Tennessee, is from Parsons (Decatur County), Tennessee. He was educated in local public schools, attended the University of Tennessee at Martin, and received his B.S. from The University of Tennessee, Knoxville, in 1968, and his Ph.D. from the University of Illinois in 1974 after serving two years in the US Army. Dr. Hayes joined the faculty at the University of Kentucky as Assistant Professor of Agronomy. In 1978, he joined The University of Tennessee Department of Plant and Soil Sciences and was located at the West Tennessee Experiment Station. Dr. Hayes primary responsibility was to development weed management systems for conservation tillage cropping systems that were efficacious and economically and environmentally sustainable. His efforts were integrated with a team of colleagues that have made Tennessee one of the leading states in the adoption of conservation tillage cropping systems.

Although not located on the main campus, he has served as major professor for 16 graduate students (7 Ph.D.) and served on the advisory committee of 18 others. He has published two book chapter, 37 refereed journal articles, 76 research reports, and 228 abstracts, 15 popular articles. His clientele include producers, consultants, research and extension colleagues, policy makers, media personnel, regulatory agencies and the general public. Dr. Hayes is a recognized expert for weed management systems in conservation tillage cropping systems. Bob's research encompasses weed-crop interference, edaphic and climatic factors affecting herbicide efficacy and environmental fate, crop response to herbicides, harvest aids, economics of weed management systems, and herbicide resistant crops and weeds. He was the first to report glyphosate resistant horseweed in the MidSouth and has led the research program to develop effective strategies to manage horseweed in cotton, corn and soybean. His insights are sought by a diverse clientele.

Dr. Hayes has been a member of Southern Weed Science Society for 30 years. He is a member and Fellow of the Weed Science Society of America. Bob is also a member of the International Weed Science Society and Council for Science and Technology. He is Past-President of the SWSS and currently serves as an Endowment Trustee. He received the 2001 SWSS Distinguished Service Award, *Progressive Farmers* 2002 Man of the Year in Service to Tennessee Agriculture Award, the 2002 UT Institute of Agriculture Research Impact Award, 2002 S. H. Phillips Distinguished Lecture in No-tillage Agriculture at the University of Kentucky and the 2004 National Conservation Tillage Cotton Researcher of the Year Award. He has also served as Associate Editor of Weed Technology and as Weed Science Technical Editor for the Journal of Cotton Science. He serves his discipline as a reviewer and through several committees.

Dr. Hayes has been invited to present his research in Germany, France, Columbia, and Argentina and has served as host for four foreign exchange students and one visiting scientist, and for numerous domestic and international groups touring no-till research at the Milan Experiment Station.

He served as Interim Superintendent of the West Tennessee Experiment Station until October 2002, when he was named the sixth superintendent of the station. He continues as a Professor in the Department of Plant Sciences.

2005 Outstanding Young Weed Scientist Award

Eric Protsko

Eric P. Prostko was born in western Pennsylvania and grew up in the diverse agricultural region of southern New Jersey. Although not born on a family farm, Eric has worked in and around agriculture for most of his life. Dr. Prostko graduated *cum laude* and received his B. S. Degree in Agronomy from Delaware Valley College in 1986. He completed is M. S. degree in 1988 in Crop 7 Soil Sciences (Weed Science) from Rutgers University under the supervision of Dr. Richard Ilnicki. Eric was employed as an Assistant Professor and County Extension Agent with Rutgers Cooperative Extension in Burlington County, New Jersey from 1988 to 1993. In that position, he was responsible for delivering a county-based extension program for row crop production in a five county regions of southern New Jersey. Eric left Rutgers University in 1993 to pursue a Ph. D. degree win Weed Science at Teas A&M University under the direction of Dr. Mike Chandler. Eric completed his Ph. D. degree in 1997 while employed as a full-time Research Associate in the Department of Soil & Crop Sciences. Eric accepted a position as an Assistant Professor and Extension Agronomist in 1997 with Texas A&M in Stephenville. He was responsible for agronomic extension education in a 21 county region of central Texas with emphasis on weed control in peanuts and field corn. Eric accepted a position as Assistant professor and Extension Weed Specialist with the University of Georgia in 1999. Dr. Prostko is located at Tifton and is responsible for the statewide extension weed science programs in peanuts, field corn, soybeans, sunflowers, and grain sorghum.

Dr. Prostko is an active member of SWSS and has made oral or poster presentations at all annual meetings since joining SWSS in 1994. Activities include serving as a judge for the graduate student paper/poster contests (4 times), member of the Outstanding Graduate Student Award Subcomittee, and is currently an Endowment Foundation Trustee. He won the SWSS Weed Contest in 1996, was a 1st Place winner of the Graduate Student Paper Contest in 1997, and a 2nd place winner of the Graduate Student Poster Contest in 1996. Dr. Prostko authored or co-authored 23 refereed journal articles, 86 abstracts, 72 popular press articles, over 325 miscellaneous extension publications. He conducts numerous in-service training meetings for extension agents and made over 250 presentations at local production meetings during his career.

Eric has been married to the former Joann Carroll for 17 years and they have three children: Nicholas (14), Shelby 910), and Isabelle (8).

2005 Outstanding Graduate Student Award (PhD)

Ian Burke

Ian Burke obtained the B. S. degree from Old Dominion University in 1997. He accepted a graduate research assistantship at N. C. State University in 1999 under the direction of Dr. John Wilcut. His responsibilities included coordinating and conducting weed management research in cotton, peanut, corn and soybean, as well as, field, laboratory, and greenhouse studies involving weed biology and herbicide physiology. His M. S. research dealt with the influence of environmental factors on broadleaf signalgrass and crowfootgrass and research involving antagonism of trifloxysulfuron, clethodim, and imazapic.

Ian has made 21 presentations at various professional meetings since 1999 and authored or co-authored on 34 abstracts from such presentations. Ian published 13 refereed journal articles and was named the Outstanding M. S. Student of the Year for the Weed Science Society of North Carolina. He also won the Outstanding Graduate Student Award from WSSA in 2003. Ian is in the process of finishing his doctorate from N. C. State University.

2005 Outstanding Graduate Student Award (MS)

Whitnee Barker

Whitnee Lee Barker was born in Kokomo IN on July 4, 1980 as the second daughter of Randy and Marcylena Barker. Shortly thereafter, her family moved to Flemingsburg KY to a dairy farm. She graduated *cum laude* from Fleming County High School in 1998 and entered the University of Kentucky. She obtained a B. S. degree with a double major of Agricultural Biotechnology and Biology in 2002. Whitnee received a Weed Science Society of America undergraduate research award to support her Agricultural Biotechnology research project in the laboratory of Dr. Michael Barrett.

Whitnee received the M. S. degree from Virginia Tech in 2004 under the direction Dr. Shawn Askew. While at Virginia Tech Whitnee was active in the SWSS, NEWSS, WSSA, ASA, CSSA, and the SSSA. She held office in the SWSS and WSSA graduate student organizations. She was a member of the Virginia Tech weed contest teams that placed second (2002) and third (2003) at the NEWSS contests. She also won a second place poster award (2003) and a first place paper award (2004) from the NEWSS. Whitnee received the Arthur J. Webber Outstanding Graduate Student award in 2004 from the Department of Plant Pathology, Physiology, and Weed Science from Virginia Tech. She currently is working on the Ph. D. degree at N. C. State University under the direction of Dr. John Wilcut.

SOUTHERN WEED SCIENCE SOCIETY 2004-2005
OFFICERS AND EXECUTIVE BOARD

100. Southern Weed Science Society Officers and Executive Board

100a. Officers

President	J.S. Harden	2005
President Elect	D.Shaw	2005
Vice President	J. Driver	2005
Secretary - Treasure	T.C. Mueller	2005
Editor	P.A. Dotray	2005
Immediate Past president	W.W. Witt	2005

100b. Additional Executive Board Memebers

Member-at-Large	S.A. Senseman	2006
Member-at-Large	W. F. Strachan	2006
Member-at-Large	J.D. Byrd	2007
Member-at-Large	S.K. Rick	2007
Representative to WSSA	T.R. Murphy	2005
Representative to CAST	J.W. Barrentine	2005

100c. Ex-Offico Board Members

Constitution and Operating Proceedures	G.D. wills	2006
Business Manager	R.A. Schmidt	
Forestry Representative	L. Nelson	2007
Student Representative	Codey Gray	2005
Web Site	D.B. Reynolds	
Endowment Foundation	E.P. Prostko	

101. SWSS Endowment Foundation

Board of Trustees (Elected)

J. C. Banks	President	2005
R. M. Hayes	V. President	2006
E. P. Prostko	Secretary	2007
R.L. Ratlif		2008

Board of Trustees (Ex-Offico)

T.C. Muller	SWSS Secretary / Treasure
Jackie Driver	SWSS Finance Committee Chair
R.A. Schmidt	Swss Business Manager
G.D. Wills	
Codey Gray	Student Representative

NAME	YEAR	EMAIL

102. Awards Committee Parent (Standing)

W.W. Witt	2005	wwitt@uku.edu
K.L. Smith	2005	102a
H.S. McLean	2005	102b
A.C. York	2005	102c
Tom Peeper	2005	102d
Barry Brecke	2005	102e

102 a. Distinguished Service Award

K.L. Smith*	2005	smithken@uamont.edu
D.L.Jordan	2005	david_jordan@ncsu.edu
J.L.Yeiser	2006	jyeiser@sfasu.edu
W.K. Vencill	2006	wvencill@uga.edu
Caroll Walls	2007	cwalls7760@aol.com
Jason Norsworthy	2007	jnorswo@clemson.edu

102b. Outstanding Young Weed Scientist

H.S. McLean*	2005	henry.mclean@syngenta.com
T.R. Murphy	2005	tmurphy@uga.edu
S.W. Murdock	2006	shea.w.murdock@monsanto.com
L.Cargill	2006	lonniecargill@hotmail.com
Henry Wilson	2007	hwilson@vt.edu
Joe Zawierucha	2007	zawierj@basf.com

102c. Weed Scientist of the Year

A.C. York*	2005	alan_york@ncsu.edu
E. Palmer	2005	eric.palmer@syngenta.com
J. Breen	2006	breen@dow.com
L.Nelson	2006	lnelson@clemson.edu
Donnie Miller	2007	dmiller@agctr.lsu.edu
Bob Scott	2007	bscott@uaex.edu

102d. Outstanding Educator

L.L. Whatley	2005	whatlel@basf.com
Megh Singh	2005	msingh@crec.ifas.ufl.edu

J. Doran	2006	jtdoran@dow.com
T.F.Peeper*	2006	peepert@okstate.edu
Russ Perkins	2007	russ.perkins@bayercropscience.com
Gary Schwarzlose	2007	gary.schwarlose@bayercropscience.com

102e. Outstanding Graduate Student

Barry Brecke*	2005	bjbe@mail.ifas.ufl.edu
S. Senseman	2005	s-senseman@tamu.edu
W. K. Vencill	2006	wvencill@uga.edu
A.W. Ezell	2006	aezell@cfr.msstate.edu
E. Scherder	2007	eric.scherder@agrigold.com
Trey Kroger	2007	ckoger@ars.usda.gov

103. Computer Application Committee

S. Senseman	2005	s-senseman@tamu.edu
A. Bailey	2005	abailey@uky.edu
A.C. Bennett*	2006	bennett@ufl.edu
W.K. Vencill	2006	wvencill@uga.edu
Tim Grey	2007	tgrey@tifton.uga.edu
Andy Kendig	2007	kendigj@missouri.edu
Dan Reynolds	Ex-Offico	dreynolds@pps.msstate.edu

104. Constitution & Operating Proceedures Committee (Standing)

G.A. Wills *	2006	gwills@drec.msstate.edu
J.A. Dusky	2006	jadusky@mail.ifas.ufl.edu
R.M. Hayes	2006	rhayes1@utk.edu

106. Finance Committee (Standing)

Jackie Driver	2005	jackie.driver@syngenta.com
David Shaw	2004	dshaw@gri.msstate.edu
Frank Carey	2006	frank.carey@valent.com
Joe Zawierucha	2006	zawierj@basf.com
Mark Shankle	2007	shankle@ra.msstate.edu
Peter Dotray	2005	peter.dotray@ttu.edu
T.C. Mueller	2005	tmueller@utk.edu

107. Historical Committee

C. D. Elmore	2004	delmore@ars.usda.gov
G.D. Wells	2004	gwills@drec.msstate.edu
N. Buehring	2006	byehring@ra.msstate.edu
J. Griffin	2006	jgriffin@agctr.lsu.edu

108. Legislative & Regulatory Committee

D. Schilling*	2006	dgs@uga.edu
G. McDonald	2006	gemac@ifas.ufl.edu
J. L.Ralston	2006	jennifer.l.ralston@monsanto.com
J. Wilcut	2005	john_wilcut@ncsu.edu
Jerry Wells	2007	jerry.wells@syngenta.com
Greg Ferguson	2007	gregory.p.ferguson@monsanto.com
Bill Stall	2007	wms@ifas.ufl.edu

109. Local Arrangement Committee (Standing)

Randy Ratliff *

110. Long Range Planning Committee (Standing)

D. S. Murray	2005	dsm@mail.pss.okstate.edu
L.L. Whatley	2005	whatlel@basf.com
J. E. Street	2006	jstreet@ext.msstate.edu
J.L. Wells	2007	jerry.wells@syngenta.com
W. W. Witt *	2008	wwitt@uku.edu
J. S. Harden	2009	hardenj@basf.com

111. Meeting Site Selection Committee (Standing)

R.L. Ratliff	2006	randy.ratliff@syngenta.com
J. D. Byrd	2005	jbyrd@pss.msstate.edu
M. E. Kurtz	2005	mekurtz@drec.msstate.edu
A. Klosterboer	2007	ajkost@tea.net

T. Grey	2008	tgrey@tifton.uga.edu

112. Nominating Committee

W.W. Witt	2005	wwwitt@uky.edu
S.K. Rick	2005	susan.k.rick@usa.dupont.com
J.A. Kendig	2005	kendigj@missouri.edu
J.L. Yeiser	2005	jyeiser@sfasu.edu
G. Schwarlose	2006	gary.schwarlose@bayercropscience.com
M.A. Thompson	2006	athompson@utk.edu
G. MacDonald	2006	gemac@ifas.ufl.edu
Jay Ferrel	2007	
Joe Street	2007	jstreet@ext.msstate.edu
Ron Strahan	2007	rstranhan@agcenter.lsu.edu

113. Placement Committee (Standing)

W.S. Garbett	2005	billgarbett@ipaper.com
R. Jain	2005	rakesh.jain@syngenta.com
C. Brommer	2007	clb.4@hotmail.com
D.Dodds	2007	
Mark Shankle	2007	shankle@ra.msstate.edu
Jeff Ellis	2007	jeffery.ellis@bayercropscience.com

114. Program Committee - 2005

Chairperson	David Shaw
Agronomic Crops	David Jordan
Turf	Cliff Waltz
Horticultural Crops	Andrew Bennett
Forest Vegetation Management	David Stevens
Rights of Way and Industrial Sites	Greg MacDonald
Physiology, Biology, and Ecology	Todd Boughman
Invasive Species	John Byrd
Developing Technology	Clifford Koger
Education and Extension	David Lanclos
Soil and Enviornmental Aspects	Cade Smith
Posters	Robert Scott
Pasture and Rangeland	Case Medlin

Regulatory	James Holloway

115. Program Committee - 2006

Chairperson	Jackie Driver
Agronomic Crops	James Holloway
Horticultural Crops	Peter Porpigilia
Soil & Environmental Aspects	Nilda Burgos
Ecological, Physiological & Biological Aspects	Shawn Askew
Pasture and Rangeland	Twain Butler
Utility, Railroad & Highway Rights of Way, Industrial Sites	Doug Montgomery
Turf	Scott Elroy
Forest Vegetation Management	Michael Blazier
Applications of Herbicides	Todd Baughman
Educations Aspects of Weed Control	David Jordan
Regulatory	Jerry Wells
Research Posters	Peter Dotray

116. Public Relations Committee (Standing)

T. Koger *	2006	ckoger@ars.usda.gov
L. Nelson	2006	lnelson@clemson.edu
G.L. Cloud	2005	gary.cloud@syngenta.com
B.W. Bean	2005	b-bean@tamu.edu
Tim Adcock	2007	timadcock@charter.net
Sam Garris	2007	samuel.garris@bayercropscience.com

117. Research Committee (Standing)

Jackie Driver	Chairperson
E.P. Webster	Economic Loss Due To Weeds
J.D. Byrd	State Extension Weed Control Publications
T. M. Webster	Weed Survey - Southern States
V.L. Ford	Chemical & Physical Properties of New Herbicides

118. Resolutions and Necrology Committee (Standing)

S. Askew	2005	saskew@vt.edu
J. C. Holloway	2005	james.holloway@syngenta.com

T. Willian	2006	todd.willian@wku.edu
C. Main	2006	cmain@utk.edu
Joe Reed	2007	joesph_reed@fmc.com
Darren Robinson	2007	drobins5@utk.edu

119. Sales Coordination Committee (Standing)

D.R. Reynolds	2005	dreynolds@pps.msstate.edu
T. Barber	2005	1tb31@pss.msstate.edu
M. DeFelice *	2006	michael.defleice@pioneer.com
J. Driver	2006	jackie.driver@syngenta.com
Shea Murdock	2007	shea.w.murdock@monsanto.com
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122. Sustaining Membership. (Sustaining)

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124. Weed Identification Committee (Standing)

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Minutes of Summer SWSS board meeting, Charlotte Westin, June 3-4, 2004

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Meeting called to order at 1:00 PM by President John Harden.

Those in attendance: Jackie Driver (Vice President), John Byrd (Board Member-Academia), Susan Rick (Board member-Industry), Scott Senseman (Board Member Academia), Peter Dotray (outgoing Proceedings Editor), Tim Murphy (WSSA Rep), David Shaw (President Elect and Program Chair), Bob Schmidt (Business Manager), John Harden (President), Dan Reynolds (Web Master), Bill Witt (past President), Gene Wills (MOP rep), Cody Gray (Grad Student Rep), Randy Ratliff (Local Arrangements Chairman), Tom Mueller (Secretary/Treasurer).

Those absent: Fred Strachan (board member-industry), Jim Barrentine (CAST Representative), Larry Nelson (Forestry Representative).

Harden discussed the agenda for the meeting, and introduced Peter Bloome as a guest.

Shaw moved, Senseman seconded to accept the minutes from the January 2004 meetings. Motion passed.

Mueller and Schmidt made financial report. SWSS had net loss of $43,295 in fiscal year 2003/2004. Most of this had been anticipated, due to 1) expense of conference at the Peabody Hotel, 2) decline in publications sales revenue, and 3) purchase of new publications. Travel expenses were also substantially above budget due to attendance of Mueller, Senseman, and Shaw at two CAST leadership training meetings. SWSS financial condition still sound.

Byrd moved, Witt seconded to accept treasurer's report. Motion passed.

Schmidt (Business Manager's report): Discussion about shipping and handling of publications.
Murphy moved, Shaw seconded to include shipping and handling costs in the stated price of all SWSS publications. Motion passed. (Newsletter Editor directed to make change in next issue).

Schmidt informed board that membership data now in “Access” software database. Reynolds suggested membership profile that would be accessible to each member for their updating and editing. Reynolds discussed the logistics of this process.

Shaw asked for clarification about drop in net worth since 1999. Schmidt attributed decrease in net worth to reduced income due to less publication sales, fewer individual memberships, fewer sustaining member companies, and increased costs for publications, and higher room rates for students at annual meeting. Shaw asked if funds would be available for a planned large expenditure for a potential future publication. Mueller and Schmidt commented that funds would be available, but this move would greatly deplete SWSS financial reserves.

Schmidt presented budget for 2004/2005, detailing income and expenses. Projected net loss for this period was $37,000.

Mueller moved, Driver seconded to accept Business Manager’s report. Motion passed.

Cody Gray (Graduate Student Report): discussed successful graduate student symposium, and proposed new ideas for future meetings (for example, mock interview of a person). Ratliff offered to facilitate and offered HR staff assistance for upcoming meeting. Board consensus was to support this idea. Gray commented on frustration of graduate student’s fund-raising efforts. Discussion ensued, and Harden advised Graduate Student Association to proceed.

Sales Coordination Committee (Harden presented report from Mike DeFelice). Early August, 2004 is projected date for delivery of DVD entitled “Interactive Encyclopedia of North American Weeds” (herein referred to as “DVD”).

Shaw moved, Mueller seconded to set the price of DVD at $69.95, which includes shipping and handling. Motion passed. (see future board minutes on this topic on June 18 conference call on this topic).

Discussion was held on the logistics of handling DVD sales through resellers. Reynolds suggested uniformity of reselling procedures for all SWSS publications. Murphy suggested considering shipping and handling expenses. After considerable discussion, the topic was tabled.

David Shaw - 2005 Program report: Goal is to have a maximum of 3 concurrent sessions. Lengthy discussion was held on various changes that are proposed. Shaw planned to make substantial changes to program, including moving presentation of some awards to early in the meeting, expanding the length of the business meeting and moving the business meeting until later in the meeting. Board was in support of program changes, with the goal of having more discussion and a more interactive meeting.

Dotray- Editor’s report: total pages up considerable. The proceedings in CD format is soon to be published. Dotray urged the rigid adherence to the rule that abstracts should be only one page in length.

Byrd-Site Selection report: Byrd distributed report from consultant Helms-Briscoe detailing a large number of potential properties. Many ideas were discussed. Discussion was tabled until the next day.

Meeting adjourned at 5:15 PM, June 3, 2004.

Meeting Reconvened by President Harden at 7:34 AM, June 4, 2004.

Mueller - Newsletter Editor Report: Schmidt expressed concern about newsletter distribution by only electronic means (planned for December 2004 and subsequent issues). Schmidt was instructed to provide a separate letter to those people who have not provided an email address notifying them that the December 2004 SWSS newsletter will only be an electronic version that will be available from the SWSS website. Newsletter Editor was instructed to place a picture of the January meeting hotel in the August Newsletter.

Murphy - WSSA report: Murphy discussed potential changes in WSSA journals, XID project status, potential of WSSA marketing of SWSS publications. Murphy discussed that Science Policy Director Rob Hedberg is to have a job description written by WSSA, and this will be provided to SWSS for possible inclusion into MOP as appropriate.

Topic of WSSA selling SWSS products re-opened from previous day (Sales Committee Report). Shaw moved, Witt seconded to set Shipping and Handling (S&H) fee at $5.00 per SWSS publication and that this fee will be passed on to all resellers. Motion was amended to indicate that all prior arrangements will be honored. Motion passed. (NOTE: see later minutes on June 18 relevant to this topic).

Reynolds asked for clarification concerning logistics of the flow of dollars on product sales:

- WSSA sells an item
- WSSA collects cost + Shipping and Handling
- WSSA contacts SWSS with order
- WSSA sends 60% of price + S&H to SWSS
- SWSS ships order

Witt moved, Shaw seconded to offer WSSA and regional weed science societies (Northeast, North Central, Western) the opportunity to sell SWSS publications with the above-described methods. Motion passed. Harden will send a letter to each of these societies offering this opportunity.

CAST report (presented by Harden). CAST membership is declining, and income is problematic.

Site Selection report (re-opened). Discussion occurred about locations, and time of year of annual meeting. Witt commented that previous survey data indicated most members were flexible towards moving the time of year that SWSS meets. Shaw moved, Mueller seconded for the SWSS to move the annual conference to an October meeting date, pending feedback from the SWSS membership at the business meeting at the January 2005 annual meeting. A final decision on this move will be made at the January 20, 2005 board meeting (the Thursday AM board meeting held in conjunction with the annual meeting). Motion passed.

Discussion followed about procedure to inform membership of this potential change:

- John Byrd (Site Selection Chair) to send out email in July/August proposing to move the meeting date to October.
- John Byrd submits article for Newsletter on same topic.
- John Harden to address separate issue of the advantages/disadvantages of having a meeting in October after having one in January of that same year (NOTE: this move is contingent on membership approval at 2005 annual meeting).

Substantial discussed occurred about positives and negatives of having a meeting either 9 months or 21 months apart.

Murphy moved, Shaw seconded that if meeting date is moved to October, SWSS would have a January 2006 meeting and an October 2006 meeting. Motion passed.

Board directed Site Selection Chair Byrd to consider 2nd and 3rd weeks of October 2006 for site selection, and be prepared to make recommendation at January 2005 board meeting.

OLD BUSINESS:

Forest Plants of the Southeast United States Book Reprint:

Witt reported that University Press of the University of Kentucky had little interest in reprinting “Forest” plants book. Harden reported that Jim Miller was exploring printing at the University of Georgia Press, with approximate bids of:

Copies	total cost	cost per copy

2000	$40,900	$20.45
4000	$50,500	$12.63
5000	$55,000	$11.00

Schmidt reported that since January 2004, sales have averaged about 20 copies per month.
Harden tabled discussion until UGA Press reports to Jim Miller.

Voting privileges of ExOfficio members
Harden led discussion concerning voting status of ex-officio members. Board consensus was for Gene Wills to bring a written report to the January 2005 board meeting concerning language to clarify voting responsibilities for appointed and ex-officio members.

Travel reimbursements to SWSS meetings
Mueller expressed concern about financial losses to SWSS in previous years. Mueller asked for clarification of reimbursement procedures for SWSS board member's travel to SWSS meetings. Harden said most industry members absorb the cost. Stated procedures are as follows:

1. No reimbursement for annual meeting (currently in January)
2. Business Manager to reimburse for mid-year meeting as per individual request (Mueller asked for upper limit, board consensus was this was not needed).

Shaw suggested MOP revision to travel reimbursement section (Wills directed by Harden to accomplish prior to January 2005 board meeting).

NEW BUSINESS:

Electronic vote discussion.
Mueller lead brief discussion about the need for paper ballots, given the ubiquity of emails. Reynolds asked to explore the possibility of electronic vote of officers. Mueller expressed concern about accountability of voter procedures, audit trails, etc. No specific actions on this item at this time.

Witt encouraged all board members to make suggestions for nominations for SWSS officers and awards.

Schmidt asked for permission to discard Weed ID Guide slide sets. Discussion ensued about possibility of donating to various groups. Several board members expressed interest in purchasing at a reduced price.

Schmidt notified SWSS board of his plans for a vacation in December, 2004.

Meeting adjourned 11:18 AM, June 4, 2004.

Respectfully submitted,

Tom Mueller
SWSS Secretary/Treasurer

Minutes of SWSS conference call:

Meeting called to order by John Harden at 10:00 Central time, June 18, 2004.
Those in attendance were: Harden, David Shaw, John Byrd, Gene Wills, Bill Vencill, Bob Schmidt, Bill Witt, Jackie Driver, Mike DeFelice (Sales Coordination committee Chairman), Scott Senseman, Fred Strachan, Tom Mueller.

Harden called to order and asked Mike DeFelice to provide an overview of his recommendations related to pricing and distribution of new SWSS product, the DVD of North American Weeds (herein referred to in this report as "DVD").

Shaw moved, Byrd seconded to set wholesale price of DVD at $35.97 and set Manufacturer's Suggested Retail Price (MSRP) at 59.95. Motion passed

Driver moved, Witt seconded to eliminate volume discounts on SWSS publication products. Motion passed

Mueller moved, Senseman seconded that the cost of shipping DVD to wholesalers or other retailers will be paid by SWSS, and then that reseller pays for shipping to the end customer; if SWSS handles and ships the order, the cost = $5.00 to North American locations, and $10.00 for international locations. Motion passed.

President Harden expressed the board's sincere appreciation and thanks to Mike DeFelice for his good efforts on behalf of SWSS. DeFelice shared his plans for a broad distribution of the DVD to as many end users as possible.

Harden and the board expressed their appreciation for David Shaw setting up the conference call.

Meeting adjourned @ 10:45 AM

Respectfully submitted,

Tom Mueller
SWSS Secretary

Minutes of Summer SWSS board meeting, Charlotte Westin, January 23, 2005

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Meeting called to order at 1:00 PM by President John Harden.

Those in attendance: Jackie Driver (Vice President), John Byrd (Board Member-Academia), Susan Rick (Board member-Industry), Scott Senseman (Board Member Academia), Peter Dotray (outgoing Proceedings Editor), Tim Murphy (WSSA Rep), David Shaw (President Elect and Program Chair), John Harden (President), Dan Reynolds (Web Master), Bill Witt (past President), Gene Wills (MOP rep), Cody Gray (Grad Student Rep), Tom Mueller (Secretary/Treasurer), Fred Strachan (Board member-Industry), Jim Barrentine (CAST representative), Larry Nelson (Forestry Representative).

Those absent: Bob Schmidt (Business Manager)

Drive moved, Strachan seconded to approve minutes of June 2004 meeting. Motion passed.

Newsletter Editor report. Mueller informed group that the transition to all electronic newsletter effective with the December 2004 issue was smooth, and that this format greatly eases the preparation and publication of the SWSS newsletter.

Editor Report. Dotray. Proceedings of 2004 meeting were distributed in June 2004. Dotray commended Reynolds for his good work on proper formatting. Discussion ensued about whether to charge $15 if an abstract is > 1 page or when papers are > 5 pages. Dotray suggested that Editor Vencill report on the number of abstracts in the 2005 proceedings that exceed page limits at summer board meeting.

Awards committee report. Witt. All faculty or professional awards to be presented on Monday afternoon. Winners of each award were: Distinguished Service Award-Academia – Joe Street; Distinguished Service Award- Industry- Ray Smith; Weed Scientist of the Year- Bob Hayes; Outstanding Young Weed Scientist- Eric Prostko; Outstanding Graduate Student-MS- Whitney Barker; Outstanding Graduate Student-PhD- Ian Burke; Outstanding Educator Award- John Wilcut.

Nomination Committee Report. Witt announced those elected to the following positions: Vice President- David Monks; Secretary/Treasurer- Alan York; CAST representative- Peter Dotray; WSSA representative- David Jordan; Endowment Board Trustee- Neil Rhodes.

Mueller commented that the rotation of VP coming from Industry/Academia in alternating years should be considered. Strachan/Rick/Driver stated that as long as industry had representation on the board that would accommodate the concerns of industry. Consensus was to make no changes until the nominating committee was not able to obtain appropriate candidates.

Long Range Planning (LRP) Committee Report. Witt commented that only 2 of the 5 members of this committee attended the committee meeting (Witt and Murray). LRP had several items to consider, including: encouraged SWSS to proceed to resolve the change the meeting date for the annual meeting and to resolve the matter; if outreach planned to a larger audience, then LRP suggests changing board composition to reflect these changes. Shaw suggested LRP tasked to prepare recommendation on options to restructure board, with report due at summer board meeting. LRP suggested clarification about voting privileges for ex-officio members. LRP suggested preparing to transition to new business manager once Bob Schmidt retires, with specific items to consider including drafting a job description, and obtaining an estimate of time until his retirement.

Program Report- Shaw received substantial feedback on program changes, and is pleased with program produced. His goal was to have only 3 concurrent sessions, but sometimes ended up with 4 or 5. Mueller asked for clarification about the number of senior authored papers a single person was allowed. Shaw stated, and Wills agreed, that the number of papers from a person is at the discretion of the program chair. Discussion ensued about program changes.

Local Arrangements. Ratliff reported about graduate student room reimbursement challenges. For the 2005 meeting, SWSS is below room block quota, but he did not foresee a problem because SWSS is well above expected food purchased from hotel, and the hotel expects to sell out on Monday and Tuesday night, he is thus not expecting SWSS to incur a penalty. Approximate room nights – 867 total room nights, with 257 on Tuesday night as maximum. Shaw expressed sincere appreciation to Ratliff and local arrangements for flexibility to program changes.

CAST report. Barrentine. CAST is going through substantial changes. Executive Vice President resigned in 2004, and the search for a replacement is progressing. Also had staff changes in the organization. CAST is trying to go through their strategic plan, and implement that plan. Publications proceeding nicely, cost-cutting still continuing, and they are striving to effectively budget and fund their operations.

WSSA report. Murphy told about future meeting sites, including New York City in 2006 and San Antonio in 2007. Other topics discussed included WSSA publication issues (Electronic journals, possible name change for Weed Technology journal, WSSA now selling SWSS DVD of NA Weeds, XID project has sold 804 copies as of 2004, WSSA now starting to aggressively market several publications, WSSA planning on digitizing back issues of WSSA journals, Grad student organization MOP finalized). Board discussed Rob Hedberg employee status. WSSA meeting costs are increased (10K fine in 2004 at Kansas City meeting) since room block is not being filled. Discussed WSSA Web site: volunteers not filling desires of high-quality website. Murphy encouraged WSSA and SWSS collaboration on website. SWSS invited by WSSA to present a poster detailing the history of SWSS at NewYork (50th annual meeting). Tom Mueller volunteered to prepare the poster. Names of people suggested he should contact include: Walter Porter, Bill Witt, Tom Monaco, Don Davis, Paul Santelman, Bob Frans, Jon Gallaher, Morris Merkle, Jack Sheets, Chester Foy, and Doug Worsham.

Business Manager report. SWSS membership still slowly declining. Net worth decline in 03-04 = $43,300. Expected loss in 04-05 estimated to be $30,000. Primary loss is due to greatly decreased sales of SWSS publications, and no corresponding decrease in expenses. Mueller expressed a "sense of urgency" about these mounting losses. Mueller reminded the board that a major publication project that the SWSS plans to invest about 100K into is about 2 years in the future. Operating budget for one year is about 100K, and SWSS still has 200K in reserve and 50K in liquid operating funds. Barrentine asked about largest expenses and income stream: Mueller reported that major expenses include:

Salaries (Schmidt, Hedberg)
Travel to meetings costs
Supplement to grad students (reduced registration and room reimbursement)

Forest Plants of SE United States now being published by UGA press, and SWSS gets a percentage of sales.

Computer Applications Committee. Reynolds requested functions related to Powerpoint presentations (technical specifications of files, collection, and distribution of CDs to section chairs) should be in the purview of computer applications committee (and not local arrangements). This would allow for greater consistency of information flow each year, with reduced problem areas. Kendig was suggested to be chair of this committee. Harden will contact.

Research Committee. Driver reported that state extension and weed surveys are in progress. Chemical/physical properties of new herbicides will not be included. Ted Webster requested to be re-appointed as chair of weed survey committee.

Constitution and Operating. Wills lead discussion on voting privileges of ex-officio members. Discussion referred to Long Range Planning committee for report at summer board meeting.

Southern Weed Contest – report by Eric Webster. Contest in 2004 held at LSU, with 8 universities participating. Webster has been chair of this committee for 6 years, so has requested a new chairman to take over. Adequate reserves are in the Weed Contest account to host the contest for 2 years.

Sunday Board meeting adjourned at 4:52 PM.

Monday Board meeting convened at 9:56 AM on January 24, 2005.

Those present included: Mueller, Driver, Dotray, Barrentine, Senseman, Murphy, Prostko, Shaw, York, Reynolds, Byrd, Hedberg, Nelson, Strachan, Wills, Harden, Witt, and Rick.

Todd Baughman reported on student contest, with number of students similar to previous year. He asked for abstracts a few days earlier to allow for preparation of judges packets sooner, asked for clarification about updating contest rules in the MOP, and asked for presentation files to be increased to 50 MB.

Sales Coordination Report. Mike DeFelice reported on DVD promotional activities. He requested better action in the SWSS region with respect to marketing the DVD, with emphasis on web distribution. He asked SWSS members to "take ownership" and sell the DVD, and he informed members they could get .pdf files from website.

Weed ID report. Charles Bryson reported on plans to increase number of weed species images to 500 for DVD revision and future book project. Jim Miller (via Bryson) has requested permission to place images of "Forest Plants of SE United States" onto USDA-Plants Database. Discussion ensued that UGA press should be contacted for their position. There may be some benefits of advertisement via this website. Bryson suggested placing on website, with the caveat that each image be marked with the notation that "book containing this image and others is available from SWSS". Witt moved, Shaw seconded to allow placing of images of Forest Plants of SE United States onto USDA-NRCS plants database website, pending approval of UGA press. Motion passed.

Finance Committee Report: Driver had following recommendations.

1. business manager to provide detailed itemization of expenses (especially travel and miscellaneous) to board
2. effective 2006 Annual meeting, discontinue reimbursing hotel rooms for students
3. reduce travel expenses by only paying for travel of executive committee (Vice President, President, Past-President, secretary/Treasurer, business manager)
4. increase registration for annual meeting from $155 to $200, effective 2006 meeting.
5. allocate 5K to program chair to cover costs of external speakers (comp registration, rooms, travel costs)
6. strongly encourage SWSS board to balance budget in 05-06 fiscal year

Witt moved, Mueller seconded that SWSS will provide travel expenses for summer board meeting to only executive board effective 2005 summer board meeting. Murphy moved, Barrentine seconded to amend motion to include Graduate Student representative compensation for travel to summer board meeting. Vote on amendment was 8 for, 5 against, amendment passed. Vote on amended motion passed.

Director of Science Policy Report. Rob Hedberg. Distributed written quarterly report, and mentioned several relevant activities to weed-related interests. Hedberg informed board that SWSS was entering 7th year of current funding cycle, and discussed future funding challenges. Reid Smeda is WSSA contact with respect to future funding from regional societies. Hedberg has broad operating priorities, and he asked for feedback about how SWSS would like him to pursuer various options for activities.

Graduate Student Representative: Cody Gray expressed concern with PM poster session and dinner plan conflicts, MOP is not up to date with respect to the student contest. He did not believe room reimbursement changes will reduce graduate student attendance, he encouraged SWSS to establish a room with 2-3 computers to check email, and suggested the use of a "jump drive" to import presentations.

Business meeting pre-planning. To allow more time for discussion, only the following reports will be made: Treasurer's, Finance, Sales Coordination, nomination, site selection, program, and old-new business.

Shaw moved, Witt seconded to accept all committee reports. Motion passed

Meeting adjourned 12:19 PM on January 24, 2005

January 20, 2005

Southern Weed Science Society

Business Manager's Report

Membership as of December 31

	2004	2003	2002	2001	2000	1999	1998
Members and Sustaining Members	464	452	500	510	527	559	662
Students	104	111	118	126	131	136	136
Totals	545	563	618	636	658	695	798

Research Methods to date

Expense $38,003 Income $41,146

Weed Identification Guide to date

Expense $489,260 Income $791,877

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

Forest Plants of the Southeast and Their Wildlife Uses

Expenses $110,379 Income $187,344 Final

Preregistration

	2005	2004	2003	2002	2001	2000	1999	1998	1997
Members	180	181	220	226	248	249	261	285	292
Students	61	74	66	80	87	115	116	74	74
Total	241	255	266	306	335	364	377	359	365
Percentage of final	66%	68%	66%	68%	76%	75%	59%	60%	60%
Total Attendance	354 est	374	400	456	492	476	501	601	584

Weed DVD

Expenses $5,138 Income $7,399

Committee No. 106
Committee Name: Finance Committee

Summary of Progress:

The SWSS Finance Committee met prior to the annual meeting at the Westin Hotel in Charlotte, NC on Monday, January 24, 2005. Peter Dotray, Tom Mueller, David Shaw, Alan York, and Jackie Driver were in attendance. The meeting was called to order by Jackie Driver at 9:00am. Tom Mueller reported to the group the financial status of the Society. He expounded on the report provided to the Board by the Business Manager. Overall the net worth of the Society is declining with additional losses expected in 2005. The decrease in publication sales coupled with no decrease in expenses if of major concern. Additionally the Society plans to invest in a major publication in about 2 years. The committee brainstormed and discussed several options to reduce expenses.

Recommendations or Request for Board Action:

1. Balance the budget the next fiscal year and thereafter.
2. Business Manager provide to the Board a detailed itemization of all expenditures, especially travel and miscellaneous.
3. Maintain travel reimbursement option for the President, Vice President, Secretary-Treasurer, Business Manager, and Past President to attend the Summer Board meeting. All remaining members are expected and encouraged to attend the meeting, but at their own expense. Participation is still expected of all Board members either through attendance or telecom. Telecom cost would be provided by SWSS.
4. Effective 2006, increase meeting registration from $155 (current) to $200.
5. Effective 2006 discontinue hotel room reimbursement for graduate students.
6. Allocate $5000 to Program Committee to cover registration and travel for external speakers participating in the Symposia and General Session.
7. During the next review period of Hedberg's position, consider a reduction in SWSS financial commitment.

Finance (if any) Requested:

Allocate $5000 to Program Committee to cover registration and travel costs for external speakers participating in Symposia or the General Session.

Respectfully Submitted,

T. Mueller
D. Shaw
P. Dotray
F. Carey
J. Zawierucha
M. Shankle
J. Driver, Chair

Committee: 102

Committee Name: AWARDS COMMITTEE, PARENT (STANDING)

Summary of Progress:

A call for nominations for awards was placed in the SWSS Newsletter and nominees were received for all awards except the Outstanding Young Weed Scientist-Industry. Award winners were:

Distinguished Service Award-Academia: Joe E. Street
Distinguished Service Award-Industry: H. Ray Smith
Weed Scientist of the Year: Robert M. Hayes
Outstanding Educator: John W. Wilcut
Outstanding Young Weed Scientist: Eric P. Prostko
Outstanding Graduate Student-Ph. D.: Ian C. Burke
Outstanding Graduate Student-M. S.: Whitnee L. Barker

Objectives for Next Year: Get nominees for all awards.

Recommendations or Request for Board Action: None

Finances Requested: Those needed for award winners

Respectively submitted:
K. L. Smith
H. S. McLean
T. F. Peeper
B. J. Brecke
A. C. York
W. W. Witt, Chair

Committee: 112

Committee Name: Nominating, PARENT (STANDING)

Summary of Progress:

A call for nominations for Board vacancies was placed in the SWSS Newsletter and several nominees were received. Additionally, members of the committee provided a list of potential candidates. The committee voted on all the nominees and ranked. I contacted the top two candidates and if they were willing to be placed on the ballot, they were. In two cases, one of the top two individuals declined and the next candidate was contacted. Those placed on the ballot were:

Vice President: Barry Brecke, David Monks
Secretary-Treasure: Dunk Porterfield, Alan York
WSSA Representitive: David Jordan, Shep Zedekar
CAST Representitive: Peter Dotray, Bill Stall
Endowment Foundation: Neil Rhodes, Ann Wiese

Those elected by the membership were: David Monks, Alan York, David Jordan, Peter Dotray, and Neil Rhodes.

Objectives for Next Year: As per MOP

Recommendations or Request for Board Action: None

Finances Requested: None

Respectively submitted:
S. K. Rick
J. A. Kendig
J. L. Yeiser
G. Schwarzlose
M. A. Thompson
G. MacDonald
J. A. Ferrell
J. W. Street
R. Strahan
W. W. Witt, Chair

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 2003, suggestions for changes in the SWSS Operating Procedures were presented to the Executive Board. All approved revisions and all directives for changes by the Executive Board during the annual meeting were made in the SWSS Manual of Operating Procedures (MOP).

Objective(s) for Next Year: To continue with timely revisions of the SWSS Manual of Operating Procedures as directed by the SWSS Executive Board and by vote of the Membership.

Finances Requested: None

Respectively submitted
J. A. Dusky, R. M. Hayes, and G. D. Wills, Chairperson

Committee Number: 117
Committee Name: Research Committee

Summary of Progress:

Reports for "State Extension Weed Control Publications" and "Weed Survey - Southern States" are in preparation and will be submitted to the Editor for inclusion in the 2005 Proceedings. No progress has been made on preparation of "Chemical and Physical Properties of New Herbicides"

Objective(s) for Next Year:

Develop a report for Chemical and Physical Properties of New Herbicides. Re-appoint Ted Webster to the Committee (his request).

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
J.E. Driver, Chair

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

Summary of Progress:

The committee discussed pricing and distribution issues with the Board of Directors after the summer meeting. Pricing for the new “Interactive Encyclopedia of North American Weeds” was set at $59.95 per copy plus a $5.00 domestic shipping charge or a $10.00 international shipping charge. Upgrades from version 2.0/2.1 was set a price of $49.95. The board also approved sales of the DVD-ROM by third parties at a wholesale price of $35.97 (60% of the suggested retail price).

Sales committee efforts were directed at promotion of the new “Interactive Encyclopedia of North American Weeds” DVD-ROM after its release on September 1, 2005. Promotional press kits consisting of a copy of the DVD-ROM, a press release letter, and a copy of the promotional/order form brochure were sent to over 50 magazines, scientific journals and societies in the biological, agronomic, horticultural, educational, and gardening areas. The attached addendum lists the names and addresses of organizations receiving a press kit.

As a result of the mailing we have received free press coverage in several magazines and newsletters including Agrow World Crop Protection News, Farm Journal, High Plains Journal, and a full-page article with color photographs in Successful Farming among others. The North Central Weed Science Society agreed to retail the DVD-ROM and provided extensive promotion in their newsletter, at their meeting, and in the state extension farm and IPM newsletters in many of the member states. The Weed Science Society of America has also agreed to sell the DVD, has advertised the product in their newsletter, and offers it for sale on their web site.

American Nurseryman press also offers the DVD through their catalog and web site. In addition, the Missouri Botanical Garden Press has also agreed to sell the DVD in their St. Louis store, their catalog, and their web site. In addition, they have sponsored a full review to be published in the American Botanical Society journal with a full-page ad on the back cover sometime later this year. It is impossible to know exactly how many of these press kits resulted in an announcement or article since we do not subscribe to all of them. A press release was also submitted on the internet “PRWEB” press release site for general distribution which seems to have resulted in numerous announcements based on a “Google” search on the DVD title.

A professional trade-show booth was developed to promote the DVD at the NCWSS, SWSS, and WSSA conferences. The booth was presented at the NCWSS in December and will be at the SWSS and WSSA meetings this year.

The Weed ID DVD-ROM web site at http://www.thundersnow.com was updated with a new demonstration page, new pricing information, and links and information on places and ways to buy the DVD.

Objective(s) for Next Year:

Continue to promote the DVD. Encourage membership of the SWSS to promote the DVD in extension newsletters, farmer meetings, and with local educators, and interested local organizations.

Recommendation or Request for Board Action:

1. None for this year.

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.

Respectively submitted;

Committee member – Jackie Driver
Committee member – A. Rhodes
Committee member – D. R. Reynolds
Committee member – T. Barber
Committee member, Chairperson – M. DeFelice

Committee Number and Name: 124 Weed Identification Committee (Standing)

Committee Chair: C. T. Bryson

Chair Phone: 662-686-5259

Chair e-mail: cbryson@ars.usda.gov

Committee Members and Terms of Service:

C. T. Bryson* 2005	**M. Blair 2007**	**T. M. Webster 2007**
C. H. Koger 2005	**J. Boyd 2007**	**S. Askew 2007**

Recommendations for Board Action:

1. Request from Jim Miller that SWSS support the posting of the images in Forest Plants of the SE on the USDA NRCS PLANTS Database website. The images by Ted Bodner in Forest Plants are copyrighted by SWSS, while the other images by Miller and others are not. Miller recommends that each photo by Ted be cited in PLANTS database as "copyrighted by SWSS" and the others cited as "appear in Forest Plants published by SWSS." This should give clear credit to SWSS on a much-used website. This request was approved by the SWSS Board pending permission by UGA Press and development of a statement for each photo released to PLANTS database.

Finances Requested:

None

Summary of Progress:

The SWSS Weed Encyclopedia of Weeds DVD-ROM was completed and available for sale in August 2004.

Action Plan for 2005:

Continue writing the SWSS Weed Encyclopedia of Weeds Identification Book.

Continue photographing and writing descriptions for new weed species for both the book and the next version of the DVD-ROM.

Summary of Strategic Goal Working Group of SWSS Board

Strategic Goal Working Group I

Goal Statement:	Get members to agree to broadened vision for the Southern Weed Science Society.
How Goal Relates to Vision:	Broadened mission will provide educational forum for larger audience interested in plant management, including biologists and ecologists.
Measure Progress:	Poll membership by vote at business meeting
Conflicts and Choices:	Will weed science lose its identity? What will be lost? This could provide more choice in viewpoints; student presentations may be reduced.
Member Engagement:	email discussions; business meeting with committee tracking comments and report to Board (Jackie Driver, chair, Sue Rick, Pete Dotray, and Dan Reynolds).
1 year objectives:	Determine membership buy-in via vote a business meeting.
Person responsible:	John Harden
6-month action steps:	1) Respected members email other members; 2) extended discussion at business meeting 3) chat room for extended discussion.
12-month action steps:	none necessary
Needed resources:	Personnel commitments.

Strategic Goal Working Group II

Goal Statement:	Increase SWSS membership to 900 by 2009.
How goal relates to vision:	Increased membership is required to make SWSS a vital and relevant organization.

Measure of progress:	Will be measured by increasing membership each year by 100 members.
Conflicts and choices:	Current membership will be resistant to change in the meeting culture (familiar faces and culture) and the meeting format.
Member engagement:	The membership needs to be regularly informed and allowed to discuss changes. This can be done at the business meeting, general session, and through electronic means (chat rooms, etc.).
1 yr Objectives:	Open discussion at 2005 Business meeting and through electronic means.
Person responsible:	David Shaw with help from Board members.
6 month action steps:	Develop outline/format for general session discussion on change.
12 month action steps:	Preliminary report from membership response will be provided at Board meeting following the 2005 SWSS meeting. A more thorough report will be discussed at the 2005 Summer Board meeting.
Needed resources:	Time on program, handouts, suggestion boxes, perhaps an electronic means of registering membership feelings at the 2005 SWSS General Session and Business meeting.

Increasing Educational Opportunities

Objective: Increase workshops and/or symposia available to membership to improve their skills:

- Grant Writing Workshop: Invite NRI personnel to provide a workshop on successful grant writing. This will help membership improve grant writing skills and allow NRI panel heads to learn about SWSS.
- Use grants to support SWSS Weed Contest
- Serve as a catalyst for groups wanting to forms teams to write grants
- Encourage formation of Information Exchange Groups (IEG) groups
- Workshops on statistics, analytical techniques, and regulatory issues would be well received

Goal: Have two workshops offered for the 2005 SWSS Meeting

Resources: Time on program.

Create Display for Marketing SWSS and promotional materials:

Objective: Prepare a poster than can be displayed at state and other regional meetings to promote SWSS and educational materials developed by SWSS.

- Authorize the Public Relations Committee to meet with a public relations group (industry members can assist with the best organization to contact) to develop a Powerpoint poster that can be available for any member to print on a poster printer and take to any suitable meeting.
- Allow members willing to promote SWSS publications at other meetings to process orders at the meeting. This would allow other groups to see value that SWSS has in addition to increasing sales of publications.

Goal: Have a display ready within 1 yr.

Resources: Costs of public relations firm to prepare Powerpoint poster.

Strategic Goal Working Group III

Goal Statement: To build and develop strategic alliances with other plant management organizations at the regional and national level.

How goal relates to vision: Increase the breadth of subjects addressed in the society and increase/broaden the membership.

Measure of progress:	a) Number of alliances developed, b) increased membership, c) diversity of subject matter/opinions/thoughts.
Conflicts and choices:	a) Turf wars, b) loss of identities, c) shared profits, d) culture and history of the SWSS
Member engagement:	Develop a Strategic Alliance Working Group (SAWG) containing members who have ties to potential alliance partners.
1 year Objectives:	Have discussions with targeted alliance organizations generate recommendations for proceeding.
Person responsible:	John Byrd
6 month actions steps:	a) Identify members for SAWG b) Form SAWG and have meeting, c) Identify and prioritize potential alliance partners
12 month action steps:	Conduct meeting and obtain feedback from targeted organizations with recommendations for next steps.
Needed resources:	Funding for SAWG meeting

101. SWSS Endowment Foundation

The SWSS Endowment Foundation met at the Westin Hotel in Charlotte, NC on Monday January 24, 2005 with Randy Ratliff, Eric Prostko, Alan York, Bob Schmidt, Darrin Dobbs, Bob Hayes and G. Neil Rhodes in attendance. The meeting was called to order by Bob Hayes at 7:00 a.m. The minutes from the previous meeting were read and approved. Bob Schmidt reported that SWSS EF had a net worth of $290,555 as of September 30, 2004. Investment income for 2004 was $5,369 and expenses were $2,016. During 2004, there was $5,060 contributed to the EF. Net earnings earning during the year ending September 30, 2004 was $8,412.30. Individual contributions received with pre-registrations for this meeting totaled $540. ($2,227 was contributed during the meeting plus $375 from Jerry Wells, high bidder, at auction of the painting donated by Charles Bryson). The EF is in sound financial condition, but still needs to grow to meet the future needs of the Society. Dr. G. Neil Rhodes was recognized as the newly elected trustee.
The EF made note of the painting donated by Dr. Charles Bryson and Dr. Ratliff displayed it at the registration desk. The EF set a goal of $300,005 in 2005. Dr. Hayes noted and thanked Monsanto for offering to match individual contributions up to $5,000. Several ideas were discussed to help the EF reach the goal. These were:

a) Place a separate flyer in the registration packet explaining what the EF is, what it does, and why individual contributions are needed.
b) Solicit contribution from state weed science societies
c) Send a letter and/or call all previous student award winners and state weed science alumni soliciting contributions
d) Raffle of donated paintings or other ‘big ticket’ items *in lieu* of current auction method.
e) Contact potential donors by email pre and post meeting.

The EF recognized the departing Trustee J.C. Banks and the Student Representative Darrin Dobbs. The meeting was adjourned.

To: Members of the Southern Weed Science Society (SWSS) Herbicide Resistant Weeds Committee (HRWC) and Participants at the January 24 Meeting

From: Andy Bailey, Secretary; Bob Nichols, Chair

Date: March 28, 2005

Subject: Report of the SWSS Herbicide Resistant Weeds Committee Meeting held January 24, 2005, at Charlotte, North Carolina, including Corrections received from Participants

Participants Present: (19)
Bob Nichols (Cotton Incorporated – Chair), Andy Bailey (Univ. of KY – Secretary), Bob Hayes (Univ. of TN), Larry Steckel (Univ. of TN), Ian Heap (WeedSmart – OR), John Wilcut (NC State Univ.), Steve Powles (Univ. of Western Australia), Carroll E. Walls (UAP Timberland), Brad Guice (BASF), Ralph Lassiter (Dow AgroSciences), David Black (Syngenta), Jayla Allen (Bayer), Nilda Burgos (Univ. of AR), Ron Talbert (Univ. of AR), Mike Chandler (Texas A&M), Art Miller (USDA (ret.), Dearl Sanders (LA State Univ.), Greg Elmore (Monsanto), Andy Kendig (Univ. of MO).

Members Not Present and Others Attending in 2004:
Frank Carey (Valent), David Gealy (USDA-ARS), Les Glasgow (Syngenta), Jonathan Green (Univ. of KY), Jim Griffin (LA State Univ.), David Heering (Monsanto), Vernon Langston (Dow AgroSciences), Greg MacDonald (Univ. of FL), Case Medlin (OK State Univ.), Tom Peeper (OK State), Dan Reynolds (MS State Univ.), Susan Rick (DuPont), Bill Vencil (Univ. of GA), Keith Vodrazka (Bayer), Glen Wehtje (Auburn Univ.), Jerry Wells (Syngenta), Henry Wilson (VA Tech.), Alan York (NC State Univ.)

cc: John Harden, Roy Cantrell, Mike Owen, Chris Boerboom

Agenda
1. Reports – Old Business
    a. Mission Statement – Handout
    b. Symposia – Notification
2. Reports of newly resistant weeds
    a. Criteria for reporting – Handout
    b. New reports
3. Activities of the Herbicide Resistance Action Committee (HRAC)
4. Report of the Weed Science Society of America (WSSA) Herbicide Resistant Plants Committee (HRPC)
5. Report of November 17, 2004, "Glyphosate Stewardship Forum"
6. "Contrasting the Glyphosate Resistant Weed Issue between the U.S. and Australia"
7. Southern Regional Bulletin – Vision for the SWSS-HRWC
8. Election of 2005-2006 officers

Old Business

Bob Nichols said that the Report of the 2004 Meeting was distributed to all 2004 Committee members in February 2004 for correction and comment, submitted to SWSS President, Bill Witt, in March 2004, and distributed again in November 2004, as an attachment to a request for 2005 agenda items. Therefore, he considered the Report reviewed and accepted. There was no objection.

a. Mission Statement
A handout with the mission statement, as revised and approved at the 2004 meeting, was distributed. The mission statement of the Herbicide Resistant Weeds Committee of the Southern Weed Science Society as adopted on January 26, 2004 is:

"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."

b. Resistance Management Symposium
At the 2004 meeting, the Committee endorsed the organization of a Symposium on weed resistance management for presentation at the current meeting. The Symposium, "Managing Weed Resistance to Herbicides" is on the program on Tuesday, Jan. 25 from 8:00 – 11:15 AM with eight speakers, a discussion session on technical needs for a management program and means to implement such a program.

New Business

1. Reports of newly resistant weeds

a. Criteria for Reporting Discovery of Newly Resistant Weeds.

The website: http://www.weedscience.org/resist/RWHelp.asp includes instructions for reporting. The membership reviewed the handout (attached) and discussed the need for follow-up research. The membership concurred that comparisons of resistant and susceptible populations should be made in replicated greenhouse experiments before initial reporting, in order to provide better confirmation of resistance. The committee also noted that such research may be difficult in situations where susceptible seed cannot be easily isolated from the suspected field or where certain species, e.g., common ragweed, do not germinate immediately following collection. There was extended discussion with members noting that follow-up research may not require characterization of fitness penalties, gene number, gene dominance or gene location in order to report a case of resistance.

b. Reports of Newly Discovered Resistant Weeds

Andy Kendig reported that a **glyphosate-resistant common ragweed population** (Ambrosia artemisifolia) has been officially confirmed by Reid Smeda in Missouri. This involved a 20-acre field and the population had been destroyed.

Nilda Burgos reported that active investigation is also being conducted in Arkansas on a common ragweed population suspected of having glyphosate resistance. This population involves 80 acres near Newport, AR.

Glyphosate-resistant common ragweed is also suspected in a few fields in Texas.

The membership expressed concern over common ragweed pollen movement to other areas.

Andy Kendig expressed **concern about *Amaranthus* species**, particularly waterhemp due to genetic variability and diversity. Situations of herbicide resistance in waterhemp may not fit into the WSSA definition of resistance. Questions relating to baseline resistance need to be addressed. Herbicide labeling terminology may need to specify stage of growth with rate recommendations.

Dearl Sanders reported **ALS-resistant red rice** (Oryza sativa) in commercial rice in southern Louisiana. This field will likely be converted to crawfish production.

2. Activities of the Herbicide Resistance Action Committee (HRAC)

Greg Elmore of Monsanto described an HRAC paper on criteria for identification of herbicide resistance. This paper has been through two reviews and is being developed as a methods manual for resistance. The paper should clarify methodology to characterize low-level (2-4X) resistance. Reviews will be finalized by the upcoming WSSA meeting. The paper could be submitted as a journal article upon HRAC approval. Bob Nichols strongly suggested that HRAC publish the article.

Greg Elmore further described the focus of HRAC. HRAC seeks to facilitate efficient resistance management through cooperation within and between industry and academia. The Council for Agricultural and Science and Technology (CAST) symposium (April 2004) was also meant to improve cooperation between industry and academia. HRAC has also discussed a classification system for herbicide labeling using a common system of letters or numbers. HRAC has also been involved in discerning the impact of low dose resistance. Resistance is easily detected with high dose resistance but much more difficult when it occurs at low levels. Accurate detection of low-level resistance will require more field and greenhouse trials.

Bob Hayes mentioned the goal of testing for resistance should be to report the level of resistance to a certain rate of an herbicide. Bob Nichols added that development of resistance is a characteristic of all pest populations and that formal resistance (significant change from baseline), early field expression, and field failures are commonly examples of resistance at different levels.

3. Report of the WSSA Herbicide Resistant Plants Committee (HRPC)

Nilda Burgos reported that Ian Heap and Hugh Beckie will soon be circulating a document for approval regarding resistance management. There will be a national document focusing on herbicide labeling, modes-of-action, weed species shifts, and general principles involved in the development of resistance. The committee is also working on a white paper for glyphosate resistance management.

4. Report of November 17, 2004 “Glyphosate Stewardship Forum”

John Wilcut reported on this meeting held in St. Louis with industry representatives from Syngenta, Bayer, and Monsanto; commodity representation from cotton, corn, soybean, wheat, canola, barley, and sugarbeet. University representatives who were present were Peter Dotray (Texas Tech), David Shaw (Mississippi State), Mike Owen (Iowa State), Alan Dexter (North Dakota State), Mark Loux (Ohio State), Phil Stahlman (Kansas State), Bob Wilson (University of Nebraska), Christy Sprague (Michigan State) John Wilcut (North Carolina State) and Chris Boerboom (Univ. of Wisconsin). Wilcut stated that some commodity participants at the meeting expressed little concern overall, and considered glyphosate resistance to be an isolated, localized problem that they would deal with when it happens.

The commodity organizations specifically did not want more regulation, but were in favor of education on proper stewardship of herbicide modes of action. Wilcut further stated that North Carolina cotton and soybean were receiving approximately 90% glyphosate and that only two new sites of action had been registered in the last 20 years in these crops. Glyphosate has also become an important tool to protect the efficiency of other herbicide modes of action. Wilcut raised the question of how do we alleviate/reduce selection pressure for resistance. With new Roundup Flex® cotton, fewer layby applications are likely to be used, and if so, selection pressure on glyphosate will be increased. Registration of additional active ingredients may be crucial to the sustainability of glyphosate. The Committee concurred that intense and expense regulation of herbicides is stifling U.S. registration of new products.

5. Contrasting the glyphosate resistant weed issue between the U.S. and Australia

Steve Powles reported that the biggest difference between the average growers in Australia and U.S. is that the Australian grower has already been through an herbicide resistance crisis, and, therefore, has more awareness and sensitivity to this problem. With glyphosate resistance being recently confirmed in rigid ryegrass (Lolium rigidum) in Australia, growers there are very concerned about glyphosate sustainability. Cotton is the only glyphosate resistant crop in Australia, although wheat is the biggest crop and receives a great deal of glyphosate for burn-down applications in no-till wheat. A Glyphosate Sustainability Group has recently been formed in Australia with representatives from Syngenta, Monsanto, and the public and private sector. This group has developed a public awareness campaign that promotes diversity in cropping, the use of non-herbicidal tools for weed control, and the prudent use of glyphosate in hopes of maximizing the sustainability of glyphosate. The absence of glyphosate resistant crops in Australia helps promote more diversity, while the abundance of glyphosate resistant crops in the U.S. promotes much less diversity. In order for a similar group to be effective in the U.S., all the major stakeholders (industry, academia, and growers) must be involved. The Australian group was initiated through funding from the Australian Grain Research and Development program (similar to the U.S. soybean check-off program). This is an independent group that doesn't involve regulatory groups.

Bob Hayes stated that U.S. Fish and Wildlife is currently involved in Delta waterfowl preservation where growers are contracted to grow grain crops to support waterfowl populations. Federal mandates prohibit the use of herbicides other than glyphosate on these crops. This example is in direct contradiction to the goal of increasing diversity of herbicide use.

6. Southern Regional Bulletin – Vision for the SWSS HRWC

Bob Nichols reported that there is an initiative to determine what a technical program for resistance management might look like. The importance of such an effort was generally supported by both industry and academia.

The National Corn Growers Association (NCGA) is working on a Web-based educational module on weed resistance and resistance management. Their hope is that other commodity organizations create modules for their respective crops and link to the NGCA module.

7. Election of 2005-2006 officers

The membership nominated John Wilcut and Bob Hayes to serve as Chair, replacing current Chair Bob Nichols. Hayes declined the nomination; Wilcut accepted the nomination. The membership nominated Nilda Burgos to serve again as Secretary, replacing current Secretary Andy Bailey. Burgos accepted the nomination.

Abstracts & Papers Index

Weed Management – Agronomic Crops

Symposia - Use & Impact of Transgenic Turfgrass Species

Symposia - Weed Control Options During Establishment of Warm-Season Turfgrass Species

Weed Management - Pastures & Rangeland

Symposia - Problem Weeds in Pastures & Rangeland

Weed Management - Horticulture

Vegetation Management - Rights-of-Ways

Symposia
Weed Management In Rights-Of-Ways

Physiological & Biological Aspects

Symposia
Glyphosate-Resistant Horseweed & Glyphosate-Resistant Cropping Technologies

Symposia
Managing Weed Resistance To Herbicides

Invasive Species

Symposia Invasive Species Management

New Technologies

Symposia
New Developments In Industry

Soil & Environmental Aspects

Symposia
Emerging Issues In Environmental Impact Of Weed Science

ROUNDUP READY CORN WEED CONTROL AND YIELD RESPONSE TO HERBICIDE COMBINATIONS AND TIME OF APPLICATIONS. M.P. Harrison[1], N.W. Buehring[1], R.R. Dobbs[1], M.W. Shankle[2], T.F. Garrett[2] and J.L. Main[2]. [1]Northeast Branch Experiment Station; North Mississippi Research and Extension Center; Mississippi State University; Verona, MS. 38879. [2]Pontotoc Ridge-Flatwoods Experiment Station; North Mississippi Research and Extension Center; Mississippi State University; Pontotoc, MS. 38863.

ABSTRACT

Studies were conducted on a Catalpa silty clay loam soil at Verona, MS and a Bude silt loam at Pontotoc, MS. in 2004 to evaluate weed management systems for Roundup Ready corn. Bicep II Magnum (metolachlor + atrazine at 1.0 + 1.4 lb ai/A) + atrazine (0.6 lb ai/A) applied preemergence (PRE) followed by (Fb) Accent (nicosulfuron) at 0.66 oz/A applied early postemergence to Dekalb DKC 69-71 [(YG/RR), Bt/Roundup Ready] and a conventional Bt hybrid (Pioneer P31B13) was included as a standard herbicide program. Soil moisture conditions in 2004 were excellent for good herbicide activity on sicklepod (*Senna obtusifolia*) and barnyardgrass (*Echinochlo crusgalli*) at Verona and broadleaf signalgrass (*Brachiaria platyphylla)* and pigweed (*Amaranthus sp.)* at Pontotoc. At Verona, 59 days after planting (DAP), all herbicide weed management systems, except the check, showed 69 to 95% barnyardgrass control and 75 to 90% sicklepod control. Roundup WeatherMAX (RWM) at 21.4 oz/A applied early postemergence (EPOT); Steadfast (24% rimsulfuron + 50% nicosulfuron) + atrazine + ammonium sulfate (AMS) + crop oil concentrate (COC) at 0.75 oz + 2 qt + 2 lb/A + 1% v/v applied EPOT; Steadfast + Callisto (mesotrione) + COC at 0.66 + 3.0 oz/A + 1% v/v applied EPOT; and Steadfast + Callisto + atrazine + AMS + COC at 0.75 oz + 2.0 oz + 3 pt + 2 lb/A + 1% v/v applied EPOT were the only systems with less than 80% barnyardgrass control. Bicep II Magnum + atrazine at 1.8 qt + 0.6 qt/A applied PRE; Lexar (19% metolachlor + 18.61% atrazine + 2.44% mesotrione) at 3 qt/A applied PRE; Bicep II Magnum + atrazine PRE Fb Accent EPOT with conventional and the Roundup Ready/Bt hybrid; and RWM at 21.4 oz/A applied at EPOT were the only systems which showed 80% or lower sicklepod control. All herbicide systems at Pontotoc, except the untreated check, provided 91 to 100% control of both broadleaf signalgrass and pigweed, 50 DAP. Steadfast applied EPOT Fb Cinch ATZ (metolachlor + atrazine) PRE, Cinch (metolachlor) PRE or in combination with Callisto caused erratic early season crop injury (yellow leaves and stunted plants) at Verona but had no effect on yield at both locations. Corn yields at Verona ranged from 87 bu/A for the untreated check to 144 bu/A with no difference among the herbicide weed management systems. At Pontotoc corn yields ranged from 172 to 216 bu/A with no differences among the Dekalb DKC 69-71 herbicide treatments, and between Dekalb DKC 69-71 and the conventional Bt hybrid Pioneer 31B13 with the standard herbicide program. The one year results with Roundup Ready corn at both locations indicated that under excellent growing conditions, adequate pigweed, broadleaf signalgrass, sicklepod and barnyardgrass control can be accomplished with the standard (1X) all PRE herbicide program of Bicep II Magnum + atrazine at 1.8 qt + 0.6 qt/A alone or Fb Accent at EPOT; the 2/3 or 1/2 rate of Bicep II Magnum + atrazine applied PRE Fb RWM at 21.4 oz/A; one EPOT application of RWM at 21.4 oz/A application; RWM at 21.4 oz/A + 0.25 standard rate (0.5 lb ai/A) of atrazine applied EPOT; and EPOT RWM at 21.4 oz/A with a LPOT repeat application at 16 oz/A. However, in comparison to one or two RWM applications, none of these systems showed improved weed control or yield.

ROUNDUP READY COTTON WEED CONTROL AND YIELD RESPONSE TO HERBICIDE COMBINATIONS AND TIME OF APPLICATIONS. R.R. Dobbs, N.W. Buehring, and M.P. Harrison. Northeast Branch Experiment Station, North Mississippi Research and Extension Center, Mississippi State University; Verona, MS 38879.

ABSTRACT

A study was conducted in 2004 to evaluate herbicide weed management systems for sicklepod (*Senna obtusifolia*) and barnyardgrass *(Echinochloa crusgalli)* control. The 2004 growing season was excellent (no drought stress) for herbicide activity. Sicklepod control for all treatments, 42 days after planting (DAP), ranged from 0 to 91%. Except for Roundup WeatherMAX (RWM) at 16.4 oz/A applied preemergence (PRE) followed by (Fb) RWM + Staple (pyrithiobac) at 22 oz/A + 1.5 oz/A applied postemergence over top (POT) at 3 to 4 leaf cotton Fb RWM at 22 oz/A applied post-directed layby (PDL); the untreated check; and Sequence (glyphosate + metolachlor) at 40 oz/A applied PRE with no POT 2 to 3 leaf or 3 to 4 leaf cotton herbicide applications Fb Touchdown Total [glyphosate (TDT)] at 24 oz/A at PDL, all treatments provided 78 to 89% sicklepod control and were not different. RWM at 16.4 oz/A applied PRE at planting Fb RWM + Staple at 22 oz/A + 1.5 oz/A applied POT at 3 to 4 leaf cotton Fb RWM applied PDL had the highest sicklepod control of 91%.

All herbicide weed management systems provided 70 to 94% barnyardgrass control 18 days after 4 leaf cotton POT applications (42 DAP). Except for the untreated check; Sequence at 40 oz/A applied PRE Fb TDT at 24 oz/A applied PDL; and RWM at 16.4 oz/A applied PRE Fb RWM at 16.4 oz/A applied POT at 2 leaf cotton Fb TDT at 24 oz/A applied PDL, all weed management systems provided 83 to 94% barnyardgrass control with no differences. Sequence at 40 oz/A applied PRE Fb TDT at 24 oz/A applied PDL; and RWM at 16.4 oz/A applied PRE Fb a repeat POT application at 2 leaf cotton Fb RWM at 22 oz/a applied PDL provided 70 and 79% barnyardgrass control, respectively. Highly erratic crop injury (11 to 14%, 42 DAP) from Envoke (trifloxysulfuron) at 0.15 oz/A and Sequence at 40 oz/A was observed 42 DAP. Except for Sequence at 40 oz/A applied POT at 2 leaf cotton Fb Envoke at 0.15 oz/A applied POT at 5 to 7 leaf cotton Fb TDT + Suprend (prometryn + trifloxysulfuron) at PDL which showed reduced yield, all herbicide weed management systems with Envoke and/or Sequence had no effect on yield.

All herbicide weed management systems produced higher yield than the check with lint yields from 847 to 1094 lb/A. Yields of 847 lb/A for Sequence at 40 oz/A applied PRE Fb TDT applied PDL, and 963 lb/A for Sequence at 40 oz/A applied POT to 2 leaf cotton Fb Envoke at 0.15 oz/A applied POT to 5 to 7 leaf cotton Fb TDT + Suprend applied PDL were lower than Sequence at 40 oz/A applied POT at 2 to 3 leaf cotton Fb TDT at 24 oz/A applied PDL; RWM at 16.4 oz/A applied PRE Fb Sequence at 40 oz/A applied POT to 2 to 3 leaf cotton Fb TDT at 24 oz/A applied PDL; RWM at 16.4 oz/A applied PRE Fb RWM at 22 oz/A applied POT to 2 to 3 leaf cotton Fb RWM + Suprend at 22 oz/A + 1.25 lb/A applied PDL; and RWM at 16.4 oz/A applied PRE Fb RWM + Staple at 22 oz/A + 1.5 oz/A applied POT to 3 to 4 leaf cotton Fb RWM at 22 oz/A applied PDL which had yields ranging from 1079 to 1094 lb/A and were not different.

Herbicide costs for each weed management system were based on retail prices of 45, 37, 46, and $33 per gallon of product for RWM, TDT, Sequence and Cotoran, respectively. The cost per ounce of product for Envoke, Staple, and Suprend was 70, 16, and $0.60, respectively. The cost per weed management system ranged from 14 to $45/A with most systems providing effective weed control and no significant lint yield reductions. Under good growing conditions in 2004, the addition of Envoke, Sequence, Staple, Cotoran or Suprend in a herbicide weed management system did not improve weed control or yield but increased cost by 7 to $25/A. The 2 leaf cotton POT application of either RWM at 22 oz/A or TDT at 24 oz/A (no RWM or TDT PRE application at planting) Fb a repeat PDL application had the lowest herbicide costs of $14 and $15/A, respectively. These treatments showed no differences in weed control or yield and yields were equal to the higher cost treatments. However, Sequence at 40 oz/A applied POT at 2 leaf cotton Fb TDT at 24 oz/A applied PDL or RWM at 16.4 oz/A applied PRE Fb Sequence at 2 to 3 leaf cotton Fb TDT increased cost by 6 and $12/A, respectively, but showed 77 to 105 lb/A higher lint yield trends than RWM at 22 oz/A or TDT applied POT at 2 leaf cotton Fb a repeat PDL application.

VARYING PESTICIDE INPUTS TO EVALUATE PEANUT MATURITY USING HYPERSPECTRAL IMAGING. D. Carley, D. Jordan, M. Burton, T. Sutton, R. Brandenburg, and P. Johnson, North Carolina State Univ., Raleigh; and C. Dharmasri, Syngenta Crop Protection, Greensboro, NC.

ABSTRACT

Peanut growers and their advisors use pod mesocarp color to determine pod maturity in order to initiate the digging and vine inversion process. Darker pods are considered advanced in maturity with pods expressing a brown or black mesocarp color considered “ready” to dig. This method requires collecting a total of approximately 150 pods from four or five places within each field. Pods are removed from vines and the mesocarp exposed either by using a standard pressure washer equipped with a turbo nozzle or by a device delivering glass beads in water under high pressure. This process can be time consuming, especially if fields are sampled multiple times. Reflectance of the crop canopy using hyperspectral or multi-spectral imaging may be an alternative to this approach. Research was conducted in 2003 and 2004 to determine if differences in pod maturity were correlated with differences in reflectance. A two-factor factorial arrangement of treatments was used in an attempt to establish differences in pod maturity. Factors included two levels of aldicarb treatment (0 and 7 lb ai/acre) and three levels of agrichemical treatment imposed on each level of aldicarb (prohexadione calcium, paraquat, 2,4-DB). The experiment was conducted at one location in 2003 and four locations in 2004. Damage from tobacco thrips or paraquat can cause a delay in maturity can delay pod maturity and reduce pod yield in some instances. Prohexadione calcium can influence pod retention and possibly pod maturity. These treatments can also influence above ground growth and development. Reflectance was measured in late September using an ASD FieldSpec Pro FR portable spectroradiometer. Reflectance for each wavelength (350 to 2,500 nm) was grouped into 50 nm sections. Data for pod yield; percentages of total sound mature kernels (% TSMK), extra large kernels (% ELK), and fancy pods (% FP), and pods with brown or black mesocarp color; and reflectance were subjected to analysis of variance appropriate for the factorial treatment arrangement. Significant damage caused by thrips was noted when aldicarb was not applied in-furrow. Paraquat also injured peanut foliage significantly. However, pod yield and percentages of TSMK, ELK, FP, and “ready” pods did not differ among treatments. These results indicate the ability of peanut to compensate following early season stress. Additionally, while prohexadione calcium-treated peanut were shorter and expressed greater row definition (triangular shaped peanut canopy), pod yield and other market grade and maturity factors did not differ from the no-prohexadione calcium control. Differences in reflectance were noted at bandwidths of 470-500 nm (blue), 500-590 nm (green), 590-700 nm (yellow/orange), 700-760 nm (red-edge), 800 nm (near infrared), 950-999 nm (near infrared), and 1000-1049 nm (near infrared) for the environment by agrichemical interaction. The aldicarb by agrichemical treatment was significant only in the near infrared region (1350-1399 nm). The three-way interaction between environment, agrichemical, and aldicarb was significant only at the lower frequency wavelengths of 700-760nm (red-edge), 800nm (near infrared), 950-999nm (near infrared), and 1000-1049nm (near infrared). Results from these experiments are inconclusive with respect to using hyperspectral imaging to determine difference in peanut pod maturity. A major limitation to this data set in making conclusions is lack of major differences in agronomic parameters that reflect difference in pod maturity. Additional research is in progress using hyperspectral imaging in trials with different planting dates and digging dates. Results from those trials may give a clearer indication of the utility of hyperspectral imaging in predicting pod maturity.

EFFECTS OF SPRAY VOLUMES AND RATES ON RICE INJURY BY SIMULATED HERBICIDE DRIFT. W.Zhang, E.P. Webster, C.T. Leon, and R. M. Griffin. Louisiana State University AgCenter, Baton Rouge, LA.

ABSTRACT

Simulated drift studies provide useful information on potential damages caused by herbicide drifts; however, high spray volumes commonly used in such studies may not represent the true drift effects. A field study was conducted at LSU AgCenter Rice Research Station near Crowley, Louisiana in 2004 to evaluate effects of spray volume and herbicide rate on rice by simulated drift. A randomized complete block design with two replications was used. Roundup WeatherMax (glyphosate), Liberty (glufosinate), NewPath (imazethapyr), and Beyond (imazamox) were applied at their full use rates, 23, 34, 4, and 5 fl oz/A, respectively, in a spray volume of 25 gallons per acre (GPA). In addition, these four herbicides were also applied at 1/8 times of their full use rates to simulate their drift rates with two spray volumes, 3.2 and 25 GPA. A nontreated was also included as a comparison. Treatments were applied postemergence to 4- to 5-leaf 'Cocodrie' rice with a CO_2-pressurized backpack sprayer calibrated to deliver a specific carrier volume. Rice visual injury at 14 and 21 days after treatment (DAT), rice plant height at harvest, and rough rice grain yield were evaluated.

At 14 DAT, all the herbicides at their full rates injured rice 73 to 99%. Rice injury was 13 to 60% with Roundup WeatherMax, Liberty, and NewPath at their drift rate in 3.2 GPA; however, no rice injury was noted when 25 GPA was used. At 28 DAT, rice injury was 99, 55, 83, and 97% with full use rate of Roundup WeatherMax, Liberty, NewPath, and Beyond, respectively. When applied at the drift rates in the spray volume of 3.2 GPA, Roundup WeatherMax and Beyond injured rice 23 and 13%, respectively. No visual rice injury was observed with Liberty and NewPath at the drift rates regardless of spray volume. Rice plant height was reduced by all the herbicides applied at the full rates. At the drift rates, Roundup WeatherMax reduced rice panicle height more when applied in 3.2 GPA compared with 25 GPA. NewPath and Beyond at drift rates reduced rice plant height regardless spray volumes. All the herbicides applied at their full use rates resulted in complete grain yield losses. Roundup WeatherMax and Beyond at their drift rates reduced rice grain yield 52 and 50%, respectively, when applied in the spray volume of 3.2 GPA; however, grain yield was similar to the nontreated when the two herbicides were applied in 25 GPA. NewPath at its drift rate reduced rice grain yield regardless of the spray volumes. These results indicate that use of the reduced spray volume is more critical in simulated drift studies involving Roundup WeatherMax and Beyond but less critical with Liberty or NewPath.

CROP TOLERANCE AND CONTROL MEASURES FOR OUTCROSSING IN CLEARFIELD RICE.

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ABSTRACT

Red rice is a noxious weed in rice in southern U.S. rice growing areas. Growth suppressants (cell division and elongation inhibitors), compounds with plant growth regulator activity, applied during the pre-heading reproductive phase of red rice, can interrupt panicle growth and development. When panicle suppression results and red rice panicles do not emerge, dehiscence is prevented and seed formation cannot occur. Limiting red rice seed production in this manner improves quality and value of harvested rice and reduces future red rice infestations. Also, in herbicide resistant/tolerant rice in which control of red rice is possible, suppressing panicle development in red rice that escapes herbicide treatment may reduce the possibility of cross pollination and the production of herbicide resistant/tolerant red rice.

Imazethapyr (Newpath, BASF) applied at 4 fl oz/A during the early stages of the reproductive phase (PD, panicle differentiation) selectively suppressed reproductive growth and development in red rice. There was a low infestation of red rice to simulate incomplete pre- and postemergence control of seedling red rice with imazethapyr, and panicle emergence was suppressed up to 98% (184 panicles/10 yd^2 in the control versus 4 panicle/10 yd^2 with imazethapyr). Seed production was absent with the high degree of panicle suppression. Imazethapyr applied during heading (HD) had negligible effects on red rice. Panicle density was 170 panicles/10 yd^2, which was less than 8% suppression. But, the bulk of the panicles from the HD application were malformed (2 panicles/10 yd^2 in the control versus 120 panicles/10 yd^2 with imazethapyr) and produced few seed. In neither instance (PD and HD applications) did imazethapyr produce phytotoxic symptoms on the rice or red rice.

CL121 (Clearfield, Horizon Ag), a rice variety tolerant to imidazolinone herbicides, was unaffected by mid- and late-season applications of imazethapyr. Crop stature, maturity, and yield were similar between the control and treatments. Mature plant height (distance from the soil surface to the tip of the panicle extended vertically) ranged between 112 and 113 cm, grain moisture (an indicator of maturity at harvest) ranged between 23.4 and 24.4%, and grain yield (adjusted to 12% moisture) ranged between 5703 and 6266 lb/A.

Mid- and late-season applications of imazethapyr can be used to suppress reproductive development in red rice with minimal effects on tolerant (Clearfield) rice varieties. The impact on grain production and future red rice infestations will be greatly improved. The ability to limit the transfer of herbicide resistance into red rice with seedhead suppressing compounds may provide an effective tool for weed resistance management.

INFORMAL SURVEY RESULTS OF PESTICDE USE BY TOP PEANUT GROWERS IN NORTH CAROLINA AND VIRGINIA. D. Jordan, G. Sullivan, A. York, and S. Toth, North Carolina State Univ., Raleigh; and J. Faircloth and C. Swann, Virginia Cooperative Extension Service, Suffolk.

ABSTRACT

A wide range of pesticides is applied to manage weeds, insects, diseases, and nematodes in peanut grown in the southern United States. Changes in state and federal pesticide registrations have altered use patterns of herbicides considerably over the past two decades. Surveys supported by the National Agricultural Pesticide Impact Assessment Program during 1988 and 1995 were used to compare historical use of herbicide with current use patterns. Although a more recent in depth survey similar to the NAPIAP surveys has not been completed with peanut Virginia-Carolina region, informal surveys of top peanut producers are collected annually in these states. These surveys are a part of a program called *Champions Night Out*, and are designed to recognize growers from each peanut-producing county in the Virginia-Carolina Region with the highest yield per acre. The program is sponsored by the North Carolina Peanut Growers Association, the Virginia Peanut Growers Association, several agribusinesses, and Cooperative Extension Services from participating states. The percentage of acres treated with preplant, preemergence, ground cracking, and postemergence herbicides was reported in the 1988 and 1995 surveys. The informal survey from top peanut producers was used to determine the percentages of farmers using a specific herbicide. Results from the years 2001, 2002, and 2003 were pooled from North Carolina peanut producers. Surveys from Virginia during 2003 were also included. A total of 67 respondents were used in the informal survey. The NAPIAP surveys included 503 respondents in 1988 and 558 respondents in 1995. The NAPIAP surveys of 1988 and 1995 provide percentages of acres while the informal survey provides percentage of growers. Glyphosate use increased when comparing surveys from 1988 to those in 2002-2203, and this most likely reflected increases in reduced tillage peanut acreage. Use of vernolate decreased from a high in 1988 to essentially no use in 2002-2004 as a result of changes in product registration and manufacturing. Use of pendimethalin increased from 20% in 1988 to 43% in 1995 and 60% in the 2002-2004 survey. Ethafluralin and benefin use decreased over this period of time while imazethapyr and diclosulam received registrations and were used by a modest percentage of growers.

Metolachlor use increased from 1988 to 1995 but then decreased in the 2002-2004 survey. Alachlor use decreased over this time period. This decrease occurred because of pressure by peanut buyers relative to the Alar and Kylar controversy that forced growers to sign contracts indicating that they did not apply alachlor to peanut. Use of diclosulam, dimethenamid, and flumioxazin reflected registrations of these herbicides 1995. Metolachlor and paraquat use increased modestly from 1988 to 1995 and 2002-2004. Acifluorfen and bentazon use remained relatively constant over the survey period. The prepackage mixture of acifluorfen plus bentazon (Storm) increased significantly from 1995 to 2002-2004. Sethoxydim use increased from 1988 to 1995 while use of clethodim and sethoxydim was equally split in the 2002-2004 survey. Imazapic was used by 23% of growers in 2002-2004. Use of 2,4-DB decreased from 73 to 75% in 1988 and 1995 to just below 50% in the 2002-2004 survey.

BEYOND DRIFT ISSUES IN NON-IMIDAZOLINONE TOLERANT RICE. M.E. Kurtz; Mississippi State University, Delta Research and Extension Center, Stoneville, MS 38776.

ABSTRACT

An experiment was initiated on July 9, 2004 to determine the effect of imazamox (Beyond) on rice injury and yield when applied postemergence at 0.75, 1.5, and 3.0 fl oz/A to dry seeded rice ‘cocodrie’ at booting. The use rate of Beyond in Clearfield rice is 5 fl oz/A. Untreated rice was fully headed on Aug. 10. At this time, rice treated with 0.75 oz of Beyond was only 25% headed. Treatments with higher rates showed no signs of normal heading. Rice treated with Beyond at all rates, was displaying signs of abnormal seed head emergence from the sides of rice sheaths. Heads were twisted, curled, or buggy whipped, and individual seeds were normal, blanked, or parrot beaked. On Aug. 17, rice treated with 0.75 oz of Beyond was 50% headed and rice treated with higher rates of Beyond still showed no signs of normal heading. On Aug. 27, rice treated with 0.75 oz Beyond, was 98% headed, the 1.5 oz treatment was 17% headed and the 3 oz treatment was still 0% headed. On Sept. 10, all treatments were harvested using a John Deere 45 rice special plot combine. Rice yield had been reduced 25% with the 0.75 oz rate of Beyond, 41% with the 1.5 oz rate of Beyond, and 72% with the 3 oz rate of Beyond when compared to the untreated control. The results of this experiment indicate that if Beyond drifts on to non-imidazolinone tolerant rice at booting, and heading is delayed 1-to 2-weeks, yields will drop at least 25% and further delays in heading will reduce yields even more drastically.

ENVOKE AND PERMIT FOR POSTEMERGENCE WEED CONTROL IN DARK TOBACCO.
W. A. Bailey, T. W. Lax, and R. A. Hill, University of Kentucky, Princeton, KY.

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 and 2004 at the University of Kentucky Research and Education Center near Princeton, KY and at the Murray State University Research Farm near Murray, KY to evaluate crop tolerance and weed control from the sulfonylurea herbicides trifloxyfulfuron-sodium (Envoke™) and halosulfuron-methyl (Permit™). 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 0.068 and 0.1 oz/A for Envoke and 0.68 and 1 oz/A for Permit. Either herbicide applied POT caused crop injury and plant height reductions of 15 to 30% at 1 wk after treatment (WAT). However, tobacco appeared to recover by 3 WAT. Crop tolerance to 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 67 to 85% with POT applications and 69 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 2252 to 2546 lb/A at Princeton. Dark tobacco that received Envoke at 0.068 oz/A POT or either rate of Permit POT yielded significantly less than nontreated dark tobacco. Gross revenue/A was also reduced with either rate of Permit POT. Federal grade index was unaffected by herbicide treatment at Princeton. At Murray, total dark tobacco yield ranged from 2814 to 3020 lb/A and herbicide treatments did not influence total dark tobacco yield, gross revenue/A, or federal grade index compared to nontreated dark tobacco.

BURNDOWN OF GLYPHOSATE RESISTANT HORSEWEED IN NO-TILL COTTON. L.E. Steckel, C.C. Craig, P.A. Brawley and R.M. Hayes. Department of Plant Sciences, University of Tennessee, Jackson, TN.

ABSTRACT

Glyphosate-resistant (GR) horseweed (*Conyza canadensis*) was first identified in 2001 in Lauderdale County, Tennessee. In 4 yrs it has spread to become a problem in 600,000 ha of cotton and soybeans grown in Tennessee. Most notably GR horseweed has become a major challenge for no-till cotton growers who in the past had relied almost entirely on glyphosate for burndown of winter annual weeds. Research was conducted at the West Tennessee Experiment Station at Jackson in 2004 that evaluated several different herbicides tank-mixtures for burndown and residual control of GR horseweed. Clarity (dicamba) tank-mixed with either glyphosate, Ignite (glufosinate) or Gramoxone (paraquat) provided the most consistent control. Tank mixtures of 2,4-D with either glyphosate, Ignite or Gramoxone provided 80 to 90% control. Gramoxone + Caparol (prometryn) and Gramoxone + Direx (diuron) controlled GR horseweed if it was applied prior to bolting. After mid-April when GR horseweed was 7 to 10 centimeters tall the Gramoxone tank-mixtures were not as consistent. Ignite applied March 30 and April 6 under colder condition did not control horseweed. Ignite applied April 15 even at the low use rate of 24 ozs/A controlled GR horseweed. Valor (flumoxazin), Caparol and Direx applied 30 days before planting provided residual control of horseweed. These research shows that no-till cotton farmers have several very viable options for control of GR horseweed prior to planting.

CO-APPLICATION AND TIMING EFFECTS ON GLYPHOSATE EFFICACY ON SELECTED WEED SPECIES. D.M. Scroggs[1], D.K. Miller[2], J. Geaghan[3], P.R. Vidrine[1], A.M. Stewart[1], and M.S. Mathews[2]. LSU AgCenter, Alexandria[1], St. Joseph[2], and Baton Rouge[3], LA.

ABSTRACT

Research was conducted in 2004 at the Dean Lee Research Station in Alexandria, La, to evaluate co-application and timing effects on glyphosate efficacy. Treatments included Roundup Weathermax (glyphosate) applied alone at 22 oz/A or in combination with Acephate (acephate) at 13.3 oz/A, Intrepid (methoxyfenozide) at 8 oz/A, Trimax (imidacloprid) at 1.5 oz/A, Karate Z (lambda-cyhalothrin) at 2.5 oz/A, Tracer (spinosad) at 2.4 oz/A, Denim (emamectin benzoate) at 12 oz/A, Steward (indoxacarb) at 11.3 oz/A, Baythroid (cyfluthrin) at 2.6 oz/A, Centric (thiamethoxam) at 1.9 oz/A, Intruder (acetamiptid) at 1.1 oz/A, Mustang Max (zeta-cypermethrin) at 3.6 oz/A, Capture (bifenthrin) at 3.8 oz/A, Bidrin (dicrotophos) at 6.4 oz/A, Ammo (cypermethrin) at 5.1 oz/A, Dimethoate (dimethoate) at 8 oz/A, Pentia IV (mepiquat chloride) at 12 oz/A, Coron at 128 oz/A, and Boron at 32 oz/A. Treatments were applied to barnyardgrass (*Echinochloa crus-galli*), johnsongrass (*Sorghum halepense*), hemp sesbania (*Sesbania exaltata*), pitted morningglory (*Ipomoea lacunosa*), and sicklepod (*Senna obtusifolia*) at the 3 to 4 or 7 to 8 leaf growth stage. A nontreated control was included. Weeds were planted in trade gallon nursery containers (17 x 16.5 cm) and thinned to one plant per pot prior to treatment. Treatments were applied with a tractor mounted compressed air sprayer at 15 GPA. Experimental design was a randomized complete block replicated four times and the entire experiment was repeated. Visual assessment of weed control was conducted 7, 14, and 28 d after treatment (DAT). At 28 DAT, plants were clipped at the soil line and fresh weight was determined. Data from the nontreated control was used for visual reference of control ratings and for conversion of fresh weight to a percent reduction from the control, but was not included in the statistical analysis. Visual control data were analyzed as a randomized complete block with a factorial arrangement of treatments and growth stage with repeated measures over the weeks of evaluation. Fresh weight reduction conversions were analyzed as a randomized complete block with a factorial arrangement of treatments and growth stage. All data analysis was conducted using PROC MIXED with estimates of means and standard errors generated using ls means. Means were separated using the Dunnett's adjustment at the 0.05 level of probability.

For all parameters measured, significant treatment by growth stage interactions were not observed. Averaged across growth stages, control of barnyardgrass, hemp sesbania, johnsongrass, pitted morningglory, and sicklepod ranged from 96 to 97, 66 to 73, 98, 67 to 72, and 86 to 91% respectively, and co-application did not result in reduced control when compared to Roundup Weathermax applied alone. Fresh weight reduction ranged from 100, 91 to 94, 100, 89 to 93, and 95 to 97% for these respective weeds and again negative co-application effects were not noted.

When applied at 22 oz/A, Roundup Weathermax co-applications offer producers the ability to integrate pest and crop management strategies and reduce application costs without sacrificing control of weeds evaluated.

INTERFERENCE OF ROUNDUP-READY CORN IN ROUNDUP-READY COTTON. W.E. Thomas, S.B. Clewis, C.M. Wilcut, and J.W. Wilcut; Department of Crop Science, North Carolina State University, Raleigh, NC.

ABSTRACT

Studies were conducted to evaluate two objectives. The first objective was to evaluate density-dependent effects of Roundup Ready corn on Roundup Ready cotton growth and lint yield. The second objective was to evaluate various Roundup Ready corn interference intervals on Roundup Ready cotton height and lint yield.

For the first objective, studies were conducted at the Central Crops Research Station near Clayton, NC, the Upper Coastal Plain Research Station near Rocky Mount, NC, and the Peanut Belt Research Station near Lewiston-Woodville, NC in 2004. All studies used a randomized complete block design with three replications. Corn densities were 0, 1, 2, 4, 8, 16, and 32 plants per 20 feet of row, which is equivalent to 0, 0.025, 0.05, 0.1, 0.2, 0.4, 0.8, and 1.6 plants per foot of row. Corn was seeded in the center two rows of each four row plot within two inches of the cotton drill on the same day cotton was planted. Corn and cotton heights were measured biweekly after planting. Additional measurements included corn dry biomass at maturity, kernel set, and cotton lint yield. Corn height was not influenced by planting density. As corn density increased, cotton height was reduced at all locations. At Clayton, Lewiston, and Rocky Mount, cotton height was reduced by 53, 26, and 35%, respectively, at the highest corn density compared to the weed-free, respectively. Corn canopied over cotton 3 to 5 weeks after planting, depending on location. The height advantage reduced cotton light reception, consequently reducing cotton height and lint yield. Regardless of location, less than 2 corn plants per row reduced cotton yield at least 10 percent. Using rectangular hyperbola model with *a* constrained to 100% yield less, *i* values were 8.98, 5.29, and 5.37 at Clayton, Lewiston, and Rocky Mount, respectively.

For the second objective, a study was conducted at the Central Crops Research Station near Clayton, NC. The study used a randomized complete block design with three replications. Corn was planted as previously described at 32 plants per row on the same day cotton was planted. Treatments included removal at 1, 2, 4, 6, 8, 10, and 12 weeks after planting. Weed-free and season long interference treatments were also included. Data collection was similar to the previous study including corn and cotton heights at bi-weekly intervals, corn dry biomass at maturity, kernel set, and cotton lint yield. Cotton heights were similar for weed-free and corn removal at 1, 2, and 4 weeks after planting. As time of removal was prolonged, cotton height decreased. When corn was removed after 4 weeks after planting or later, cotton heights were similar and ranged from 31 to 45% less than weed free cotton plots. When corn was removed at 1 and 2 weeks after planting, less than 5% yield loss was observed. However, greater than 70% yield losses were observed with corn removal after 8 weeks after planting. Therefore, these data show that corn should be removed no later than 2 to three weeks after planting.

Effects of 2,4-D Timings and Rates on Cotton Growth and Yield. J.D. Everitt, J.W. Keeling, and P.A. Dotray, Texas Agricultural Experiment Station and Texas Tech University, Lubbock.

ABSTRACT

Cotton production in the Texas High Plains is challenging due to early season severe weather including wind, hail, and excessive rainfall, erratic seasonal rainfall, and occasional cool, wet fall and early freezes. These challenges are occasionally compounded by man-made problems including herbicide drift to susceptible crops. Cotton production has increased in the central and northern High Plains regions of Texas over the last 3 to 5 years. These areas have traditionally produced large acreages of wheat, corn and sorghum, and include large grassland areas where the use of 2,4-D is common. Cotton acreage in the Texas Panhandle and Northern High Plains has increased from 600,000 acres planted in 1998 to 900,000 acres in 2002, and this trend has continued. In this same district, approximately 700,000 acres of corn, 980,000 acres of grain sorghum, and 2,400,000 acres of wheat are also produced. These expanding cotton areas are at high risk of exposure to drift of 2,4-D. Cotton is highly susceptible to injury from 2,4-D, even at extremely low rates. Injury to cotton from 2,4-D is characterized by leaf malformation (strapping, cupping), stem malformation (twisting and curling), callus formation, delayed or lack of fruit retention, and delayed boll maturity. Little information is available that clearly identifies the relationship between exposure level, crop injury, and cotton yield reductions following 2,4-D drift. Previous research has focused mainly on injury, but has not made a correlation between injury and yield loss. The objectives of this study were to determine the effects of 2,4-D applied at varying rates and growth stages on cotton growth and yield, and to correlate cotton injury levels and effects on cotton lint yield and fiber quality to aid management decisions.

Studies were initiated at the Texas Agricultural Experiment Station in Halfway, TX in 2004 on an Olton clay loam. Cotton (FM 960 BR) was planted on May 11. Applications of 2,4-D were made at four growth stages including: cotyledon to 2 leaf, 4 to 5 leaf, pinhead square, and first bloom. Rates of 2,4-D included: 0.25 (1/2X), 0.125 (1/4X), 0.063 (1/8X), 0.025 (1/20X), 0.0025 (1/200X), and 0.00025 lbs ai/A (1/2000X). Visual injury was recorded at 14 days after treatments (14 DAT), and cotton was harvested and ginned to determine lint quality.

2,4-D (0.025 lb ai/A and greater) visually injured cotton 15 to 78% 14 DAT when applied at cotyledon to 2 leaf and 4 to 5 leaf cotton, and visual injury levels ranged from 40 to 90% by the end of season. Applications made at pinhead square and first bloom visually injured cotton similar to the cotyledon to 2 leaf and 4 to 5 leaf stages. Cotton lint yield was reduced 66% following 2,4-D at 0.025 lb ai/A (1/20X) applied at pinhead square, but only resulted 16% yield reduction when 2,4-D was applied at cotyledon to 2 leaf. 2,4-D injured cotton at rates as low as 0.025lb ai/A (1/20X) applied at cotyledon to 2 leaf, pinhead square, and first bloom. Rates as low as 0.0025 lb ai/A (1/200X) visually injured cotton when applied at 4 to 5 leaf. Yield was most affected by pinhead square applications, with yield reductions observed following 2,4-D at 0.0025 lb ai/A (1/200X). This result indicates that pinhead square is the most susceptible stage for cotton yield loss. The correlation between visual injury and yield loss varied by application timing. 2,4-D applications had little effect on lint quality when applied at any growth stage.

RICE TOLERANCE AND WEED CONTROL WITH PENOXULAM HERBICIDE. K.B. Meins, R.C. Scott, and N.D. Pearrow; University of Arkansas, Division of Agriculture, Cooperative Extension Service, Lonoke, AR.

ABSTRACT

Since the introduction of clomazone (Command) herbicide for grass weed control in rice (*Oryza sativa*), Arkansas producers have been able to control grass weeds more cost effectively than in years past. This has led to widespread adoption of clomazone. However, with the continued use of clomazone there has been an increasing problem with certain broadleaf weeds, such as hemp sesbania (*Sesbania exaltata*) and annual sedge (*Cyperus compressus*). Clomazone has no activity on these weeds. Penoxulam (Grasp) is a new product being developed by Dow AgroSciences that has been shown to have the potential of controlling these broadleaf weeds in a clomazone based weed control program.

Two studies were conducted in 2004 to evaluate rice tolerance and weed efficacy of penoxulam herbicide. In the tolerance study, 2 and 4 ounces of product per acre of penoxulam was applied at six timings from the 2 to 3-leaf up to the boot stage of rice. No injury was observed from treatments applied after flood. When applied at the 2 to 3-leaf stage or pre-flood stage injury in the form of stunting and root pruning (root inhibition) was observed at both 2 and 4 oz per acre. Roots were inhibited as much as 35% by the 4 oz rate applied pre-flood and the plants were 5-10% stunted two weeks after the pre-flood treatments were applied. However, by 8 weeks after treatment no injury was visible and rice yield was not affected.

In the efficacy study, penoxulam at 2 oz per acre applied alone, tank-mixed with or following clomazone controlled hemp sesbania and annual sedges 91% or more late in the season. Penoxulam also was controlling barnyardgrass (*Echinochloa crus-galli*) 75% by 14 weeks after treatment when applied alone. The combination of clomazone (0.3 lb/A) and penoxulam at this location was an excellent weed control program. Clomazone alone or with penoxulam controlled barnyardgrass 91% or more at all timings.

FLUMIOXAZIN PLUS GLYPHOSATE COMBINATIONS FOR BURNDOWN IN RICE.. J.A. Bond, P.K. Bollich, G.R. Romero, R.P. Regan, and J.P. Leonards; Louisiana State University AgCenter, Rice Research Station, Crowley, LA.

ABSTRACT

Reduced tillage has gained acceptance in Louisiana rice production, and, in 2004, approximately 32% of rice in Louisiana was produced under no-tillage or stale seedbed systems. Burndown programs for stale seedbed rice production in Louisiana usually consist of glyphosate or glyphosate plus 2,4-D applied 3 to 4 wk prior to planting. The addition of a residual herbicide to a burndown program containing glyphosate could enhance the weed spectrum and prevent emergence of new weeds prior to planting. An experiment was conducted in 2004 at Crowley, LA, to evaluate flumioxazin (Valor) and glyphosate (Roundup Weathermax) combinations for burndown application in a stale seedbed rice production system.

Field preparation consisted of fall disking and field cultivation. The experimental site was left fallow during the winter. Burndown herbicide treatments were applied on March 14, 2004. Burndown herbicide treatments consisted of Roundup Weathermax at 23 oz/A alone and in combination with Valor at 1 oz/A, Valor at 1 oz/A plus crop oil concentrate (COC) at 16 oz/A, Valor at 2 oz/A, or 2,4-D at 32 oz/A. The long-grain rice cultivar, 'Cocodrie', was drill-seeded on April 14, 2004. The experimental design was a randomized complete block with four replications. Control of broadleaf signalgrass (*Brachiaria platyphylla*), Persian clover (*Trifolium resupinatum*), and California burclover (*Medicago polymorpha*) was visually estimated prior to rice planting. Rice injury was visually estimated 14 d after emergence (DAE). Main- and ratoon-crop rice grain yields were adjusted to 12% moisture. Total rice grain yields were calculated from main- and ratoon-crop grain yields. Data were subjected to ANOVA with means separated by Fisher's Protected LSD test at $P = 0.05$.

Including Valor in burndown programs with Roundup Weathermax resulted in 10 to 15% rice injury 14 DAE. Broadleaf signalgrass control ranged from 79 to 85% at planting, with no differences among herbicide treatments. Control of Persian clover and California burclover was greater when Valor was applied with Roundup Weathermax than when Roundup Weathermax was used alone. However, increasing the Valor rate to 2 oz/A or adding COC to Valor plus Roundup Weathermax did not improve control of broadleaf weed species over Valor at 1 oz/A plus Roundup Weathermax. Burndown programs containing Valor led to delays in rice maturity and lower main-crop and total rice grain yields compared with burndown programs containing Roundup Weathermax alone or Roundup Weathermax plus 2,4-D.

Combinations of Valor plus Roundup Weathermax were more effective than Roundup Weathermax alone but less effective than Roundup Weathermax plus 2,4-D as burndown treatments for Persian clover and California burclover. Valor plus Roundup Weathermax burndown combinations would be beneficial when broadleaf weed species are prevalent prior to planting. Residual control from Valor used for burndown may help minimize early-season broadleaf weed competition with rice. However, sequential applications of glyphosate would be needed for complete control of annual grasses emerging prior to rice planting.

INVESTIGATION OF A POPULATION OF COMMON RAGWEED SUSPECTED OF GLYPHOSATE RESISTANCE. R.C. Scott, T.W. Dillon, K.B. Meins, and L.R. Oliver; University of Arkansas, Division of Agriculture, Cooperative Extension Service, Lonoke, AR, and Fayetteville, AR.

ABSTRACT

In the summer of 2004, a soybean (*Glycine max*) field was identified in Jackson county Arkansas where a population of common ragweed (*Ambrosia artemisiifolia*) had survived at least one and possibly two applications of 1.5 pints per acre of Roundup Original MAX. After our initial investigation, suspicions were high that the population might in-fact be resistant to glyphosate. Varying levels of control were observed throughout the field, re-growth of previously controlled ragweed plants, and the fact that all other weeds in the field were controlled by the glyphosate program led us to believe that further investigation was needed. The chronology of the soybean fields glyphosate applications for 2004 is as follows: 1.5 pints per acre of Gly-Star on 3/12, 1.5 pints per acre of Roundup Original MAX on 5/28 (pre-plant burndown), 1.5 pints per acre of Roundup Original MAX on 6/19 (in-crop), 2.0 quarts per acre of Roundup Original MAX 6/28 (in-crop) and our studies were established on 7/29. It is not known if the common ragweed was emerged at the time of the first two glyphosate applications.

Two studies were established in areas previously treated with glyphosate either once or twice by the producer. Study one was placed in a part of the field where the grower had made one in-crop application of 1.5 pints per acre of Roundup Original MAX. Study two was placed directly behind study one and was in a part of the field where the grower had previously applied 1.5 quarts per acre of Roundup Original MAX followed by 2.0 quarts of Roundup Original MAX 10 days after that. The treatments for studies one and two were identical. They included POST applications of 2, 4 and 8 quarts per acre of Roundup Original + 1% v/v crop oil concentrate. At the time of application, the size and condition of the common ragweed plants located in both study areas was variable. Previous applications of glyphosate had left some plants uninjured, some were practically fully controlled, some were green and actively growing with no glyphosate symptomology and some were chlorotic with significant re-growth.

The only treatment in both study one and study two that provided over 75% control of common ragweed was the 8 quart per acre rate of Roundup Original. In study two the test had already received 1.5 pints per acre followed by 2 quarts per acre of Roundup Original MAX, applying an additional 2 or 4 quarts per acre of Roundup Original resulted in only 70% control by 9 weeks after treatment. The 8-quart per acre rate was also the only treatment that was able to reduce seed production in surviving common ragweed plants.

The results of these field studies indicated that this population of common ragweed had a higher level of tolerance to glyphosate than should be expected. However, observations made in the field could not confirm resistance. Plant materials and seed were taken to the greenhouse for further evaluation. Early indications from those trials suggest that the population is in-fact glyphosate resistant.

WEED MANAGEMENT IN LIBERTYLINK AND ROUNDUP READY FLEX COTTON. J.W. Wilcut[1]; S.B. Clewis[1], and J. Collins[2]; [1]Crop Science Department, North Carolina State University, Raleigh, NC; and [2]Bayer CropScience, Research Triangle Park, NC.

ABSTRACT

The experiment was conducted at the Upper Coastal Plain Research Station near Rocky Mount in 2004 to compare LibertyLink and Roundup Ready Flex cotton systems. Plots were arranged in a randomized split block design with 30 treatments arranged in a factorial treatment arrangement. Factorial options included LibertyLink and Roundup Ready Flex cotton varieties (early postemergence (EPOST) and postemergence (POST) herbicide), preemergence (PRE) herbicide, and post-directed (LAYBY) late season herbicides. Cotton and POST herbicide options included Roundup Flex (Roundup WeatherMAX at 0.75 lb ae/A) and LibertyLink (Ignite at 0.42 lb ai/A) cotton. PRE herbicide options included No PRE, Prowl at 1 lb ai/A, and Prowl plus Cotoran at 1 lb ai/A. EPOST herbicide options included Roundup WeatherMAX alone and tank-mixed with Dual Magnum at 1. lb ai/A as well as Ignite alone and tank-mixed with Dual Magnum. LAYBY options included Caparol at 1 lb ai/A plus MSMA at 2 lb ai/A, Valor at 0.063 lb ai/A plus MSMA, Roundup WeatherMAX alone at 0.75 lb ai/A, Roundup WeatherMAX plus Caparol, Roundup WeatherMAX plus Valor, Ignite alone at 0.42 lb ai/A, Ignite plus Caparol, and Ignite plus Valor. No cotton injury was observed with any herbicide applications. An economic evaluation of treatments was conducted using a cotton production cost estimate of $409/A (excluding weed management costs) for both cotton systems developed from the North Carolina Cooperative Extension Service cotton budget. Herbicide costs were calculated for all treatments and net returns were calculated. One Ignite application on 1 to 2 leaf cotton controlled 1 to 2 leaf goosegrass 84% at 9 days after treatment (DAT) while Roundup WeatherMAX controlled 99%. Roundup and Ignite controlled broadleaves and all other grasses 99 to 100% 9 DAT when weeds were cotyledon to 5 leaf and cotton was 1 to 2 leaf. When no PRE was applied Roundup WeatherMAX and Ignite applied alone EPOST controlled Palmer amaranth 87 and 52% at 27 DAT, respectively. Greater than 95% control of all grass and broadleaf weeds was observed when a residual herbicide was applied PRE (Prowl) or tank-mixed EPOST (Dual Magnum) with Roundup WeatherMAX and Ignite. Ratings 29 days after LAYBY applications (late July) showed LAYBY treatments following Roundup WeatherMAX and Ignite tank-mixed with Dual Magnum EPOST controlled Palmer amaranth 100 and 95%, respectively when no PRE herbicide was applied. LAYBY applications following Roundup WeatherMAX and Ignite tank-mixed with Dual Magnum EPOST controlled all other weeds 98 to 100%. Cotton lint yields were statistically similar for all weed management systems that used sequential herbicide applications with yields ranging from 952 to 1137 lbs/A. LibertyLink and Roundup Ready Flex cotton lint yields were not statistically significant for herbicide systems of similar intensity. Single applications of Roundup WeatherMAX or Ignite on 1 -2 leaf cotton and EPOST resulted in no yield and, subsequently, a net loss. All three or four application treatment regimes resulted in a net return of $257 per acre or greater. The greatest net return was seen in LibertyLink cotton with Liberty plus Dual EPOST followed by Valor plus MSMA LAYBY with a net return of $391 per acre. The greatest net return with Roundup Ready Flex cotton was the treatment of Roundup WeatherMAX plus Dual EPOST followed by Roundup WeatherMAX plus Valor LAYBY with a return of $361 per acre. Net returns for these treatments were numerically greater than the traditional herbicide system of Prowl plus Cotoran PRE followed by Staple EPOST followed by Cotoran plus MSMA post-directed followed by Caporal plus MSMA LAYBY.

WEED CONTROL IN SUNFLOWERS GROWN FOR DOVE. T.W. Dillon, R.C. Scott; J.P. Reed; and B.D. Black; University of Arkansas, Division of Agriculture, Cooperative Extension Service, Lonoke, AR; FMC Corporation, North Little Rock, AR; and Syngenta Crop Protection, Searcy, AR.

ABSTRACT

Several products are currently labeled and effective for grass weed control in sunflower (*Helianthus annuus*). These herbicides primarily control grass weeds such as barnyardgrass (*Echinochloa crus-galli*), broadleaf signalgrass (*Brachiaria platyphylla*), johnsongrass (*Sorghum halepense*), and crabgrass (*Digitaria sanguinalis*). This leaves a whole complex of broadleaf weeds free to compete with and in many cases choke out sunflowers. Broadleaf weeds such as pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), Palmer amaranth (*Amaranthus palmeri*), and cocklebur (*Xanthium strumarium*) can be very troublesome to the sportsman who is trying to establish a good area for dove hunting. While a few weeds may benefit dove in terms of habitat, weeds can cause reduced sunflower seed production and hinder hunting efforts by making it difficult to find harvested birds. Weeds may also reduce the value of a lease, which is becoming an important source of income to many landowners and farmers.

For some time now many sunflower growers have used broadleaf herbicides that are labeled in cotton and other crops, but not specifically labeled in sunflowers. This is a violation of federal and state law. Although penalties have been few and far between for these offenses, it is still unethical for any Extension recommendations to be made using these products. Fortunately, Spartan herbicide from FMC Corporation is now labeled for use in sunflower.

The objectives of these studies were: 1) to evaluate sulfentrazone and sulfentrazone tank mixtures for broadleaf weed control in sunflowers, 2) to develop weed control programs and recommendations for dove hunters, 3) to add these recommendations to our state weed control guide (MP44), and 4) to reach a new demographic for our extension programs in the Arkansas population.

Spartan alone controlled yellow nutsedge and Palmer amaranth 86% or more regardless of rate. Pitted morningglory control improved with increasing rate from 0% control at 0.0625 lb ai/A to 56% control at 0.1875 lb ai/A. An activating rainfall was received at this location in 2003. The combination of 1.0 lb ai/A of Prowl plus Spartan at 0.125 lb ai/A controlled pitted morningglory, yellow nutsedge, and Palmer amaranth 86, 90, and 90%, respectively. In addition, Spartan alone or with Prowl resulted in less than 45% control of broadleaf signalgrass, or johnsongrass. Following any Spartan treatment with 0.094 lb ai/A of Select resulted in 85% control of broadleaf signalgrass and 78% control of johnsongrass.

In our research, a program approach of Spartan at 0.125 lb ai/A tank-mixed with 1.0 lb ai/A Prowl or 1.0 lb ai/A Dual Magnum or Spartan followed by 6-8 oz/A Select applied POST to grasses was an excellent overall weed control program for sunflowers. Minimal crop injury was observed for any Spartan treatment at any location.

GRAMOXONE TANK-MIXTURES FOR GLYPHOSATE-RESISTANT HORSEWEED (*CONYZA CANADENSIS L. CRONQ.*) CONTROL. B.D. Black, J.C. Holloway, Jr., E.W. Palmer, C.L. Foresman, and C.A. Sandoski; Syngenta Crop Protection, Greensboro, NC 27419.

ABSTRACT

Horseweed (*Conyza canadensis L. Cronq.*) expressing resistance to the herbicide glyphosate was first observed in the United States in Delaware in 2000. Since then, glyphosate resistant horseweed has been confirmed in 10 states including Tennessee and Arkansas. Field trials were conducted in 2004 evaluating selected burndown herbicide treatments followed by at-planting herbicide treatments targeting glyphosate resistant horseweed in cotton. Trials were conducted by the University of Tennessee near Jackson, TN and by the University of Arkansas near Blytheville, AR evaluating similar treatments. At 10 – 11 days after early pre-plant (EPP) applications, control of resistant horseweed was 23 and 48% from glyphosate (Touchdown Total®[1]) at 840 g ae/ha in these trials, respectively. Paraquat (Gramoxone Max®) at 1120 g ai/ha + dicamba at 280 g ai/ha + non-ionic surfactant at 0.25% V/V provided 90 and 91% control of glyphosate resistant horseweed in these trials. Prior to planting (29 and 31 days after application), control of resistant horseweed was 48 and 63% from the glyphosate treatments, whereas, control from the paraquat + dicamba + non-ionic surfactant treatments was 98 and 97% from these trials.

[1] Gramoxone Max® and Touchdown Total® are registered trademarks of Syngenta Crop Protection.

SIMULATED DRIFT RATES OF GLYPHOSATE IN CONVENTIONAL COTTON. S.P. Nichols, C.E. Snipes, and H.R. Robinson, Delta Research and Extension Center, Mississippi State University, Stoneville, MS 38776.

ABSTRACT

Currently, greater than 95% of the cotton grown in Mississippi is glyphosate-resistant. In addition, acreage of glyphosate-resistant soybeans and corn is increasing in the state. Non glyphosate-resistant cotton planted in the vicinity of glyphosate-resistant crops is at risk of glyphosate drift or misapplication. The introduction of Roundup Ready Flex Cotton will likely increase the potential for drift or misapplication of glyphosate to non-target sites. The potential of decreased boll retention, delayed maturity, and yield loss due to glyphosate applied is amply documented in the literature. Heightened precautions are needed to reduce misapplication of glyphosate to conventional cotton through spray drift or spray tank contamination. In the unfortunate event of a misapplication of glyphosate to conventional cotton, producers are often faced with the decision of whether to keep the injured crop or to replant. Research to better predict yield loss from varying rates of glyphosate misapplications would be beneficial in making replant decisions. Field trials were conducted from 2002 through 2004 at the Delta Research and Extension Center near Stoneville, MS to determine conventional cotton response to glyphosate applied at two growth stages, to determine the relationship of glyphosate injury to yield loss in conventional cotton, and to evaluate other indicators of glyphosate injury in conventional cotton.

Simulated drift rates of glyphosate applied to conventional cotton at the 2-leaf growth stage had no effect on lint yield two out of three years even at the highest treatment rates, although a downward trend was observed both years. In 2004, simulated drift rates of 0.12, 0.24, and 0.48 lb ai/acre glyphosate reduced lint yield by 22, 31, and 79%, respectively, compared to the untreated check. When applied at the 6-leaf growth stage, simulated drift rates of 0.24 and 0.48 lb ai/acre glyphosate reduced lint yield all three years of the study. Yield losses ranged from 12 to 28% for simulated drift rates at 0.24 lb ai/acre and 31 to 70% for 0.48 lb ai/acre. Additionally, a 2.0 lb ai/acre rate of MSMA did not reduce lint yield in two out of three years. In 2004, lint yield was reduced 14% by this treatment.

Based on yield reduction, conventional cotton was more sensitive when applications occurred at the 6-leaf timing compared to the 2-leaf timing. Visual injury tended to overestimate yield loss, as injury symptoms observed at the lower application rates did not result in a reduction of lint yield. Crop and environmental conditions at around the time of application appeared to influence the level of injury and yield reduction. No adverse differences were observed in fiber quality due to treatments.

SENSITIVITY OF ROUNDUP READY SOYBEAN IN REPORDUCTIVE DEVELOPMENT TO GLYPHOSATE. D.K. Miller[1], J.A. Kendig[2], K. Bradley[3], E.L. Clawson[1], and M.S. Mathews[1], LSU AgCenter, St. Joseph, LA[1], University of Missouri, Portageville[2] and Columbia[3].

ABSTRACT

Research was conducted in 2004 at the Northeast Research Station in St. Joseph, La, the University of Missouri Delta Center in Portageville, Mo, and the University of Missouri in Columbia, Mo to evaluate sensitivity of Roundup Ready soybean to late-season application of glyphosate during reproductive development. At St. Joseph, separate experiments evaluated glyphosate (Roundup Weathermax) applied as a single application at the R4 reproductive stage and a sequential application at the R4 followed by R6 reproductive stages, respectively. Glyphosate rates evaluated in both the single and sequential application experiments were 0, 0.5, 1, 1.5, 2, and 3 lb ai/A. At both Portageville (Glyfos Xtra) and Columbia (Glyphomax Plus), treatments evaluated included a factorial arrangement of glyphosate rates (0.75, 1.5, or 3 lb ai/A) and application timings (prebloom, bloom, pod formation, and pod fill). At all locations, experiments were conducted in relatively weed-free areas that were maintained weed free during the growing season with two applications of glyphosate (0.75 lb ai/A) approximately three and five wk after planting. Experimental design was a randomized complete block with four replications at all locations. Soybean varieties evaluated included Terral 52R42 at St. Joseph, DK 4898 RR and DG 3583N RR at Portageville, and DK 38-52 RR at Columbia. Only soybean yield is reported, however, additional yield components are in the process of being measured. Data were subjected to ANOVA and means separated using LSD at the 0.05 level of significance.

At St. Joseph, analysis of soybean yield data indicated no negative effect from glyphosate application at rates ranging from 0.5 to 3.0 lb ai/A applied as single (R4) or sequential (R4 followed by R6) applications when compared to plots receiving no glyphosate during reproductive development. No visual injury was observed in either experiment and soybean yield in the single and sequential experiment ranged from 42.9 to 45.5 and 40.6 to 47.7 bu/A, respectively. At both Portageville and Columbia, an interaction between glyphosate rates and application timings was not observed and no difference in soybean yield was noted among glyphosate rates or application timings for the varieties evaluated. Yield of DK 4898 RR, DG 3583N RR, and DK 38-52 RR soybean ranged from 51 to 63, 55 to 62, and 55 to 61 bu/A, respectively, for all treatments evaluated.

Based on results, late-season application of glyphosate during reproductive development does not result in negative effects on yield of soybean varieties evaluated.

EVALUATION OF SEQUENCE IN ROUNDUP READY SOYBEAN. D.K. Miller and M.S. Mathews, LSU AgCenter, St. Joseph, LA.

ABSTRACT

Research was conducted in 2004 at the Northeast Research Station in St. Joseph, La to evaluate weed control with Sequence applied alone or in co-application with insecticides in Roundup Ready soybean. Treatments evaluated included Sequence (glyphosate + metolachlor) at 40, 48, or 64 oz/A alone or at 40 oz/A in combination with insecticides Karate Z (lambda-cyhalothirn) at 1.5 oz/A, Centric (thiamethoxam) at 2 oz/A, Sevin (carbaryl) at 16 oz/A, Larvin (thiocarb) at 16 oz/A, or Lorsban (chlorpyrifos) at 16 oz/A. Additional treatments included Dual magnum (s-metolachlor) at 16 oz/A, Touchdown Total (glyphosate) at 16 oz/A, and a sequential application of Touchdown Total at 12 oz/A. A nontreated control was included for comparison. The study design was a randomized complete block with four replications. Treatments were applied with a tractor mounted compressed air sprayer delivering 15 GPA to each 13.33' x 30' four row plot. Weeds evaluated included barnayardgrass (*Echinochloa crus-galli*), entireleaf morningglory (*Ipomoea hederacea*), hemp sesbania (*Sesbania exaltata*), johnsongrass (*Sorghum halepense*), pitted morningglory (*Ipomoea lacunosa*), redroot pigweed (*Amaranthus retroflexus*), and sicklepod (*Cassia obtusifolia*). Weed control was visually estimated at 10 and 26 d after treatment. Initial application was to 2 to 3 trifoliate DP 5644 RR soybean and subsequent application was to 4 to 5 trifoliate soybean. Data were subjected to ANOVA and means separated using LSD at the 0.05 level of significance.

At 10 d after treatment, control of all weeds evaluated was similar among Sequence rates (84 to 95%). With few exceptions, weed control with insecticide co-application was not reduced compared to the equivalent Sequence rate applied alone. At 26 d after treatment, results were similar with weed control equivalent among all rates of Sequence. Control of the respective weed evaluated range from 84 to 89, 79 to 84, 65 to 78, 95, 79 to 84, 94 to 95, and 85 to 89%. With the exception of hemp sesbania control with Karate Z (68 vs. 51%) and Sevin (68 vs. 48%) co-applications, tank mixture with insecticides did not reduce weed control with Sequence at 40 oz/A. Soybean yield was generally reflective of season-long weed control as yield was equal among Sequence rates (24.9 to 29 bu/A) and not negatively affected from co-application with insecticides (21.1 to 25.9 bu/A). Yield with single Sequence applications (21.1 to 29 bu/A) was equal to that of a sequential program of Touchdown Total at 12 oz/A (24.6 bu/A).

In Roundup Ready soybean, early season applications of Sequence can provide equivalent weed control and soybean yield to that observed with sequential applications of Touchdown Total. Co-application of insecticides Karate Z and Sevin with Sequence at the rate of 40 oz/A may result in reduced control of hemp sesbania, however, in the current research soybean yield was not affected by tank mixture with insecticides evaluated.

The Effectiveness of Penoxsulam in Water-Seeded Rice and Clearfield Rice Systems. R.B. Lassiter, V.B. Langston, R.K. Mann, J.S. Richburg and L.C. Walton; Dow AgroSciences LLC, Indianapolis, IN.

ABSTRACT

Penoxsulam is a novel, broad-spectrum triazolopyrimidine sulfonamide herbicide being developed globally for rice weed control by Dow AgroSciences LLC, and recently received U.S. EPA Federal registration. Penoxsulam will be sold in the southern U.S. under the commercial trade name of Grasp*SC herbicide. Studies were conducted during 2003 and 2004 in AR, LA, MS, and TX to evaluate the utility of Grasp SC in water-seeded rice weed management systems and in Clearfield rice systems as a tank mix partner and spectrum enhancer for Newpath (imazethypyr).

Results of these studies demonstrated excellent utility of Grasp SC in water-seeded rice for control of barnyardgrass (*Echinochloa crus-galli*), ducksalad (*Heteranthera limosa*), rice flatsedge (*Cyperus iria*), northern jointvetch (A*eschynomene virginica*), dayflower (*Commelina diffusa*), and eclipta (*Eclipta prostrata*). Tank mixes or sequential programs with Clincher* herbicide (cyhalofop-butyl) or Command (clomazone) were needed to provide acceptable control of Amazon sprangletop (*Leptochloa panicoides*). Grasp SC applied at 0.031 lb ai/acre from 1 LF up to 4-5 LF rice was safe to the crop, and provided excellent control of the broadleaf weeds and sedges present. At the late application timing (4-5 LF rice), Grasp SC appeared to be slightly less effective on the larger, tillering barnyardgrass than observed at the earlier timings for control of pre-tillered barnyardgrass.

In Clearfield rice systems, Grasp SC demonstrated an excellent fit as a tank mix partner with Newpath to increase Newpath's broadleaf weed control spectrum. The tank mix of Grasp SC plus Newpath provided good to excellent control of hemp sesbania (*Sesbania exaltata*), northern jointvetch, eclipta, dayflower, morningglory species (*Ipomoea spp*.), rice flatsedge, and barnyardgrass. These studies suggest that Grasp SC has a better fit in the mid-post application timing of Newpath compared to the early-post application timing, particularly in areas with heavy densities of hemp sesbania.

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BURNDOWN CONTROL OF ITALIAN RYEGRASS WITH DIFFERENT GLYPHOSATE PRODUCTS APPLIED WITH AND WITHOUT AMMONIUM SULFATE. J.R. Martin and C.H. Slack; Department of Plant and Soil Sciences, University of Kentucky, Princeton 42445.

ABSTRACT

Two studies were conducted to evaluate AMS as an additive for enhancing burndown control of ryegrass with different formulations of glyphosate applied in mid March or mid April.

Liquid AMS was included in the appropriate treatments in both studies at a rate of 3.7% v/v. Burndown control was evaluated periodically during the first 4 weeks after treatment.

The first study compared seven products based on the following formulations: isopropyl amine salt with 3 lb ae/gal (Clearout 41 Plus, Glyphomax Plus, Honcho); diammonium salt with 3 lb ae/gal (Touchdown IQ); isopropylamine salt with 3.73 lb ae/gal (Roundup UltraMax); potassium salt with 4.17 lb ae/gal (Touchdown Total); and potassium salt with 4.5 lb ae/gal (Roundup WeatherMAX). Glyphosate was applied in all treatments in study 1 at 0.75 lb ae/A in combination of S-metolachlor at 1.3 lb ai /A plus atrazine at 1.6 lb ai/A. The height of ryegrass averaged 3 inches on March 13 for EPP-1 (early preplant -1) and 6 inches on April 14 for EPP-2.

Ryegrass response was substantially slower when treatments were applied at EPP-1 than at EPP-2. Average control ratings across all glyphosate treatments at EPP-1 were 3, 47, and 77% compared with 47, 80, and 86% for EPP-2 treatments at 9, 16, and 24 DAT (days after treatment), respectively. The fact the average temperature for the first 24 days after application was 53^0 F for EPP-1 treatments, compared with 64^0 F for EPP-2 treatments, may have contributed to the difference in speed of response. The addition of AMS did not enhance the speed of control with the EPP-1 treatments. However, the addition of AMS to Clearout 41 Plus tank mixture applied at EPP-2 increased ryegrass control from 43 to 53% at 9 DAT, but did not enhance control of other products. AMS did not enhance ryegrass control of any glyphosate treatment when evaluated at 16 and 24 DAT.

Applying Touchdown Total plus S-metolachlor plus atrazine at EPP-1 provided 90 and 92% ryegrass control at 24 DAT, with and without AMS, respectively. The use of Roundup UltraMax at EPP-1 resulted in 77 and 83% control with and without AMS, respectively. The other glyphosate treatments at EPP-1 provided an average of 74% control at 24 DAT, regardless whether or not AMS was included.

The second study compared Roundup WeatherMAX and Clearout 41 Plus at .75 or 1.125 lb ae/A applied either alone or with AMS. The average height of ryegrass was 6 inches on March 15 for EPP-1 treatments and 11 inches on April 5 for EPP-2 treatments.

The cooler temperatures associated with EPP-1 treatments caused ryegrass to respond slower relative EPP-2 treatments. Roundup WeatherMAX and Clearout 41 Plus provided similar ryegrass control, however there were as few instances where differences between products occurred. When 0.75 lb ae/A was applied alone at EPP-1 timing, Roundup WeahterMAX provided 63% control at 30 DAT compared with 50% for Clearout 41 Plus. Including AMS as an additive with glyphosate at 0.75 lb ae/A, resulted in 77% control for Roundup WeahterMAX but only 53% for Clearout 41 Plus.

Increasing the glyphosate rate from 0.75 to 1.125 lb ae/A improved ryegrass control in 3 of 4 instances for EPP-1 treatments and 1 of 4 instances for EPP-2 treatments

In summary, application timing tended to have the most impact on burndown control of ryegrass, with April applications usually providing faster and slightly better control than March applications. The different glyphosate formulations generally provided similar level of ryegrass control, yet there were a few differences in control due to formulation. AMS generally did not enhance ryegrass control, except in a few instances. Increasing the glyphosate rate from 0.75 to 1.125 lb ae/A tended to improve control, particularly when treatments were applied during early spring.

EFFECT OF SOIL pH ON BIOAVAILABILITY OF IMAZAPIC. W. K. Vencill, E. Prostko, Univeristy of Georgia, Athens and Tifton and S. Senseman, Texas A & M University, College Station.

ABSTRACT

The adsorption, desorption, and bioavailability of imazaquin was examined on two common peanut soils from Georgia. Imazapic was weakly adsorbed to both soils at all soil pH levels. In a Tift loamy sand, imazapic adsorption isotherms indicated K_d values of 0.17, 0.11, and 0.30 on soil with a pH of 4, 6, and 8, respectively. In a Greenville sandy clay loam, imazapic adsorption isotherms were 0.45, 0.65, and 0.17 on soil with a pH of 4, 6, and 8, respectively. In the Tift loamy sand, the amount of imazapic available in soil solution increased with soil pH whereas it did not in the Greenville sandy clay loam. Desorption isotherms were non-linear. Laboratory studies were conducted to measure the level of bioavailable imazapic in the Tift ls and Greenville scl at three soil pH ranges over a 35 d period by centrifuging (12,000 x g) biologically available water out of the soil and measuring imazapic levels using ^{14}C-imazapic. Soil were measured for 21 d then spiked with potassium hydroxide to raise the soil pH to determine what effect this would have on bioavailable imazapic. Kd values from these studies were similar to the batch equilibrium studies. Raising the soil pH 21 d after incubation increased the level of bioavailable imazapic in all soils examined.

IMPACT OF SEQUENTIAL APPLICATIONS OF CYHALOFOP-BUTYL AND WATER FLOOD DEPTH ON POSTFLOOD GRASS CONTROL IN SOUTHERN U.S. RICE. R.K. Mann, R.B. Lassiter, V.B. Langston, J.S. Richburg and L.C. Walton, Dow AgroSciences, Indianapolis, IN.

ABSTRACT

Clicher*SF (cyhalofop-butyl) is applied after the permanent flood in direct-seeded rice in the southern US to control grass weeds that escape pre-flood control efforts. It is necessary for flood water depth to be low enough to provide sufficient grass weed foliage to allow Clincher*SF to be effective. Research was conducted to determine the effect of sequential applications of Clincher*SF for grass weed control versus single applications, as well as the impact of flood water depth and the percentage of exposed weed foliage on Clincher*SF grass weed control efficacy.

Field research results demonstrated that sequential applications of Clincher*SF at 15 oz product/ac (0.28 lb ai/ac) followed 10 days later by Clincher*SF at 10 oz product/ac (0.19 lb ai/A)) provided improved

WEED MANAGEMENT WITH IGNITE IN LIBERTY LINK® COTTON. Griff Griffith, Jim Barrentine, Marilyn McClelland, Ken Smith, and Monica Kelley, Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

Ignite (glufosinate) is a broad-spectrum herbicide developed for use in conventional and transgenic cotton (Liberty Link). Liberty Link cotton cultivars have excellent season-long tolerance to postemergence (POST) and post-directed Ignite applications. This technology offers farmers a larger window for topical applications and allows applications to be made based on weed size rather than crop growth stage.
In Arkansas, pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), Palmer amaranth (*Amaranthus palmeri*), and annual grasses are troublesome weeds in cotton production. Field studies were initiated to evaluate management of these weeds with Ignite programs in Liberty Link cotton.

Two locations were selected in Marianna, AR, and one in Rohwer, AR, to establish field studies evaluating weed management with Ignite. The experimental design for all studies was a randomized complete block with four replications. Marianna experiments were planted on May 11, 2004, and June 14, 2004, on a silt loam soil. 958LL cotton was planted on four rows in a 12.67 by 40-foot plot. The Rohwer experiment was planted on May 20, 2004. 966LL cotton was planted on four rows in a 12.67 by 25-foot plot. Marianna applications were made with a tractor-mounted boom with 19-in. nozzle spacing at 20 GPA. Rohwer applications were also made with a tractor-mounted boom with 19-in. nozzle spacing, and an output of 12 GPA was used. Visual ratings for weed control and cotton injury were taken at all locations. Cottonseed yield was also taken at all locations. Data were analyzed by ANOVA, and means were separated with a protected LSD at P=0.05.

At Marianna I, POST Ignite alone was not effective in controlling Palmer amaranth, annual grasses, or pitted moringglory; however, prickly sida was controlled equally by all treatments. POST Ignite + Staple provided good control of pitted morningglory and prickly sida at Marianna I. There was better control of Palmer amaranth with Ignite + Staple at Rohwer than at Marianna I. Annual grass control with Ignite + Staple POST was poor at both Marianna I and Rohwer. Staple + Karmex was generally a better PRE than Staple + Cotoran. Marianna II had good control of all species 14 DAT. A later planting date of June 14 gave optimum conditions for POST herbicide activity. Although weed control was exceptional because of the planting date, this caused a later harvest date and a significantly lower yield for Marianna II.

IMPACT OF SEQUENTIAL APPLICATIONS OF CYHALOFOP-BUTYL AND WATER FLOOD DEPTH ON POSTFLOOD GRASS CONTROL IN SOUTHERN U.S. RICE. R.K. Mann, R.B. Lassiter, V.B. Langston, J.S. Richburg and L.C. Walton, Dow AgroSciences, Indianapolis, IN.

ABSTRACT

Clincher*SF (cyhalofop-butyl) is applied after the permanent flood in direct-seeded rice in the southern US to control grass weeds that escape pre-flood control efforts. It is necessary for flood water depth to be low enough to provide sufficient grass weed foliage to allow Clincher*SF to be effective. Research was conducted to determine the effect of sequential applications of Clincher*SF for grass weed control versus single applications, as well as the impact of flood water depth and the percentage of exposed weed foliage on Clincher*SF grass weed control efficacy.

Field research results demonstrated that sequential applications of Clincher*SF at 15 oz product/ac (0.28 lb ai/ac) followed 10 days later by Clincher*SF at 10 oz product/ac (0.19 lb ai/A) provided improved control (95%) of barnyard grass *(Echinochola crus-galli*) compared to single applications of Cincher*SF at 13.5 (0.25 lb ai/ac) (84 and 85% control, respectively) across 5 locations. At three locations, there was no difference in control of sprangletop (*Leptochloa spp*) with single verses sequential applications of Clincher*SF (98% control).

When water flood depth was controlled to provide 25%, 50% and 75% exposed grass weed foliage at a postflood application timing of Clincher*SF, improved barnyardgrass control was achieved with Clincher*SF at 15 oz/ac as the percent of exposed foliage was increased (66% control with 25% exposed, 79% with 50% exposed, and 85% control with 75% exposed foliage). Sequential foliar postflood applications of Clincher*SF at 15 oz/ac, with the sequential application providing 87% control with 25% exposed, 94% control with 50% exposed, and 94% with 75% exposed.

THE EFFECTIVENESS OF CARFENTRAZONE AS A POST-DIRECTED TREATMENT IN COTTON.
F.E. Groves, K.L. Smith, J.R. Meier, and M.B. Kelley; Southeast Research and Extension Center, University of Arkansas, Monticello, AR 71656.

ABSTRACT

Tankmixtures including glyphosate have replaced the standard cotton layby treatment of diuron and MSMA. The increased efficacy of glyphosate on amaranthus species helped drive the rapid adoption of glyphosate as a layby product. The prevalence of glyphosate resistant horseweed enhanced awareness of herbicide resistance management and elevated the need for alternative chemistries in weed control programs. In 2004 a study was conducted near Rohwer, AR to investigate the efficacy of carfentrazone-ethyl (AIM EC™) as a late-postemergence directed treatment in cotton. Treatments included various tankmixtures of carfentrazone, MSMA, diuron, glyphosate, fluometuron, trifloxysulfuron, prometryn + trifoxysulfuron, glufosinate, pyrafluen-ethyl, and flumioxazin for cotton layby. Visual ratings on a scale of 0-100 were taken on Palmer amaranth (*Amaranthus palmeri S. Wats.*), pitted morningglory (*Ipomoea lacunosa L.*), prickly sida (*Sida spinosa L.*), and barnyardgrass [*Echinochloa crus-galli (L.) Beauv.*] at 17 and 41 days after application (DAA). Cotton was harvested and seed cotton weight was recorded. At 14 DAA and harvest no differences were observed among treatments except the untreated control. At 41 DAA tankmixtures including carfentrazone-ethyl provided equal or superior control when compared to other treatments across all weed species observed.

BENEFITS OF WINTER WEED MANAGEMENT WITH VALOR® SX HERBICIDE. J. Etheridge, J. Pawlak, B. Corbin and C. Henderson, Valent USA Corporation, Mid-South Agricultural Research Center, Greenville, MS.

ABSTRACT

Valor SX (flumioxazin) herbicide by Valent U. S. A. Corporation is currently approved for use in soybean (*Glycine max*) and peanut (*Arachis hypogaea*) pre-emergence and for use in cotton (*Gossypium hirsutum*) as a post-directed herbicide. It is also approved as a pre-plant burn-down herbicide in a number of crops. Valor SX can be used in combination with labelled burn-down herbicides to control emerged weeds and to provide residual weed control prior to crop emergence. Crops grown where Valor SX herbicide was applied in the fall were observed to be greener and more robust than crops grown in other areas. A trial was designed to determine what agronomic effects a fall application of Valor SX has on crops planted the following spring.

Three chemical treatments were applied at Valent's Agricultural Research Center in Greenville, MS: (1) Valor SX plus Roundup (.063 +0.50 lb ai/A) applied in the fall, (2) Roundup (1.0 lb ai/A) applied in the fall and (3) Roundup (1.0 lb ai/A) applied in the spring. Roundup 1.0 lb ai/A was applied to the entire trial on April 2, 2004 to kill all vegetation prior to planting. The trial was set up as a split block with crops (cotton, corn, soybean, rice, grain sorghum and wheat) being the main factors and chemical treatments being the sub-plot factors. The main blocks were 45x30 feet and each sub-plot was 15x30 feet. Crops were planted on April 19, 2004 with commercial no-till planters.

Soil samples and soil temperature were collected April 19, 2004, at the day of planting. The Valor treated plots had more soil exposed to the sun. As a result, the soil in the Valor treated plots was 12 degrees F warmer, at a two-inch depth, than plots that did not receive a fall herbicide treatment. Soil samples were analyzed for nitrogen content by an independent laboratory. The value of nitrogen in the soil was calculated using the price of ammonium sulphate ($0.17/lb) as the basis. The Valor treated plots had a net gain of 33.96 lbs/A of nitrogen, for a value of $15.44/A, compared to untreated plots (there were much fewer weeds in the Valor plots to consume the nitrogen produced by decaying plant matter). Plots were kept weed free after planting. Plant height and dry weight were measured on May 11, 2004, at 22 days after planting. The heights and dry weights of all crops, except rice, were significantly greater in the plots where Valor treatments were applied in the fall than in plots that did not receive any herbicide treatment until the spring. The height and weight measurements for rice were numerically greater in the Valor treatments, but were not significantly greater.

Winter weed management with Valor SX herbicide gave the following positive benefits:

1. Soil temperature was increased by 12 degrees F at planting, which caused faster emergence.
2. The soil had better tilth, which gave better soil to seed contact, resulting in a better stand.
3. Increased early season crop vigor; crops were taller and had higher dry weights.
4. Increased soil nitrogen for a net gain of 34 lbs of nitrogen per acre, with a value of $15.44 per acre.
5. The combination of warmer soil temperature and no weed canopy caused the soil to dry faster, which allowed crops to be planted earlier.

ROUNDUP READY COTTON WEED CONTROL AND YIELD RESPONSE TO HERBICIDE COMBINATIONS AND TIME OF APPLICATIONS. R.R. Dobbs, N.W. Buehring, and M.P. Harrison. Northeast Branch Experiment Station, North Mississippi Research and Extension Center, Mississippi State University; Verona, MS 38879.

ABSTRACT

A study was conducted in 2004 to evaluate herbicide weed management systems for sicklepod (*Senna obtusifolia*) and barnyardgrass *(Echinochloa crusgalli)* control. The 2004 growing season was excellent (no drought stress) for herbicide activity. Sicklepod control for all treatments, 42 days after planting (DAP), ranged from 0 to 91%. Except for Roundup WeatherMAX (RWM) at 16.4 oz/A applied preemergence (PRE) followed by (Fb) RWM + Staple (pyrithiobac) at 22 oz/A + 1.5 oz/A applied postemergence over top (POT) at 3 to 4 leaf cotton Fb RWM at 22 oz/A applied post-directed layby (PDL); the untreated check; and Sequence (glyphosate + metolachlor) at 40 oz/A applied PRE with no POT 2 to 3 leaf or 3 to 4 leaf cotton herbicide applications Fb Touchdown Total [glyphosate (TDT)] at 24 oz/A at PDL, all treatments provided 78 to 89% sicklepod control and were not different. RWM at 16.4 oz/A applied PRE at planting Fb RWM + Staple at 22 oz/A + 1.5 oz/A applied POT at 3 to 4 leaf cotton Fb RWM applied PDL had the highest sicklepod control of 91%.

All herbicide weed management systems provided 70 to 94% barnyardgrass control 18 days after 4 leaf cotton POT applications (42 DAP). Except for the untreated check; Sequence at 40 oz/A applied PRE Fb TDT at 24 oz/A applied PDL; and RWM at 16.4 oz/A applied PRE Fb RWM at 16.4 oz/A applied POT at 2 leaf cotton Fb TDT at 24 oz/A applied PDL, all weed management systems provided 83 to 94% barnyardgrass control with no differences. Sequence at 40 oz/A applied PRE Fb TDT at 24 oz/A applied PDL; and RWM at 16.4 oz/A applied PRE Fb a repeat POT application at 2 leaf cotton Fb RWM at 22 oz/a applied PDL provided 70 and 79% barnyardgrass control, respectively. Highly erratic crop injury (11 to 14%, 42 DAP) from Envoke (trifloxysulfuron) at 0.15 oz/A and Sequence at 40 oz/A was observed 42 DAP. Except for Sequence at 40 oz/A applied POT at 2 leaf cotton Fb Envoke at 0.15 oz/A applied POT at 5 to 7 leaf cotton Fb TDT + Suprend (prometryn + trifloxysulfuron) at PDL which showed reduced yield, all herbicide weed management systems with Envoke and/or Sequence had no effect on yield.

All herbicide weed management systems produced higher yield than the check with lint yields from 847 to 1094 lb/A. Yields of 847 lb/A for Sequence at 40 oz/A applied PRE Fb TDT applied PDL, and 963 lb/A for Sequence at 40 oz/A applied POT to 2 leaf cotton Fb Envoke at 0.15 oz/A applied POT to 5 to 7 leaf cotton Fb TDT + Suprend applied PDL were lower than Sequence at 40 oz/A applied POT at 2 to 3 leaf cotton Fb TDT at 24 oz/A applied PDL; RWM at 16.4 oz/A applied PRE Fb Sequence at 40 oz/A applied POT to 2 to 3 leaf cotton Fb TDT at 24 oz/A applied PDL; RWM at 16.4 oz/A applied PRE Fb RWM at 22 oz/A applied POT to 2 to 3 leaf cotton Fb RWM + Suprend at 22 oz/A + 1.25 lb/A applied PDL; and RWM at 16.4 oz/A applied PRE Fb RWM + Staple at 22 oz/A + 1.5 oz/A applied POT to 3 to 4 leaf cotton Fb RWM at 22 oz/A applied PDL which had yields ranging from 1079 to 1094 lb/A and were not different.

Herbicide costs for each weed management system were based on retail prices of 45, 37, 46, and $33 per gallon of product for RWM, TDT, Sequence and Cotoran, respectively. The cost per ounce of product for Envoke, Staple, and Suprend was 70, 16, and $0.60, respectively. The cost per weed management system ranged from 14 to $45/A with most systems providing effective weed control and no significant lint yield reductions. Under good growing conditions in 2004, the addition of Envoke, Sequence, Staple, Cotoran or Suprend in a herbicide weed management system did not improve weed control or yield but increased cost by 7 to $25/A. The 2 leaf cotton POT application of either RWM at 22 oz/A or TDT at 24 oz/A (no RWM or TDT PRE application at planting) Fb a repeat PDL application had the lowest herbicide costs of $14 and $15/A, respectively. These treatments showed no differences in weed control or yield and yields were equal to the higher cost treatments. However, Sequence at 40 oz/A applied POT at 2 leaf cotton Fb TDT at 24 oz/A applied PDL or RWM at 16.4 oz/A applied PRE Fb Sequence at 2 to 3 leaf cotton Fb TDT increased cost by 6 and $12/A, respectively, but showed 77 to 105 lb/A higher lint yield trends than RWM at 22 oz/A or TDT applied POT at 2 leaf cotton Fb a repeat PDL application.

DICLOFOP-RESISTANT RYEGRASS CONTROL. M.T. Bararpour, J.A. Bond, C.E. Brewer, and L.R. Oliver; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, 72704.

ABSTRACT

The genus *Lolium* (ryegrass) is native to the Mediterranean region but is now widely distributed throughout temperate areas of the world. Resistance in ryegrass is one of the most economically important examples of herbicide resistance in world agriculture, and diclofop-resistant ryegrass is the number one weed problem in Arkansas wheat. Field studies were conducted in 2001-02, 2002-03, and 2003-04 at the Agricultural Experiment Station, Fayetteville, to evaluate the efficacy of herbicides available to Arkansas producers. The plot areas contained a uniform natural infestation (± 300 plants/m^2) of diclofop-resistant Italian ryegrass (*Lolium multiflorum*). The experimental design was a randomized complete block with four replications. Twenty-eight, 46, and 30 combinations of herbicides, application timings, herbicide rates, and herbicide tank-mixtures were evaluated for wheat injury, Italian ryegrass control, and wheat yield in 2001-02, 2002-03, and 2003-04, respectively. Six treatment applications, which provided better control of Italian ryegrass and produced better wheat yield were selected and reanalyzed. These treatments were as follows: 1) Osprey (mesosulfuron) at 0.043 lb ai/A + MSO (methylated soybean oil) at 0.75 qt/A + UAN 28% at 2 pt/A (2- to 3-leaf wheat), 2) Osprey at 0.043 lb/A + MSO + UAN 28% (4-leaf to 2-tiller ryegrass), 3) Axiom (flufenacet/metsulfuron) at 0.425 lb ai/A (1- to 2- leaf wheat), 4) Sencor (metribuzin) at 0.25 lb ai/A (2- to 3-leaf wheat) fb Sencor at 0.25 lb/A (2- to 3-tiller wheat), 5) Finesse (chlorsulfuron/metsulfuron) at 0.023 lb ai/A PRE, and 6) Finesse at 0.023 lb/A PRE fb Osprey at 0.043 lb/A + MSO (4-leaf to 2-tiller ryegrass). The environmental conditions were warm and wet in 2001-02 and 2003-04 and were cold and dry in 2002-03 (51 F and 2.3 in rainfall versus 42 F and 0.04 in rainfall, 18 d after application, respectively).

The herbicide application of Finesse PRE fb Osprey at 4-leaf to 2-tiller ryegrass provided 88% control of Arkansas diclofop-resistant Italian ryegrass for the three years tested. Treatments 2, 3, and 4 provided equivalent ryegrass control (average 85%) compared to treatment 6. However, treatment 3 was the only treatment that provided equivalent wheat yield compared to treatment 6. The plots that received treatments 6 and 3 produced 51 and 48 bu/A wheat yield, respectively. Italian ryegrass interference reduced wheat yield to 12 bu/A. Italian ryegrass control from the application of Osprey at 2- to 3-leaf wheat in 2003 reduced from 93% [average of two years (2002 and 2004)] to10% and wheat yield from 58 bu/A [average of two years (2002 and 2004) to 3 bu/A. This may have been due to environmental conditions, which were cold and dry compared to 2002 or 2004, which were warm and wet at and following applications. When data were combined over 2002 and 2004, the percent Italian ryegrass control and wheat yield production were better than data combined over three years (2002, 2003, and 2004). The application of treatments 1, 2, 3, 4, and 6 provided > 90% Italian ryegrass control, and the plots that received those applications produced an average of 57 bu/A (2002 and 2004). In general, Italian ryegrass control and wheat yield in 2003 were much lower than the combination of two years.

Overall, the plots that received Finesse at 0.023 lb/A PRE fb Osprey at 0.043 lb/A + MSO at 4-leaf to 2-tiller ryegrass provided excellent control (96%) of Arkansas diclofop-resistant Italian ryegrass and produced the highest wheat yield (59 bu/A) in 2002 and 2004. However, the treatment applications (for two years) of Sencor at 2- to 3-leaf wheat fb Sencor at 2- to 3-tiller wheat; Axiom at 1- to 2-leaf wheat; Osprey at 2- to 3-leaf wheat; and Osprey at 4-leaf to 2-tiller ryegrass provided equivalent Italian ryegrass control (96, 95, 93, and 89%, respectively) and wheat yield (52, 55, 58, and 59 bu/A, respectively). The efficacy of Osprey activity can be drastically reduced by environmental conditions following applications (cold and dry). The natural infestation of Arkansas diclofop-resistant ryegrass interference reduced wheat yield 77 (2002, 2003, and 2004), 72 (2002 and 2004), and 94% (2003) compared to the yield of the best treatment (Finesse PRE fb Osprey).

PROGRESS WITH WEED-SUPPRESSIVE CULTIVARS AND HYBRID SELECTIONS IN SOUTHERN U.S. RICE. D.R. Gealy[1], H.L. Black[1], K.A.K. Moldenhauer[2], and W.G. Yan[1]. [1]USDA – ARS – Dale Bumpers National Rice Research Center, Stuttgart, AR 72160, and [2]University of Arkansas, Division of Agriculture, Rice Research and Extension Center, Stuttgart, AR 72160.

ABSTRACT

Weed control is one of the key challenges to sustainable rice production systems in the southern U.S. In previous screening efforts, rice cultivars (e.g. PI 312777 and PI 338046) with good to excellent weed suppressive characteristics were identified from world rice collections as potential components of reduced herbicide systems. Although grain yields and weed suppression levels for these lines have sometimes been promising, other agronomic characteristics generally have not been commercially acceptable. Thus, a rice-breeding program was initiated to combine the desirable grain quality and agronomic characteristics of 'Katy' commercial rice with the weed suppression potential of PI 338046 and PI 312777. In drill-seeded field plots, F_5 or later generations of PI 338046/Katy crosses and PI 312777/(PI338046/Katy) crosses were evaluated with their original parental lines, and additional commercial and weed suppressive rice standards. Plant height, days to heading, tiller production, grain yield and visual control of barnyardgrass were among the characteristics evaluated.

Three tests were conducted in 2004 at Stuttgart, Arkansas. In one test, of the 12 crosses evaluated, 10 had visual barnyardgrass control of 60% or greater, 10 had weed-free rice grain yield of 6,500 kg/ha or higher and 11 had grain yield in weedy plots of at least 70% of their respective weed-free checks. This compares favorably to the weed-suppressive parents, PI 312777 and PI338046. Several of the standard lines also met these criteria.
In all three tests, RiceTec ClearField XL8 (imidazolinone-resistant hybrid rice) planted at 430 seeds/m^2 had visual barnyardgrass control of 60% or greater, and high rice grain yields.

Overall, certain selections from the crosses produced commercially acceptable yields and moderately elevated levels of weed suppression. However, these selections generally yielded less than their commercial parents and suppressed barnyardgrass less than their suppressive cultivar parents.

WHEAT AND ITALIAN RYEGRASS RESPONSE TO FLUFENACET PLUS METRIBUZIN. C.M. Whaley, J.C. Sanders, H.P. Wilson, and T.E. Hines, Eastern Shore Agricultural Research and Extension Center, Virginia Tech, Painter, VA 23420.

ABSTRACT

Field experiments were conducted to evaluate wheat (*Triticum aestivum* L.) and Italian ryegrass (*Lolium multiflorum* Lam.) response to the commercial mixture of flufenacet plus metribuzin at several rates and application timings. The first experiment was conducted in 2001 and 2002 and included flufenacet plus metribuzin at 0.14 + 0.03, 0.20 + 0.05, 0.27 + 0.07, 0.34 + 0.08, 0.4 + 0.10 lb ai/A, respectively, applied preemergence (PRE) and at wheat spiking (SPIKE). A second experiment was conducted in 2003 and 2004 and included flufenacet plus metribuzin at 0.20 + 0.05, 0.27 + 0.07, 0.34 + 0.08, respectively, lb/A applied at wheat emergence (EMERGE) and at the three-leaf growth stage (3 LF). Wheat injury increased with flufenacet plus metribuzin application rate in 2001 and 2002. In 2003, injury was higher with EMERGE applications than with 3 LF, but injury was similar between all treatments in 2004 regardless of herbicide rate or application timing. Italian ryegrass control in 2001 and 2002 was generally higher when flufenacet plus metribuzin was applied SPIKE compared to PRE, but in 2002 control was low overall. Low control in 2002 was likely a result of low rainfall for 6 weeks after planting. In 2003, control was higher with EMERGE applications, but control was similar by all rates within each application timing. Flufenacet plus metribuzin at 0.27 + 0.07 and 0.34 + 0.08 lb/A, respectively, was generally more effective than the lower rate in 2004 at each application timing, but control was higher when applied EMERGE compared to PRE. In all years, flufenacet plus metribuzin at all rates significantly reduced Italian ryegrass inflorescences compared to the nontreated check. Wheat yields were generally higher than the nontreated check, but occasional differences existed in the magnitude of yield increase.

WEED SUPPRESSION PROVIDED BY RYE AND CLOVER IN CONSERVATION-TILLAGE COTTON AND CORN. Price A.J., Balkcom K S., and Arriaga F.J., USDA-ARS National Soil Dynamics Laboratory, Auburn, AL.

ABSTRACT

Historically, cover crop planting and termination has occurred at the discretion of growers' schedules and weather conditions. One advantage of using cover crops in conservation tillage is weed suppression through physical as well as chemical allelopathic effects. Cereal rye (*Secale cereale* L.) and crimson clover (*Trifolium incarnatum* L.) are the two most common winter cover crops recommended for cotton (*Gossypium hirsutum* L.) and corn (*Zea mays* L.) production in the U.S, respectively. Both of these cover crops also contain allelopathic compounds that inhibit weed growth. Previous research has shown that a winter cover's planting date and termination date influences both quality and quantity of residue production, and subsequent weed suppression. Therefore, a field study was conducted at the E.V. Smith and Tennessee Valley Research and Extension Centers to determine optimum dates for planting and terminating winter cover crops to maximize biomass production, summer annual weed suppression, and cash crop yields. Rye and crimson clover were established with a no-till drill as winter covers, preceding conservation-tillage cotton and corn, respectively, at 2 and 4 wk prior to, 2 and 4 wk after, and on the historical average first frost. In the spring, winter covers were terminated at 4, 3, 2, and 1 wk prior to cash crop planting with glyphosate at 1.12 lb ai/ha. The rye was flattened prior to burndown application with a mechanical roller-crimper to form a dense residue mat on the soil surface. Additionally, 2,4-D was applied at 0.28 kg ai/ha to the clover to enhance termination. Each cover's biomass from each plot was measured immediately before termination by clipping the above-ground portion from one randomly-selected 0.25-m^2 area in each plot, dried at 60 C for 72 h, and weighed. Weed biomass was determined in two 0.25-m^2 area as described above when cotton reached the 4-leaf growth stage and corn reached the V4 growth stage. No herbicide was applied after cover termination until immediately after weed biomass sampling; plots were kept weed free until harvest using Alabama Cooperative Extension recommended practices. At E.V. Smith, rye planted 4 wk after first frost and terminated 4 wk before cotton planting produced the least biomass, 318 kg/ha, 27 times less than highest biomass treatment in which rye was planted 4 wk prior to first frost and terminated 1 wk prior to cotton planting. Correspondingly, weed biomass was 1,198 kg/ha in the treatment with the least rye biomass, 42 times greater compared to the treatment with the greatest rye biomass. Similar relationships were observed at the Tennessee Valley site. At E.V. Smith, clover planted 4 wk after the first frost and terminated 2 wk before corn planting produced the least biomass 406 kg/ha, nine times less than the highest biomass treatment in which clover was planted 2 wk prior to first frost and terminated 2 wk prior to corn planting. Weed biomass was 77 kg/ha in the treatment with the least clover biomass, eight times greater compared to the treatment with the greatest clover biomass. Again, similar relationships were observed at the Tennessee Valley site.

TWO-YEAR EVALUATION OF ET MIXTURES IN SOYBEAN. P.R. Vidrine and D.M. Scroggs, LSU AgCenter, Dean Lee Research Station, Alexandria, LA 71302

ABSTRACT

With the majority of soybeans planted today being Roundup Ready, weed control expressed from glyphosate can be very important. Because glyphosate can be weak on larger broadleaf weeds (Webster et al. 1999; Culpepper et al. 2000), the addition of a postemergence herbicide to enhance control of these weeds would be very beneficial.

ET (Pyraflufen-ethyl), has shown excellent control of selected broadleaf weeds (Vidrine and Scroggs 2003), but has the potential to cause significant injury to soybean when applied POT. If a combination of ET and glyphosate can be safely applied POT to a soybean crop, better overall weed control may be accomplished.

A two-year study was implemented at the Dean Lee Research Station at Alexandria, LA to determine soybean tolerance following mixtures of ET and Roundup WEATHERMAX (RWM). Soybean variety used both years was Delta and Pineland 5806 RR. Treatments were applied to soybean at the 2-3 trifoliate stage. Treatments were applied with a tractor-mounted compressed air sprayer at 15 GPA with 110 03 XR FF spray tips. Treatments were arranged in a Randomized Complete Block (RCB) design with 3 replicates. Visual ratings were taken at 7 and 28 DAT. Data were subjected to GLM analysis $P \geq 0.05$.

Two-year results indicate that at the 7 and 28 dat ratings, soybean injury was less when ET @ 2.0 oz/a was applied with RWM @ 22 oz/a. However, soybean injury was not lessened with the addition of RWM to ET @ 1.0 or 0.5 oz/a. At each ET rate (0.5, 1.0, 2.0 oz/a) soybean yield increased with the addition of RWM @ 22 oz/a. If ET is applied POT to soybeans, injury can occur; however, this injury could be reduced with the addition of RWM @ 22 oz/a. Tests will be conducted in 2005 evaluating soybean injury from POT applications of higher rates of ET in combination with higher rates of RWM.

FLAME WEED CONTROL FOR ORGANICALLY GROWN SOBYEAN IN MISSISSIPPI. Poston, D.H., C.E. Snipes, T.W. Eubank and S.P. Nichols. Delta Research and Extension Center, Stoneville, MS 38776.

ABSTRACT

Organic foods is currently the fastest growing sector in U.S. agriculture with annual increases in sales of greater than 17% for the past 6 consecutive years. Organic food sales exceeded $10 billion in 2003 and now represent nearly 2% of all U.S. food sales. Selling prices for organic soybean can range from $7.00 per bushel for low quality soybean to as much as $22.00 per bushel. Organic production systems for soybean have not been widely developed for the southern United States. Increased weed, insect, and disease pressure compared to more northern production regions and closer proximity to processing for northern producers may be some of the reasons why much of the organic soybean production has occurred in the Midwest. An affordable and efficacious organic weed control system may involve coupling flame cultivation with the early planting. The objective of this research was to evaluate the flame cultivation for weed control in April- and May-planted organically grown soybean in Mississippi.

Treatments included: 1) a nontreated control, 2) cultivation + hand weeding, 3) flame cultivation + hand weeding, 4) flame cultivation only, and 5) hand weeding only. At least 86% annual grass and pigweed control occurred with all treatments in April-planted tests. These weeds were more difficult to control with flame cultivation alone in May-planted soybean. Control in May plantings ranged from 68-80% and 51-90% for annual grasses and pigweeds, respectively. Morningglory control with flame cultivation was at least 88% regardless of planting date or year. Prickly sida control with flame cultivation was >90% and equal to the best treatments evaluated both years in April and May plantings. In 2004, velvetleaf was the most difficult to control weed with flame cultivation alone and control was 78 and 63% in April and May plantings, respectively, compared to essentially complete control with all other treatments evaluated including the glyphosate only system. Hemp sesbania control was occasionally lower than the best treatments with glyphosate only and flame only weed control programs. Supplemental hand weeding improved weed control and yield in some instances over flame cultivation alone, but net returns were never improved. Supplemental hand weeding will likely reduce the soil weed seedbank for future production years in organic production systems, but it will be difficult to justify the added labor expense. It may be of most utility to remove large-seeded erect weeds like velvetleaf and hemp sesbania.

Although overall treatment costs were similar with cultivation + hand weeding and flame cultivation + hand weeding, the actual labor cost was $76 per acre less following flame cultivation than it was following conventional cultivation. Slightly improved weed control with flame cultivation reduced the time needed to remove weeds that survived treatment. Given the difficulty of acquiring labor and the cost associated with labor, flame weed control seems the more profitable and sensible option.

In April-planted studies, flame weed control alone produced soybean yields of 48 bushels per acre that were similar to the 50 bushels per acre that was achieved with the glyphosate resistant weed control program that consisted of two applications of glyphosate. In May plantings, soybean yields with flame cultivation equaled those achieved with the glyphosate-resistant program only 1 of 2 years. Soybean yield in the May 2004 planting with flame weed control alone was 25 bushels per acre compared to 32 bushels per acre with the glyphosate-resistant program. Assuming a selling price of $12.00 per bushel for organically grown soybean, however, net returns above weed control cost with flame weed control always exceeded returns with a 2-application sequential glyphosate program in April plantings. In May plantings, trends were towards higher returns with flame weed control alone, but differences were not always significant.

Averaging treatment costs and yields associated with all programs evaluated, soybeans grown using flame weed control only would have to be sold for a premium of approximately $2 per bushel to equal the returns that would occur using the glyphosate only system as long as non-organically grown soybean prices remained in the $5 to $10 per bushel price range.

Chemical-free soybeans were produced successfully in the Mississippi delta using a production system that combined the benefits of the Early Soybean Production System and flame cultivation for weed control.

PREEMERGENCE WEED CONTROL IN SOYBEAN WITH A PRE-MIX OF FOMESAFEN AND S-METOLACHLOR. D.K. Miller and M.S. Mathews, LSU AgCenter, St. Joseph, LA.

ABSTRACT

Research was conducted in 2004 at the Northeast Research Station in St. Joseph, La, to evaluate preemergence (PRE) weed control in Roundup Ready soybean with a pre-mix of fomesafen and s-metolachlor. Treatments evaluated included the pre-mix at rates of 16, 24, 32, 40, and 48 oz/A applied alone or at at 16, 24, or 32 oz/A in combination with Canopy XL (sulfentrazone + chlorimuron ethyl) at 2 or 4 oz/A or Firstrate (cloransulam-methyl) at 0.3 or 0.6 oz/A applied PRE. Comparison PRE treatments included Boundary (s-metolachlor + metribuzin) at 24 or 29 oz/A, Prowl H_2O (pendimethalin) alone at 34 oz/A or in combination with Canopy XL at 4 oz/A, Canopy XL at 4 oz/A, and Domain (metribuzin + flufenacet) at 10 oz/A. A nontreated control was included for comparison. Experimental design was a randomized complete block with four replications. Treatments were applied with a CO_2 back-pack sprayer to each four-row, 13.33' x 30' plot at 15 GPA. Soybean 'DP 5644 RR' was planted on May 5 in a conventionally tilled silty clay loam soil. Weeds evaluated 29 and 56 d after treatment (DAT) included barnyardgrass (*Echinochloa crus-galli*), entireleaf morningglory (*Ipomoea hederacea*), hemp sesbania (*Sesbania exaltata*), johnsongrass (*Sorghum halepense*), pitted morningglory (*Ipomoea lacunosa*), redroot pigweed (*Amaranthus retroflexus*), and sicklepod (*Senna obtusifolia*). Soybean yield was determined following harvest of the center two rows of each plot. Weed control and yield data were subjected to ANOVA and means were separated using LSD at the 0.05 level of significance.

At 29 DAT, control of the respective weeds evaluated was 69 to 89, 89 to 93, 81 to 89, 76 to 85, 89 to 95, 95, and 83 to 86% and similar among rates of the premix of fomesafen and s-metolachlor applied alone. Addition of Canopy XL or Firstrate did not result in increased weed control over that observed with the pre-mix applied alone. Weed control with the premix was equal to or greater than that observed with other PRE herbicides evaluated. At 56 DAT, results were similar with rates of the pre-mix providing 80 to 86, 84 to 90, 75 to 80, 76 to 85, 84 to 90, 95, and 73 to 76 control of barnyardgrass, entireleaf morningglory, hemp sesbania, johnsongrass, pitted morningglory, redroot pigweed, and sickelpod, respectively. Control among rates was similar and no benefit observed to addition of Canopy XL or Firstrate. Soybean yield was generally reflective of weed control ratings with no differences noted between pre-mix rates (33.4 to 43 bu/A). Tank mixture with Canopy XL at 4 oz/A did, however, result in increased yield compared with the pre-mix applied alone at 16 oz/A (44.1 vs. 33.4 bu/A) and 24 oz/A (52.7 vs. 39.7 bu/A). This increase in yield was not observed with addition of lower rates of Canopy XL or tank mixture with Firstrate to the pre-mix of fomesafen and s-metolachlor.

The premix of fomesafen and s-metolachlor applied PRE in soybean can provide good to excellent control of weeds evaluated. When applied at rates below 32 oz/A, however, yield can be maximized with the addition of Canopy XL at 4 oz/A.

INFLUENCE OF MANGANESE FORMULATION ON GLYPHOSATE EFFICACY IN SOYBEAN. J.C. Sanders, D.H. Poston, D.M. Dodds, K.W. Bradley, T.W. Eubank, C.M. Whaley, H.P. Wilson, and D.R. Shaw; Virginia Tech, Painter, VA; Mississippi State University, Stoneville, MS; Mississippi State University, Mississippi State, MS; University of Missouri, Columbia, MO.

ABSTRACT

Many soils where soybeans are grown have manganese (Mn) deficiencies which are usually amended using foliar Mn fertilizers. Glyphosate and foliar Mn are commonly applied in combination in a single postemergence application. Previous research demonstrated antagonism of some Mn formulations when applied in combination with glyphosate, but this research did not include any of the EDTA (ethylenediaminetetraacetic acid) –chelated Mn formulations which are currently available. Research was conducted in the 2004 growing season at five locations which included: Eastern Shore Agricultural Research & Extension Center (Painter, VA), Black Belt Branch Experiment Station (Brooksville, MS), R. Foil Plant Science Research Center (Starkville, MS), Delta Research & Extension Center (Stoneville, MS), and the Bradford Research & Extension Center (Columbia, MO). Experiments were conducted in field plots arranged in a randomized complete block design and replicated four times. Treatments included glyphosate alone at 0.77 lb ae/A and in combination with each of ten different Mn formulations at 0.5 lb Mn/A. Two different types of Mn were used and included four EDTA-chelated Mn (Dissolvine E-Mn-6, Dissolvine E-Mn-13, Librel, and Traco Mn-EDTA) and six non-EDTA-chelated Mn (Citraplex, Tecmangam, Post-man, Tracite LF Mn, Pholex, and Ele-Max Mn). Percent weed control was evaluated at 14 days after treatment (DAT), pH readings of spray solution with Mn were collected with and without the addition of glyphosate, and a cost analysis was conducted upon Mn formulations at an application rate of 0.5 lb Mn/A. Weeds that were evaluated included entireleaf morningglory (*Ipomoea hederacea var. integriuscula*), ivyleaf morningglory (*Ipomoea hederacea*), pitted morningglory (*Ipomoea lacunosa*), common ragweed (*Ambrosia artemisiifolia*), common lambsquarters (*Chenopodium album*), jimsonweed (*Datura stramonium*), sicklepod (*Senna obtusifolia*), hemp sesbania (*Sesbania exaltata*), tall waterhemp (*Amaranthus tuberculatus*), barnyardgrass (*Echinochloa crus-galli*), giant foxtail (*Setaria faberi*), and large crabgrass (*Digitaria sanguinalis*). EDTA-chelated manganese had no significant influence on glyphosate performance on several broadleaf and grass weeds when evaluated at 14 DAT and had little influence on spray solution pH. Weed control was similar among all EDTA-chelated manganese formulations evaluated. Post-man, Tracite LF, and Tecmangam antagonized weed control from glyphosate by 13 to 48%. The addition of Post-man, Tecmangam, or Citraplex to glyphosate reduced spray solution pH 1.28, 1.98, and 1.99 respectively. The addition of Ele-max, Pholex, or Tracite LF to glyphosate increased spray solution pH 0.31, 2.32, and 4.44 respectively. Based on an application rate of 0.5 lb Mn/A, EDTA-chelated manganese costs approximately $2.50 more than Post-man. EDTA-chelated manganese formulations antagonized weed control less than other Mn formulations when applied in mixtures with glyphosate, and had little influence on spray solution pH.

BEYOND AS A RESCUE TREATMENT FOR RED RICE CONTROL IN CLEARFIELD* RICE. J.H. O'Barr, S.D. Willingham, G.N. McCauley, and J.M. Chandler. Texas A&M University, College Station, TX. Department of Soil & Crop Sciences, Texas A&M University, College Station, TX 77843-2474.

ABSTRACT

Field studies were conducted in 2003 and 2004 at the Texas A&M Research and Extension center near Beaumont to evaluate timing and rate of Beyond on late season red rice control and crop tolerance. Rice variety CL161 was drill-seeded at 80 lbs/A with red rice drill-seeded perpendicular at 30 lbs/A to ensure uniform and adequate red rice density. Command (clomazone) was applied at 0.5 lbs ai/A preemergence over the entire study to eliminate all grass weeds except red rice. Blazer (acifluorfen) was applied at 0.175 lbs ai/A at the rice four leaf stage to eliminate broadleaf weeds. Application of Newpath for red rice control was not made prior to rescue treatments as required by the Beyond label, ensuring intense red rice pressure. In 2003, Beyond (imazamox) was applied at 0.031, 0.039 and 0.047 lbs ai/A at the rice 1-2 tiller, 3-4 tiller, booting, and flowering stages. Red rice control with all rates of Beyond applied at 1-2 and 3-4 tiller ranged between 85 and 93%. Delaying Beyond application to booting stage provided less than 80% red rice control. Application at flowering stage provided less than 10% control. Red rice control results within each timing were similar regardless of the Beyond rate. However, there were significant differences with red rice heading. The application of Beyond at the booting stage prevented red rice seed head formation. No visual crop injury was noted, however, rice yield significantly decreased when the Beyond application was delayed to the booting or flowering stage. This could be due to a longer period of red rice competition and lack of control at these timings and/or potential crop injury to the commercial rice in its reproductive phase. In 2004, application timings were modified. Beyond was applied at 0.031, 0.039 and 0.047 lbs ai/A at the rice 2-4 tiller, panicle initiation, panicle initiation +10 days, and panicle initiation +17 days. Red rice control up to 60% was achieved at the 2-4 tiller application stage. As Beyond application was delayed percent control was reduced to 23%. All timings except panicle initiation +10 days resulted in red rice seed head formation at all rates of Beyond. No visible rice injury or significant differences in yield were observed. Lower red rice control in 2004 might be due to later planting date of April 14, 2003 vs. May 6, 2004 and nearly three times as much rainfall during the 2004 growing season.

INTERACTIONS BETWEEN MANGANESE FERTILIZERS AND GLYPHOSATE. Poston, D.H.[1], V.K. Nandula[1], T.W. Eubank[1], J.C. Sandersr[2], H.P. Wilson[2], D.M. Dodds[3], and D.R. Shaw[3]. Delta Research and Extension Center, Stoneville, MS 38776[1]; Eastern Shore Agricultural Research and Extension Center, Virginia Polytechnic Institute and State University, Painter, VA 23420[2]; Plant and Soil Science Department, Mississippi State University, Mississippi State, MS 39762[3].

ABSTRACT

Research is lacking on the influence of manganese (Mn) on glyphosate activity. Three field studies were conducted both at Stoneville, MS and Painter, VA in 2004 to determine the effect of Mn fertilizer formulation and rate on glyphosate efficacy, to determine the effect of glyphosate rate on Mn fertilizer antagonism, and to determine effect of glyphosate formulation on Mn fertilizer antagonism. First, the potassium (K) salt formulation of glyphosate at 0.86 kg ae/ha was combined with 4 formulations of Mn fertilizer, Pholex or Dissolvine E-MN-6, Dissolvine E-MN-13, Post-man, and Traco Mn-EDTA, each at 0.22, 0.45, and 0.9 kg ai/ha and applied to IPOSP (morningglory), SEBEX (hemp sesbania), SIDSP (teaweed), ECHCG (barnyard grass), and CASOB (sicklepod) at Stoneville and to DATST (jimsonweed), AMBEL (common ragweed), CHEAL (common lanbsquarters), and IPOSP (morningglory) at Painter. Second, the K salt formulation of glyphosate at 0.86 kg/ha was combined with 4 formulations of Mn fertilizer, Pholex or Dissolvine E-MN-6, Dissolvine E-MN-13, Post-man, and Traco Mn-EDTA, each at 0.56 kg/ha and applied to all weed species as above except sicklepod at Stoneville. Third, the K salt, IPA, and di ammonium (NH4+) formulations of glyphosate, each at 0.86 kg/ha were combined with 4 formulations of Mn fertilizer, Pholex or Dissolvine E-MN-6, Dissolvine E-MN-13, Post-man, and Traco Mn-EDTA, each at 0.56 kg/ha and applied to all weed species. All treatments were applied postemergence to the weeds and percent weed control evaluated 4 wk after treatment.

Postman formulation of Mn at 0.9 kg/ha significantly reduced glyphosate efficacy on IPOSP, SEBEX, SIDSP, and CASOB at Stoneville, and DATST and AMBEL at Painter. Further, Postman Mn formulation antagonized ECHCG control at Stoneville and CHEAL and IPOSP at Painter, especially at 0.45 and 0.9 kg/ha. Postman and Traco Mn-EDTA formulations of Mn, both, significantly reduced glyphosate efficacy on all weeds at Stoneville; at Painter Postman Mn formulation significantly affected DATST and AMBEL control when glyphosate was applied at the low rate of 0.63 kg/ha. Also, at Painter, except when glyphosate at 1.86 kg/ha was combined with any of the 4 formulations for CHEAL control or with either Dissolvine E-MN-13 or Traco Mn-EDTA for IPOSP control, a significant antagonism by Mn on glyphosate efficacy on CHEAL and IPOSP was observed. In general, glyphosate formulation did not have any impact on weed control by glyphosate in combination with Mn fertilizer. The differences observed were mostly due to antagonism by the Postman Mn formulation.

In conclusion, Postman Mn fertilizer formulation significantly reduced weed control by glyphosate. Increasing glyphosate rate accentuated Mn antagonism to some extent. Glyphosate formulation did not influence weed control.

HORSEWEED CONTROL WITH GLYPHOSATE-, GLUFOSINATE, AND PARAQUAT-BASED HERBICIDE PROGRAMS. Nandula, V.K[1], D.H. Poston, T.W. Eubank[1], and C.H. Koger[2]. Delta Research and Extension Center, Stoneville, MS 38776[1], USDA-ARS Southern Weed Science Laboratory, Stoneville, MS 38776[2].

ABSTRACT

Horseweed [*Conyza canadensis* (L.) Cronq.] is becoming a problem in the mid-South region of the US in reduced till and no-till crop production systems as the adoption of herbicide-resistant crop technology increases. Also, resistance to glyphosate in horseweed populations is spreading.

Three field studies were conducted at Stoneville, MS in 2004 to evaluate glyphosate-, glufosinate-, and paraquat-based herbicide treatments for efficacy on glyphosate-susceptible horseweed. Glyphosate at 0.84 kg ae/ha applied alone provided excellent horseweed control at this location, whereas, glufosinate and paraquat required a tank-mix partner to provide complete control. Control with 0.47 kg ai/ha glufosinate and 0.84 kg ai/ha paraquat + 0.25% NIS applied alone was only 83 and 76%, respectively. Adding 2,4-D or dicamba to glufosinate provided complete horseweed control. In contrast, only the addition of dicamba to the paraquat treatment provided complete control. The addition of burning herbicides like flumioxazin and metribuzin noticeably reduced horseweed control by glyphosate, but provided greater than 90% control when mixed with glufosinate or paraquat. At least 90% control was achieved by adding 2,4-D, dicamba, [sulfentrazone + chlorimuron], or prometryn to any of the non-selective herbicides evaluated. It is important to note, however, that complete control of horseweed is critical given the potential for further resistance development. While 90% control is generally accepted as excellent control, it may not be adequate for the management of resistant populations where the potential of weed survival and the subsequent production of seed exist. It should also be noted that this test location received an early fall burndown and the weed populations being evaluated emerged following this fall burndown. Late-emerging horseweed plants are likely easier to control than plants that emerge in late summer and early-fall and have larger root systems.

Treatments containing flumioxazin, [sulfentrazone + chlorimuron], or sulfentrazone provided the most consistent residual control lasting for several wk after application. Residual control to prevent subsequent flushes of spring emerging horseweed plants is an important component in the management of glyphosate-resistant horseweed. Residual herbicides as part of a pre-plant burndown program can result in clean seedbeds at planting thereby reducing the need for an additional burndown application at planting.

USE OF RESIDUAL HERBICIDES IN PREPLANT WEED CONTROL PROGRAMS IN EARLY-PLANTED SOYBEAN IN MISSISSIPPI. Poston, D.H.[1], V.K. Nandula[1], T.W. Eubank[1], and C.H. Koger[2]. Delta Research and Extension Center, Stoneville, MS 38776[1], USDA-ARS Southern Weed Science Laboratory, Stoneville, MS 38776[2].

ABSTRACT

The Early Soybean Production System (ESPS) is commonly used throughout the mid-southern US. In 2004, approximately 89% of the Mississippi soybean crop was planted by May 3 and 90% harvested by early October. To take full advantage of the ESPS, soybean must be planted from late-March through approximately April 20. Few days for field operations are available during this time interval making it extremely important that producers be ready to plant when the opportunity arises. Consequently, the use of well-timed, efficacious, and cost effective pre-plant burndown programs is essential. Residual herbicides as components of glyphosate-based pre-plant burndown programs may improve weed control and allow fields to remain essentially weed free until planting thereby reducing or eliminating the need for follow-up at planting burndown applications. Few data are available relative to the profitability of such pre-plant weed management systems within the confines of the ESPS. The objectives of this research were: 1) to determine the effect of residual herbicides as components of glyphosate-based pre-plant burndown programs on weed control, soybean yield, and net returns above weed management costs and 2) to determine if follow-up at-planting burndown applications were necessary for all programs evaluated.

Glyphosate 0.84 kg ae/ha, glyphosate 0.63 kg ae/ha + 2,4-D 0.84 kg ai/ha, glyphosate 0.63 kg ae/ha + flumioxazin 0.071 kg ai/ha, glyphosate 0.63 kg ae/ha + [sulfentrazone + chlorimuron] 0.145 kg ai/ha, and a nontreated control were the treatments evaluated. Treatments were applied as pre-plant burndown application 3 to 8 weeks prior to planting at 5 locations over 2 years. A split plot treatment arrangement (pre-plant treatment x with or without a followup burndown) was used. Paraquat at 0.84 kg ai/ha + 0.25% v/v NIS was used as the at-planting burndown for plots that received a pre-plant burndown and 1.1 kg ai/ha paraquat + 0.25% NIS was used in plots that received no prior burndown.

Weed control 4 WAT exceeded 90% with all tank mix treatments except glyphosate alone which was only 86%. However, plots treated with glyphosate + [sulfentrazone + chlorimuron] or glyphosate + flumioxazin were the only plots that consistently had less than 10% groundcover at planting. Therefore the residual treatments likely reduced weed competition just after planting more effectively than non-residual treatments. All treatments significantly increased soybean yield compared to nontreated plots. The best soybean yields were obtained using glyphosate + [sulfentrazone + chlorimuron] with or without a followup burndown at planting and with glyphosate + flumioxazin followed by and at-planting burndown. Yields with all other treatments were significantly less than the best treatment. The nontreated control was the only treatment to respond significantly to an at-planting followup burndown. At-planting followup burndowns were generally not profitable in this early-planted scenario, except in nontreated plots. Glyphosate only pre-plant burndowns and the nontreated control were the only programs evaluated that did not produce net returns equal to the best treatments assuming a $5.00 per bushel selling price. At a soybean selling price of $8.00 per bushel, highest net returns were achieved only with residual programs and a glyphosate + 2,4-D pre-plant burndown followed by an at-planting burndown.

Maximum net returns and highest yields tended to occur where residual herbicides were used in conjunction with glyphosate-based burndown programs. These findings demonstrate that the added cost of residual herbicides in pre-plant burndown programs in early-planted soybean can be more than offset by increased yields and savings in extra trips across the field. In addition, residual herbicides used in this fashion increase the likelihood of timely planting by consistently eliminating the need for followup burndowns, especially when soybean prices are high.

ANNUAL RYEGRASS (*LOLIUM MULTIFLORUM* L.) CONTROL IN WINTER WHEAT WITH MESOSULFURON-METHYL (OSPREY HERBICIDE). J.M Ellis, S.S. Hand, K. Vodrazka, J.M. Rosemond, J.W. Sanderson, and A. Hopkins; Bayer CropScience RTP, NC 27709.

ABSTRACT

Osprey Herbicide is a new postemergence herbicide 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). Osprey Herbicide 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, Osprey Herbicide 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 either a high-quality methylated seed oil containing 10% emulsifier or greater at 1.3 to 1.5 pint/acre, a basic blend type adjuvant at a concentration of 1% v/v, or a non-ionic surfactant containing at least 80% active non-ionic surfactant at a concentration of 0.5% v/v. A nitrogen source must be used when non-ionic surfactant is used as the adjuvant system. Nitrogen should be an ammonium nitrogen fertilizer that can be either spray grade 28 to 32 percent urea ammonium nitrogen at 1 to 2 quart/acre or ammonium sulfate fertilizer at 1.5 to 3 pounds/acre.

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. Osprey Herbicide is rapidly degraded and unlikely to pose any risk to succeeding crops. Excellent control of ACC-ase resistant wild oat (*Avena fatua* L.) biotypes has 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.

DOWNY BROME (*BROMUS TECTORUM*) AND CHEAT (*BROMUS SECALINUS*) CONTROL IN WINTER WHEAT WITH PROPOXYCARBAZONE-SODIUM (OLYMPUS HERBICIDE). J.M. Ellis, S.S. Hand, W.R. Perkins, J. Cagle, A. Wyman and G. Hudec; Bayer CropScience RTP, NC 27709.

ABSTRACT

Olympus Herbicide is a new postemergence herbicide 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. Olympus Herbicide 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, Olympus Herbicide controlled downy brome, cheat, Japanese brome, soft chess, wild oat, 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. Olympus Herbicide offers a flexible recropping profile to succeeding crops.

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.

INTERACTION OF GLUFOSINATE AND POSTEMERGENCE GRAMINICIDES ON ANNUAL GRASSES. A.P. Gardner, A.C. York and D.L. Jordan, Department of Crop Science; North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Liberty Link cotton was commercialized in 2004 and centers upon the use of the non-selective herbicide glufosinate-ammonium. Previous research has indicated timely application is vital to achieve control of annual grasses. Grasses that are not treated in a timely manner will be larger than the optimum size and therefore more difficult to control. Thus, we conducted experiments to investigate the interactions that may occur if post-emergence graminicides were used with glufosinate to supplement annual grass control. Previous research has determined that antagonism commonly occurs when post-emergence graminicides are mixed with other herbicides. Two experiments were conducted in North Carolina in 2004 to determine the potential for antagonism with combinations of glufosinate and graminicides and also to determine how to alleviate negative interactions should they exist.

Fallow field sites were selected with populations greater than 300 plants/m^2 of large crabgrass, broadleaf signalgrass, and/or goosegrass. Treatments were applied to 10 to 20 cm grasses to simulate a late herbicide application. Control was visually evaluated 7, 14, 21 and 28 days after treatment applications. Rating data were then arcsine transformed and subjected to ANOVA, and means were separated using Fisher's protected LSD test at P=0.05.

The first experiment was conducted at five locations. The objectives were to determine if interactions occur with mixtures of graminicide and glufosinate, to compare response with four graminicides, and to determine if negative interactions could be alleviated by increasing the graminicide rate. Treatments consisted of a factorial arrangement of graminicides, graminicide rates, and glufosinate rates. Graminicides included quizlofop-p-ethyl, fluazifop-p-butyl, sethoxydim, and clethodim. Graminicide rates were 0, 1X, and 1.5X, with the X rate denoting the manufacturers' suggested use rate. The glufosinate rates were 0 and 468 g ai/ha. A crop oil concentrate was added to each treatment at 1% (v/v). Additional treatments included glufosinate alone and glufosinate with crop oil concentrate. All graminicides applied alone controlled annual grasses at least 89% 28 days after application. Reduced control (9 to 23%) was noted when glufosinate was mixed with all graminicides. However, glufosinate reduced control by fluazifop less than it reduced control by the other graminicides. All graminicide plus glufosinate mixtures were antagonistic according to the Colby procedure. Antagonism was not alleviated by increasing the graminicide rate by 50%.

The second experiment was conducted in four locations. The objectives of this study were to determine if antagonism with tank mixtures could be alleviated by sequential application, and also to determine the application order and waiting interval between applications necessary to alleviate antagonism. Treatments were a factorial arrangement of graminicides, glufosinate rates, and application timings. The graminicides were fluazifop-p-butyl and clethodim at the manufacturers' suggested use rate. Glufosinate rates were 0 and 468 g/ha. Application timings included the following: graminicides applied 1, 3 or 5 days before glufosinate; graminicides mixed with glufosinate; and graminicides applied 1, 3, 5, or 7 days after glufosinate. All graminicide treatments included a crop oil concentrate at 1% (v/v). Control by clethodim was greater than fluazifop, 77% and 69% respectively, when applied alone. Antagonism was alleviated by applying the graminicides 3 or 5 days before glufosinate or 7 days after glufosinate. Control was reduced when graminicides were applied 1 day before glufosinate, tank mixed with glufosinate, or applied 1, 3, or 5 days after glufosinate.

USING ENVOKE AND SUPREND WITH TOUCHDOWN FOR COTTON WEED CONTROL IN THE SOUTHWEST. B.W. Minton and W.J. Grichar: Syngenta Crop Protection, Cypress, TX 77433, and Texas Agricultural Experiment Station, Beeville, TX 78102,

ABSTRACT

Field studies were conducted during the 2002 thru 2004 growing seasons at two locations in south-central Texas cotton production region to evaluate Envoke and Suprend in combination with either Dual Magnum, MSMA, and Touchdown for weed control and cotton response. Cotton leaf burn (13-19%) was noted in 2002 at one location with Suprend applied late postemergence directed. Cotton injury was <5% with all other treatments. Herbicide combinations which included Envoke controlled barnyardgrass (*Echinochloa crus-galli* L.), hemp sesbania (*Sesbania exaltata*), yellow nutsedge (*Cyperus esculentus* L.), Palmer amaranth (*Amaranthus palmeri* S. Wats), smooth pigweed (*Amaranthus hybridus* L.), ivyleaf morningglory (*Ipomoea hederacea* L.), pitted morningglory (*Ipomoea lacunose* L.) and smellmelon (*Cucumis melo* L.) at least 80% in most instances. Touchdown applied early postemergence over-the-top to 2-leaf cotton and mid-postemergence to 5-leaf cotton at 0.75 lb ae/A followed by Suprend at 1.01 lb ai/A applied late postemergence directed controlled the previously mention weeds plus Texas panicum (*Panicum texanum* Buckl.) at least 92%. No other herbicide program provided effective control (>85%) of Texas panicum. Cotton yields were increased over the untreated control with the herbicide programs that included at least two applications timings.

REMOTE SENSING AS A DECISION MAKING TOOL FOR DESICCATION OF MISSISSIPPI SOYBEAN. T.W. Eubank*, D.H. Poston, C.H. Koger, and D.R. Shaw. Delta Research and Extension Center. Mississippi State University. Stoneville, MS.

ABSTRACT

Weeds present at harvest may interfere with combine efficiency and may increase soybean moisture, dockage, and foreign material resulting in loss profits for producers. The desiccation of weed and soybean green matter (including leaves and stems) may reduce seed staining, hasten seed maturity, and promote an earlier harvest. Desiccation of weeds at harvest may improve soybean quality and harvest efficiency.

Remote sensing is a tool, which can be used for detecting weed infestations in agricultural crops. Remote sensing technology has enabled researchers the ability to target problem areas and make site-specific applications to weeds to account for variability in weed populations. The potential benefits of site-specific herbicide applications include reducing application time, herbicide use, herbicide costs, non-target drift, and increasing control of tolerant weed species. A weed that is problematic for Mississippi soybean producers, at harvest, is pitted morningglory (*Ipomoea lacunosa* L.).

Studies were conducted at the Delta Research and Extension Center, in Stoneville, Mississippi to determine if remote sensing can be used as a decision making tool in the justification of a pre-harvest desiccant on Mississippi soybean. The study was conducted using a randomized complete block design with a split plot treatment structure (weed density x pre-harvest desiccant) and 4 replications. Plots were 40 x 40 feet for aerial imagery and 13.3 ft x 40 ft for herbicide treatment and harvest purposes. AG4902RR soybeans were planted mid-April of 2003 using a 40-inch row spacing. Pitted morningglory were hand seeded following the final application of in season glyphosate and thinned to densities of 0, 0.5, 1, 2, 4, 8 plants/m^2. A pre-harvest desiccant was applied on September 12, 2003 using a tractor-mounted sprayer applying 15 GPA @ 38 psi with Teejet XR11003VS nozzles. Desiccant herbicide used was paraquat @ 0.25 lb ai/acre + sodium chlorate @ 3 lb ai/acre + 0.25% v/v NIS. Soybean yield and net returns were calculated using elevator standards and dockages.

A strong linear correlation existed between NDVI (normalized difference vegetation index) and groundcover, whereas pitted morningglory densities can be accurately detected using remote sensing. A slight relationship was seen between soybean yield and percent groundcover. Soybean yields increased in response to a pre-harvest desiccant up to approximately 40% groundcover after which yields declined. Similar results were observed when comparing NDVI to yield response to a desiccant and groundcover to economic response. As pitted morningglory densities increased soybean yield decreased. Averaged across pitted morningglory densities, pre-harvest desiccation increased soybean yield 4.3 bu/A. It should be noted that in the 0 pitted morningglory plots there was a 4.2 bu/A increase with desiccant as opposed to without. This was likely due to the soybean containing 60% green stems at time of application. Harvest moisture and foreign matter both increased as morningglory densities increased and were reduced with the applications of a desiccant.

Data presented shows that remote sensing can be used to detect various densities of pitted morningglory in Mississippi soybean. The addition of a desiccant at harvest showed a yield response and reduction of harvest moisture and foreign matter in soybean, more research is needed in determining the economic justification of such an application.

WHEN CROPS BECOME WEEDS: EFFECTS OF FULL SEASON INTERFERENCE FROM ROUNDUP READY COTTON OR SOYBEAN. D.R. Lee[1], D.K. Miller[2], J.W. Wilcut[3], I.C. Burke[3], M.S. Mathews[2], and C.M. Wilcut[3]. LSU AgCenter, Lake Providence[1] and St. Joseph[2], LA and North Carolina State University, Raleigh, NC[3].

ABSTRACT

Research was conducted in 2004 at the Northeast Research Station in St. Joseph, La and in Lewiston, Rocky Mount, and Clayton North Carolina to determine the competitiveness of Roundup Ready (RR) cotton and RR soybean as weeds in RR soybean and RR cotton crops, respectively. In St. Joseph, PM 1218 BR cotton and DP 5644 RR soybean were evaluated as both the crop and weed. In North Carolina, only FM 989 RR cotton as a crop was evaluated with Asgrow 6202 RR soybean as the weed species. Weeds were planted with the crop approximately two inches from the drill and thinned to 0, 1, 2, 4, 8, 16, and 32 plants per 20 row ft following emergence. Heights of up to 4 weed and crop plants were recorded weekly for a total of 10 wk in St. Joseph and 14 wk in North Carolina. Crop yield was determined following mechanical harvesting. The experiments were designed as a randomized compete block with four replications. Data were subjected to analysis of variance and regression analysis.

Estimated maximum height calculations (Gompertz equation) indicated that at all locations weeds remained below the crop canopy for the duration of the experiment with no height differences detected among densities. In RR cotton, based on calculated interference index values (I value) of 1.7 and 2.8 in North Carolina and St. Joseph, respectively, RR soybean does not appear to be very competitive when compared to other weeds evaluated in previous research (prickly sida I = 15.5; ivyleaf morningglory I = 19; sicklepod I = 27; hemp sesbania I = 47). At a density of 5 plants per 20 row ft, a cotton yield reduction of approximately 7 and 12% would be expected based on results in North Carolina and St. Joseph, respectively. In RR soybean, based on a calculated I value of 0.55 and a yield loss of only 15% at the highest density, RR cotton does not appear to be a very competitive weed.

Based on results, both RR cotton and soybean do not appear to be very competitive weeds in RR soybean and cotton, respectively. Extreme rainfall in Louisiana during the early growing season, however, may have contributed to results obtained, therefore experiments will be repeated in 2005. Although RR cotton and RR soybean do not appear to be very competitive, further work is needed to address impact on additional parameters including effects on harvest efficiency, cotton grades, and insect control.

WHEN CROPS BECOME WEEDS: DETERMINING CRITICAL INTERFERENCE PERIOD FOR ROUNDUP READY COTTON OR SOYBEAN. D.R. Lee[1], D.K. Miller[2], J.W. Wilcut[3], I.C. Burke[3], M.S. Mathews[2], and C.M. Wilcut[3]. LSU AgCenter, Lake Providence[1] and St. Joseph[2], LA and North Carolina State University, Raleigh, NC[3].

ABSTRACT

Research was conducted in 2004 at the Northeast Research Station in St. Joseph, La and in Lewiston, Rocky Mount, and Clayton North Carolina to determine the critical interference period for Roundup Ready (RR) cotton and RR soybean as weeds in RR soybean and RR cotton crops, respectively. In St. Joseph, PM 1218 BR cotton and DP 5644 RR soybean were evaluated as both the crop and weed. In North Carolina, only FM 989 RR cotton as a crop was evaluated with Asgrow 6202 RR soybean as the weed species. Weeds were planted with the crop approximately two inches from the drill and thinned to 32 plants per 20 row ft following emergence. Weeds were allowed to compete for 0, 1, 2, 3, 4, 5, 6, 7, and 8 wk in St. Joseph and 0, 1, 2, 4, 6, 8, 10, and 12 wk in North Carolina. Weeds were manually removed at each removal timing. Crop yield was determined following mechanical harvest. The experiments were designed as a randomized compete block with four replications. Data were subjected to analysis of variance and regression analysis.

Data analysis indicated that the critical timing of removal for RR soybean as a weed within a RR cotton crop was 2.5 and 6.5 wk in North Carolina and St. Joseph, respectively. Although competition began much earlier, RR cotton yield was much lower in North Carolina and the duration of interference had much less effect on overall cotton yield at that location. In RR soybean, the critical removal timing for RR cotton as a weed was 7.1 wk.

Based on results, RR cotton yield can be negatively affected in North Carolina and Louisiana when RR soybean is allowed to compete for 2.5 and 6.5 wk, respectively. In RR soybean, RR cotton can reduce yield if allowed to compete for 7.1 wk. Adequate control measures should be taken within each crop prior to these critical timings to maximize yield. Extreme rainfall in Louisiana during the early growing season, however, may have contributed to increased competition period prior to yield loss, therefore experiments will be repeated in 2005. Although yield may not be affected prior to weed removal at the critical timing, other factors such as weeds serving as hosts for crop pests should be taken into consideration in management decisions.

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

ABSTRACT

Research on weed scouting methodology is needed in order to increase the existing knowledge about threshold-based weed management decisions in peanuts. Sixteen on-farm field trials were conducted in 2003 and 2004 to evaluate weed control in peanuts using four different scouting methods. County Extension personnel were provided travel money, new handheld computers, and extensive training sessions for use in the trials. Field plots ranged from 8 to 10 acres each, and were located on farms in eight peanut-producing counties in eastern North Carolina. The Extension agents contacted and arranged permission from the grower to conduct the research on their farm. Objectives of the research were focused on obtaining estimates for scouting times and determining quality of herbicide recommendations using four different scouting procedures, comparing herbicide recommendations made by the extension agent with those generated by HADSS, and acquainting extension agents with HADSS while obtaining evaluations on performance.

Different locations were scouted each year in each of the eight different counties resulting in sixteen unique locations. Three scouts (including the agent) determined weed populations in fields approximately three weeks after peanut was planted. Weed populations were estimated using four different methods: 1) windshield (standing on the edge of the field, each scout identified weed species and estimated population densities); 2) loop (each scout walked a loop through the field and estimated weed species and densities); 3) range (each scout recorded weed populations from six random spots in the field using a range from 1-5 where 1 was very low and 5 was very high); and 4) counts (each scout identified and counted weed populations from six random spots in the field). The Extension agent returned to the field two additional times during the growing season to monitor weed control. The decision support system HADSS^{TM} was used to determine the optimal treatment for each field and expected net return for each available treatment. HADSS uses current market prices for peanut and herbicides, as well as estimated yield loss based upon weed competition, to determine expected net return. Count data from 18 randomly-selected spots in the field were used to determine the optimal treatment.

Each scouting method was analyzed to determine accuracy (based upon $ lost/acre), and time required for completion. On average, the windshield method took 6 minutes to scout, the loop method 15, the range method 20, and the count method 30. The count method resulted in the fewest mistakes in treatment selection (2.5% loss on average), but was the most expensive method due to the time required (30 minutes). A less time-consuming and still fairly accurate method was the loop method (3.6% loss) because it only took an average of 15 minutes to complete. In 2003 the most inaccurate scouting method was the windshield method (6.2% loss). Not surprisingly, the windshield method is also one of the fastest and easiest ways to scout weeds. In 2004 the most inaccurate scouting method was the range method (12.7% loss). Some of the inaccuracy of the range method may be attributed to confusion among the scouts. In most cases, the agent agreed with the recommendations generated by HADSS, and at least one of the top 5 herbicide recommendations in HADSS corresponded with the agent recommendation.

RICE CULTIVAR ROOTING TOLERANCE TO PENOXSULAM (GRASP). A.T. Ellis, B.V. Ottis, and R.E. Talbert; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

Two separate studies were conducted at the Rice Research and Extension Center in Stuttgart, AR in 2004 to assess the effects of penoxsulam on root development of rice. In one experiment observations were made on the effect of penoxsulam on rice rooting tolerance (root pruning) at four timings each at 2 rates. Wells cultivar was drill-seeded at 100 kg/ha. Application were made at the 1- to 2-leaf (lf) rice stage, 4- to 5- lf rice stage, postflood (POFLD) 1 wk, and at panicle iniation (PI) with rates of 0.035 kg ai/ha (1x) and 0.07 kg/ha (2x). Root pruning from the 4- to 5-lf application was (58%) for the 1x rate at 2 wk after flood (WAF) and 52% for 2x rate. Root pruning from 1- to 2-lf and POFLD 1wk applications with the 1x rate was 38% and 45%, respectively, 2WAF and 41 and 44% with the 2x rate at the same timing. The PI application had no effect on root pruning. No significant differences were observed in root pruning between rates or timings. At 3 WAF there was no root pruning observed with any treatment. The root pruning observed during the vegetative stage of the rice plants had no effect on yield.

The second study evaluated the response of four cultivars to 0.035 kg/ha (1x) and 0.07 kg/ha (2x) rates of penoxsulam applied at the 4- to 5- lf rice stage. Cultivars Wells, Cocodrie, XL8, and Bengal were chosen in this study. Wells, Cocodrie, and Bengal were drill-seeded at 100 kg/ha and XL8 at 33 kg/ha. XL8 was the most tolerant to root pruning from penoxsulam, peaking at 28% with the 2x rate 7 days after treatment. Cocodrie was the least tolerant to penoxsulam with 65% root pruning from the 1x rate and 77% from the 2x rate at 2WAF. Wells and Bengal showed 63% root pruning with the 2x rate 2 WAF. Wells was the only cultivar to show a significant rate response between the 1x rate (38% pruning) and the 2x rate (63% pruning). Root growth had fully recovered by 3 WAF. The yields for all cultivars were not affected by pruning observed following applications of penoxsulam.

WEED SPECTRUM SHIFTS FOLLOWING PASTURE CONVERSION WITH SEVEN YEARS OF GLYPHOSATE-RESISTANT SOYBEAN PRODUCTION. C.J. Gray, D.R. Shaw, and K.C. Hutto; Mississippi State University, Mississippi State, MS.

ABSTRACT

A seven-year experiment with glyphosate-resistant soybean [*Glycine max* (L.) Merr.] was initiated in 1998 at the Black Belt Branch Experiment Station near Brooksville, MS. The experiment was designed to observe weed population shifts in a variety of different continuous conventional and glyphosate weed management systems. The field size was 7.8 ha, and prior to 1998 was in tall fescue (*Festuca arundanacea* Schreb.) pasture. Each year 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. In 1998 the most prevalent weed was yellow foxtail (*Setaria glauca* L.); however, in 2003 and 2004, four of the most prevalent weed species were yellow nutsedge (*Cyperus esculentus* L.), horsenettle (*Solanum carolinense* L.), broadleaf signalgrass [*Brachiaria platyphylla* (Griseb.) Nash], and hophornbeam copperleaf (*Acalypha ostryifolia* Riddell). These data were then subjected to linear regression analysis using year as a repeated measure. Weed maps were interpolated using inverse distance weighted procedures.

Horsenettle, broadleaf signalgrass, and hophornbeam copperleaf populations have increased linearly over the seven-year period. The yearly average increase for horsenettle, broadleaf signalgrass, and hophornbeam copperleaf is 3805, 1320, and 975 plants/ha, respectively. In areas of the field containing the greatest horsenettle densities, populations have increased from 7 plants/m^2 in 1998 to more than 30 plants/m^2 in 2002, 2003, and 2004. Broadleaf signalgrass populations have increased from 20 plants/m^2 in 1998 to over 45 plants/m^2 in 2002 and 2003. Hophornbeam copperleaf was not found in the field in 1998; however, in 2004 hophornbeam copperleaf populations reached 70 plants/m^2.

Yellow nutsedge populations have not shown a linear trend, suggesting populations are neither increasing nor decreasing over time. The constant yellow nutsedge populations can be attributed to the species' natural affinity to be found in low, wet areas of the field.

Weed spectrum shifts could be expected since other grass and broadleaf weeds were eliminated allowing these species to flourish. In addition, all glyphosate applications were made mid- or late-postemergence. At these application timings, weed sizes were larger than desired and weed escapes eminent. Thus, indicating that seven years of repeated herbicide application can select for weed populations that are not controlled or only marginally controlled by their activity resulting in population shifts.

INTERFERENCE AND SEED RAIN DYNAMICS OF JIMSONWWEED IN PEANUT. W.L.Barker, M. Schroeder, C.M. Wilcut, and J.W. Wilcut.

ABSTRACT

While jimsonweed (*Datura stramonium* L.) is not typically considered to be a problematic weed in many of the southern states, it can be a problematic weed in many of the Southeast transitional states. Jimsonweed plants can reach heights of 67 cm in cotton. Jimsonweed has been shown to be a problematic weed in North Carolina and the effects of interference in peanut (*Arachis hypogaea* L.) have not been evaluated. Therefore, objectives of this study were to determine yield and growth reductions caused by jimsonweed interference in peanut. Experiments were conducted in 2004 at the Upper Coastal Plain Research Station located near Rocky Mount, NC and the Cherry Research Farm near Goldsboro, NC. Herbicide applications were made 6 weeks after planting to control weeds other than jimsonweed. Treatments included clethodim at 0.125 lb ai/A and bentazon at 0.75 lb ai/A over the top and a hooded application of acifluorfen at 0.25 lb ai/A. With the exception of jimsonweed, the experimental area was kept weed-free by weekly hand-hoeing. Fertilization and insect and disease management practices were standard for peanut production in North Carolina. Jimsonweed seedlings at the cotyledon to 2-leaf stage were planted into plots immediately after peanut planting at the following densities: 0, 1, 2, 4, 8, 16, and 32 plants per 20 ft of row. Jimsonweed seedlings were planted into the center two rows of each plot with the two outer rows left as weed-free borders. There were no jimsonweed density effects on peanut diameter. As jimsonweed density increased, peanut height also increased. The Gompertz equation was used to describe peanut and jimsonweed height over time, which also increased with increasing density. Contrary to peanut and jimsonweed height, number of seed produced per plant decreased with increasing jimsonweed density, nearly 30,000 seed per one plant per row, which was reduced to 10,000 seed per plant when densities increased to 32 plants per 20 ft of row. Percent peanut yield reduction increased with increasing jimsonweed density. A rectangular hyperbola was fitted to percent yield loss (y = (ID)/[1 = (ID/A)]), where *y* is the percent yield reduction, *I* the yield loss per weed and weed density approaches zero, *D* is weed density, and *A* is the asymptote for yield loss. The *i* value for jimsonweed in peanut is 10.7, *i* is the percent yield loss as weed density approaches zero, with *a* equaling 98. As a comparison, the *i* value for common ragweed in peanut was 68, indicating common ragweed was more competitive in peanut than jimsonweed. Three herbicides were evaluated for economic threshold, aciflourfen, bentazon, and imazapic. Imazapic as the most expensive herbicide required higher infestation to gain a return on the investment, 1 plant per 7.1 ft of row compared to 11 or 12 ft of row for bentazon or aciflourfen, respectively.

INTERFERENCE OF CLEARFIELD CORN IN PEANUT. W. J. Everman, I. C. Burke, J. D. Wilcut, and J. W. Wilcut; NC State University, Raleigh, NC

ABSTRACT

Imidazolinone herbicides are commonly applied pre and postemergence in peanut. With the introduction of Clearfield corn the potential for volunteer corn to become problematic in peanut is increased. No studies have evaluated interference relationships of imidazolinone resistant corn in peanut. Therefore, objectives of this study were to determine yield and growth reductions caused by Clearfield corn interference in peanut and to determine an economic threshold for herbicide application to control Clearfield corn in peanut. Thus, studies were conducted to evaluate the competitiveness of Clearfield corn when plants are grown at several densities in peanut. Separate studies (RCBD, 3 replications) were conducted at the Upper Coastal Plain Research Station near Rocky Mount and the Peanut Belt Research Station near Lewiston-Woodville, NC in 2004. Clearfield corn seed was planted in the middle two of four peanut rows at 0, 0.05, 0.1, 0.2, 0.4, 0.8, and 1.6 plants ft^{-1} crop row. Undesirable weeds were removed throughout the season with herbicide applications when necessary and weekly hand weeding. Height and diameter of four peanut and height of 4 corn plants per plot were collected at 3, 4, 5, 8, and 13 weeks after planting. Just before peanut harvest, 4 corn plants were harvested by hand for biomass as well as seed set and weight. The remaining corn plants were removed to aid inversion of peanut for harvest. Peanut plots were then harvested and yield determined. Bi-weekly height and diameter data were fit to the Gompertz growth equation and estimated parameters and year effects were evaluated in SAS statistical software. ANOVA was conducted with sums of squares partitioned to test for linear and nonlinear effects of corn density and location effects. Regression analysis (linear or nonlinear depending on ANOVA) was used for the seven densities in peanut and trends with significant correlation coefficients were interpreted.

Corn did not influence trends in peanut height at any density; however, peanut diameter was reduced as corn density increased. Peanut plants caused a height reduction in corn plants at a density lower than 0.4 plants per ft crop row. The relationship between corn density and peanut yield was fit to the hyperbolic function (Y=IX/(1+(IX/100)), with asymptote constrained to 100%, which explained the relationship between corn density and percent yield loss. The competitiveness of corn was indicated by the estimated value of *I*, which was 38.6. As a comparison, the *I* value for common ragweed in peanut was 68, indicating common ragweed was more competitive in peanut than corn, and the *I* value for jimsonweed in peanut was 10.7, indicating corn was more competitive than jimsonweed. An economic threshold for application of clethodim (Select at \$16.04 A^{-1} for chemical plus application) and sethoxydim (Poast at \$12.53 A^{-1} for chemical plus application) or (Poast Plus at \$13.66 A^{-1} for chemical plus application) would be 1 plant in every 25, 32, and 29 feet of crop row, respectively.

INTERFERENCE OF LIBERTYLINK CORN IN LIBERTYLINK COTTON. S.B. Clewis, W.J. Everman, C.M. Wilcut, and J.W. Wilcut; Crop Science Department, North Carolina State University, Raleigh, NC.

ABSTRACT

Experiments were conducted at the Peanut Border Belt Research Station near Lewiston-Woodville, the Upper Coastal Research Station near Rocky Mount, and the Central Crops Research Station near Clayton, NC in 2004. Cotton was planted on either 36 or 38 in row spacing depending on the location in 12 by 20 foot plots. The cotton variety FiberMAX 9598LL was planted in early to mid-May in sandy loam soils typical of North Carolina cotton production land. The corn hybrid 'Pioneer 34A55' was planted on the same day as cotton at each location. Glufosinate-resistant corn densities were 0, 1, 2, 4, 8, 16, and 32 corn plants per 20 feet of crop row. All studies were in a randomized complete block with three replications of treatments. Densities were maintained on the center two rows of the plots. Plots were keep weed free except for the corn for the entire growing season. Several types of data were collected throughout the growing season. Corn and cotton heights were taken at Lewiston, Rocky Mount, and Clayton. Corn was hand harvested at maturity. Four corn plants were taken to quantify kernel set and dry plant biomass. For the second set of studies, only one time of removal study was conducted at Central Crops Research Station near Clayton, North Carolina in 2004. Similar to density studies, this study used a randomized complete block design with three replications of treatments. 32 corn plants were planted in the center two rows of each plot. Time of removal treatments included 1, 2, 4, 6, 8, 10, and 12 weeks after planting. Weed-free and season long corn interference treatments were also included. All plots were hand weeded to maintain weed-free plots except for inter-planted corn.

Cotton height of the weed free treatment was the tallest with a similar trend of as the density of corn plants increased, cotton height decreased with the smallest cotton height correlating to the highest corn density for all locations. Corn plants began to canopy the cotton at 4 weeks after planting at Lewiston and Rocky Mount. At Clayton, corn plants began to canopy the cotton at 5 weeks after planting. A density of 2 corn plants per row resulted in a 5-10% yield reduction at all locations. 4 corn plants per row resulted in a 12-20% reduction and 32 corn plants per row resulted in a 55-65% of the cotton yield potential to be loss. Based on recommended graminicide rates in North Carolina, 1corn plant/32-89 ft of row would warrant the use of control measures. *I* values generated for this work ranged from 3.71 to 5.37 correlating to similar *i* values of prickly sida based on other's research. For the time of removal study, cotton height was the tallest in the absence of corn interference. The longer the corn was allowed to compete with the cotton the shorter the cotton grew. Cotton never recovered after 4 weeks of corn interference. As the time of removal was delayed, a correlation was seen with cotton height and yield loss. Cotton height decreased and yield loss increased. Only 2 weeks of interference caused a 10% cotton yield loss. At 4 weeks of interference, cotton height lost 2 inches and 20% of its yield potential.

There is a small window of two weeks after planting to remove volunteer corn plants to maximize your cotton yield potential. Even though glufosinate-resistant corn had a small *i* value, there is still a viable concern for yield loss to growers in a total postemergence system.

RED RICE MANAGEMENT IN LOUISIANA RICE. C.T. Leon, E.P. Webster, W. Zhang, 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. Red rice infestations result in yield loss, harvesting problems, and quality loss through discounts. In the past, red rice has been managed using cultural practices such as water-seeding to reduce red rice germination. Our study was designed to evaluate water-seeding practices in conjunction with glufosinate- and imazethapyr-resistant rice technologies for season-long red rice control. The study was conducted using a split-plot design with a 3 by 5 by 2 FAT with 4 replications. Factor A was flood management (continuous, pinpoint, delayed); factor B was herbicide program (no glufosinate, 500 g ai ha^{-1} glufosinate applied EPOST fb LPOST, no imazethapyr, and 70 g ai ha^{-1} imazazethapyr applied PRE fb MPOST or EPOST fb LPOST); and Factor C was red rice infestation (0 or 20 plants m^{-2}).

Plot size was 1.5-m x 5.2-m. The fertilizer program consisted of 280 kg ha^{-1} 8-24-24 applied preplant incorporated followed by 280 kg ha^{-1} urea nitrogen (34-0-0) postflood. The study was planted May 3, 2002, May 14, 2003, and May 25, 2004. Seed was broadcast by hand into individual plots and the water was drained 24 hr after planting. The permanent flood was established 3, 6, and 27 d after planting for the continuous, pinpoint, and delayed floods, respectively. Rice and red rice plant height and d to 50% heading were recorded. Weed control ratings for hemp sesbania, red rice, barnyardgrass, and Amazon sprangletop were evaluated. The plots were harvested with a small plot combine. A 125-g subsample from each plot was milled using a McGill Mill to determine head rice and total milling percent. The milled samples were graded according to USDA guidelines with respect to red rice contamination.

Data was analyzed using the Mixed Procedure of SAS with year used as a random factor. Years, replication (nested within years), and all interactions containing either of these effects were considered random effects; treatment was considered a fixed effect. Considering year or combination of year as random effects permits inferences about treatments over a range of environments. Type III statistics were used to test all possible effects of fixed factors (flood management, herbicide treatment, and presence of red rice) and least square means were used for mean separation at 5% probability level ($p \leq 0.05$).

Glufosinate controlled hemp sesbania 98%, but no combination of imazethapyr and flood management controlled hemp sesbania more than 35%. With the exception of imazethapyr applied EPOST fb LPOST, red rice, barnyardgrass, and Amazon sprangletop were controlled at least 95%. Applying imazethapyr PRE controlled Amazon sprangletop 96% compared with 79% control when the first application was applied EPOST.

Weed interference reduced rice height 7 to 12 cm. Red rice, compared with the rice cultivars evaluated, reached 50% heading 3 d before to 12 d after in the continuous flood, 6 d before or after rice in the pinpoint flood, and 2 d before to 1 d after rice in the delayed flood. Regardless of the flood management system and herbicide applied, the possibility of outcrossing was always present and the technologies should be managed with that in mind to ensure outcrossing does not occur. There was no difference in head rice or total milling percent within each herbicide tolerant system. Applying either glufosinate or imazethapyr improved rice grade to USDA number 1 or 2 compared with the nontreated, which was USDA grade 4. Only the USDA grade 4 would have received a loan discount, which would be $0.60 per hundredweight. When either herbicide was applied there were one or fewer red rice panicles per 8 m^2 plot at harvest. Delaying the permanent flood improved rice yield by allowing more time for root establishment.

In this small plot research, flood management was not critical for adequate weed control due to how rapidly the permanent flood can be established. In an imazethapyr system, herbicide timing was important for Amazon sprangletop control, and alternative herbicides are needed to control hemp sesbania. In large fields, permanent flood establishment will be important to maintain adequate weed control and prevent weed reemergence following the final herbicide application.

BAS 772 H FOR WEED CONTROL IN CLEARFIELD* RICE. **S.D. Willingham, J.H. O'Barr, G.N. McCauley, J.M. Chandler; Texas Agricultural Experiment Station, Texas A&M University, College Station, TX 77845-2474**

ABSTRACT

BAS 772 H, a premix of NewPath and Facet, to be named Clearpath^{TM}, is a new herbicide developed by BASF for control of red rice, grasses and broadleaf weeds in CLEARFIELD* rice. Field studies were conducted in 2003 and 2004 at the Texas Agricultural Experiment Station near Beaumont, Texas to evaluate treatment application timings and combinations using BAS 772 H and NewPath.

Rice variety CL161 was drill-seeded at 80 lbs/A with red rice drilled perpendicular at 30 lbs/A to ensure uniform and adequate red rice levels. BAS 772 H was applied to rice preemergence (PRE), at the rice1 leaf, 4 leaf, or 1 tiller stage at 0.363 lb ai/A fb NewPath at 4oz/A at the same application timings. A non-treated check, command plus NewPath fb NewPath, and NewPath fb NewPath treatments were applied at the labeled rates for comparison. Red rice (*Oryza sativa*), hemp sesbania (*Sesbania exaltata*), and barnyardgrass (*Echinochloa crus-galli*) control and crop injury was evaluated.

Red rice and barnyardgrass control was >90% with all treatments of NewPath and BAS 772 H independent of which herbicide was applied PRE or at the 4 leaf stage. BAS 772 H applied at rice 1 leaf fb NewPath at rice 4 leaf obtained 90% control of red rice compared to NewPath applied at 1 leaf fb ClearPath at 4 leaf, receiving 85% control. Later applications of NewPath or BAS 772 H at the rice 1 tiller stage following a one-leaf application resulted in control greater than 93%. Hemp sesbania control was achieved greater than 82% for all treatments that included BAS 772 H. In 2003, early applications (PRE and 1 leaf) of BAS 772 H provided less control ranging between 82 and 85% when compared to the later applications at 4 leaf and 1 tiller. In 2004 there were no significant differences providing greater than 90% control. No visual crop injury was noted, however, rice yield significantly decreased when single treatments of NewPath and command were applied. This was due to the lack of control of hemp sesbania whereas treatments using the premix BAS 772 H obtained the highest yields.

COMPARISON OF DRIFT CONTROL ADJUVANTS USING AIR MIX® AND EXTENDED RANGE TEEJET® SPRAY NOZZLES.

G.D. Wills[1], J.E. Hanks[2], E.J. Jones[1], R.E. Mack[3], and B.W. Alford[3]; [1]Delta Research and Extension Center, [2]USDA-ARS Application Production and Technology Research Unit, Stoneville, MS, and [3]Helena Chemical Co., Memphis, TN.

ABSTRACT

Field and laboratory studies were conducted to determine the effect of the drift control adjuvants HM 2005B, HM 0343, and HM 9752 each at 9 lb/100 gal on the efficacy and droplet size of glyphosate as formulated without surfactant as Roundup D-Pak® and with surfactant as Roundup Original® with both the TeeJet® Extended Range 110015VS and the Greenleaf Technologies Air Mix® 110015 spray nozzles. In the field study, glyphosate was applied at 0.5 lb ai/A which is less than the recommended rate of 1 lb ai/A in order to detect any increase or decrease in efficacy due to the addition of the drift control adjuvants. Mixtures of glyphosate formulated both with and without surfactant were applied with each drift control adjuvant using a tractor-mounted sprayer at 42 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.] spaced 38 inches apart, 40 feet long and interspaced with 3-to 5-inch-tall barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], 4-to 6-inch-tall pitted morniggloryy (*Ipomoea lacunosa* Lag.), 1- to 3-inch-tall prickly sida (*Sida spinosa* L.), and 3-to 5-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. In the laboratory study, droplet size was determined for each combination of spray mixture with glyphosate at 1 lb ai/A and nozzle type using an Insitec Measurement Systems® laser particle analyzer at 40 psi spray pressure as replicated three times. Droplet size was determined as the percentage of the spray volume resulting in fine highly driftable droplets less than 141 microns (< 141 *u*) in diameter. Data were subjected to analysis of variance. Means were separated using Fisher's Protected Least Significant Difference (LSD) at P=0.05.

The percent of the spray volume as fine droplets (<141 *u*) over all combinations of nozzle types and spray mixtures ranged from 7 to 13% using the Air Mix 110015 spray nozzle type to 31 to 49% using the Extended Range 110015VS nozzle type. With the Extended Range nozzle type, the percent of the spray volume as fine droplets <144 *u* using glyphosate formulated without and with surfactant with no drift control adjuvant was 47 and 49%, with HM 2005B was 33 and 33%, with HM 0343 was 33 and 31%, and with HM 9752 was 39 and 33% respectively. With the Air Mix nozzle type, the percent of the spray volume as fine droplets using glyphosate formulated without and with surfactant with no drift agent was 11 and 13%, with HM 2005B was 7 and 7%, with HM 0343 was 8 and 8%, and with HM 9752 was 9 and 10% respectively.

At 2 WAT, weed control of the four weedy species in this study using the Extended Range nozzle type with glyphosate formulated without surfactant with no drift control agent was 81 to 93%, with HM 2005B was 93 to 97%, with HM 0343 was 90 to 94%, and with HM 9752 was 91 to 95%. Using glyphosate formulated with surfactant the percent control with no drift agent was 89 to 96%, with HM 2005B was 91 to 96%, with HM 0343 was 94 to 98%, and with HM 9752 was 94 to 98%. Weed control with the Air Mix nozzle type using glyphosate formulated without surfactant with no drift agent was 55 to 90%, with HM 2005B was 80 to 95%, with HM 0343 was 89 to 94%, and with HM 9752 was 88 to 97%. Using glyphosate formulated with surfactant with no drift control agent was 84 to 95%, with HM 2005B was 90 to 95%, with HM 0343 was 88 to 95%, and with HM 9752 was 91 to 98%. Averaged over all treatment mixtures there were less volumes of fine (<141 *u*) spray droplets using the Air Mix than using the Extended Range nozzle types. With each nozzle type, there were similar effects on herbicidal efficacy and droplet size with each drift control adjuvant. With each nozzle type, the addition of a drift control adjuvant to glyphosate formulated without and with surfactant resulted in approximately 25 and 35% less spray volume as fine droplets respectively than glyphosate with no drift control adjuvant.

GLYPHOSATE-RESISTANT HORSEWEED (CONYZA CANADENSIS) CONTROL WITH GLUFOSINATE (IGNITE): SELECTED FIELD AND CONTROLLED-ENVIRONMENT STUDIES. M.R. McClelland, R.E. Talbert, J.L. Barrentine, K.L. Smith, and G.M. Griffith. Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

Glufosinate (Ignite) is a promising preplant option for glyphosate-resistant horseweed control in Arkansas because of its broad spectrum of activity and lack of plantback interval. However, activity has been erratic, with many plants regrowing from axillary buds after glufosinate application. Glufosinate binds to glutamine synthetase, preventing ammonia assimilation, which leads to ammonia toxicity, disruption of amino acid levels, and inhibition of photosynthesis. Glufosinate activity is affected by temperature, relative humidity, light intensity, time-of-day of application, soil moisture, and differential plant species susceptibility due, in part, to differential absorption and translocation. After evaluating rates of Ignite in the field, we initiated controlled-environment studies to begin to determine why erratic response of horseweed to glufosinate occurs. Temperature and effect of light intensity were evaluated.

A field study was conducted at Marianna, AR, on a heavy horseweed population (1 plant/ft^2; 1- to 8-inch-tall plants). Glufosinate was applied at 0.21, 0.31, 0.42, 0.52, and 0.63 lb ai/A (16, 24, 32, 40, and 48 oz Ignite/A). Ignite was applied with flat-fan nozzles at 20 GPA output volume. Plants for growth chamber studies were grown in Sunshine Mix from seed from glyphosate-resistant plants. After emergence in flats, seedlings were transplanted into 4-inch pots at two plants per pot. Experiments were conducted as split plot designs with three or four replications. Shaded plants in the shade experiments were placed in a shade box covered with 50% shade cloth, and one experiment was conducted in the growth chamber and one in the greenhouse. (Temperatures and light intensities for each experiment are presented along with results.) Plants were sprayed with glufosinate using a backpack sprayer with flat-fan nozzles at 15 gpA. Visual injury on a scale of 0 to 100% was recorded weekly for 4 wk after treatment. Data were analyzed by ANOVA, and means were separated with an LSD.

In the field study, horseweed control with glufosinate at less than 0.52 lb/A was poor (<70%) at 30 DAT. Control from 2,4-D alone was poor, but 2,4-D helped prevent regrowth common with glufosinate. In temperature study I, initial activity on large rosette (36 leaves) plants was more rapid at warm (78/59 F day/night) temperatures than at cool (58/44 F) temperatures. Control with Ignite at 0.26, 0.39, and 0.52 lb/A was complete in either temperature, but control with 0.13 lb/A was better by 22 DAT under cool temperatures than warm. Regrowth of plants grown in the warm regime was significant, and control was only 48% by 28 DAT, compared to 95% in the cool regime. In a similar study on larger plants (two sizes: 5- to 7-in. and 11- to 16-in. tall), control was better 14 DAT in the cool temperature regime than in the warm regime (97 and 76%, respectively, averaged over the two sizes and Ignite at 0.39 and 0.52 lb/A). Under warm conditions, plants were controlled better by 0.52 lb/A than by 0.39 lb/A, but control of plants in the cool environment did not differ. By 28 DAT, plants in the cool environment were controlled 94 to 98%, but plants in the warm environment had significant regrowth, and control was only 23% with 0.39 lb/A and 56% with 0.52 lb/A. Results of shaded plants differed depending on whether they were grown in the greenhouse or growth chamber. Growth chamber plants responded as expected, with better control of non-shaded (430 umol cm^{-2} s^{-1}) plants than shaded (185 umol cm^{-2} s^{-1}) plants at 14 DAT, but equal control (99%) by 28 DAT. Day/night temperatures were cool for this experiment (58/45, no shade; 55/45, shade). In the greenhouse, however, plants growing in shade (240 umol cm^{-2} s^{-1}) were controlled better than plants growing in no shade (620 umol cm^{-2} s^{-1}) (89 and 64%, respectively) at 28 DAT. Other researchers have reported that temperature was less important than factors such as relative humidity and soil moisture for control of some species with glufosinate. Our results suggest that temperature does have some importance for control of horseweed. It is possible that under cool conditions, there is a slow, but chronic, accumulation of ammonia that may inhibit horseweed regrowth. Shade may have a similar effect. These factors may also prevent rapid contact activity of the Ignite, allowing better penetration and translocation. Effects on ammonia accumulation in horseweed treated under different temperatures, relative humidity, and light intensities and absorption and translocation patterns need to be explored.

EFFECT OF ADDING SURFACTANT TO VARIOUS GLYPHOSATE PRODUCTS FORMULATED WITH SURFACTANT. J.E. Hanks, USDA-ARS, Stoneville, MS 38776; J.A. Garr, GARRCO Products, Inc., Converse, IN 46919; and G.D. Wills, Mississippi State University, Delta Research and Extension Center, Stoneville, MS 38776.

ABSTRACT

Preliminary studies were conducted at Stoneville, MS to determine the effect of using additional surfactant with glyphosate products formulated with surfactant. The four commercially available glyphosate formulations used were Weathermax®, Glyphomax Plus®, Gly Star Plus®, and Clearout®. Each glyphosate formulation was applied at a rate of 0.420 kg a.e./ha with the surfactant Improve™ added at rates of 0.25% and 1.0% v/v and without additional surfactant in a spray volume of 94 L/ha. Applications were made with a 4-row boom mounted on a John Deere 2355 tractor equipped with an air compressor to pressurize the spray system. Spraying Systems Turbo TeeJet®, 110015vs nozzles were used and calibrated to apply 94 L/ha at 7.4 km/hr. Applications were over-the-top to four rows each of non-Roundup Ready® soybeans (*Glycine max* L. Merr) 'Pioneer 9594' spaced 1-m apart, 13-m long and interspaced with velvetleaf (*Abutilon theophrasti* Medik.). Barnyardgrass [*Echinochoa crus-galli* (L.) Beauv.] was broadcast over the entire area. Percent control over all the plant species in the field study at 3 WAT with glyphosate applied without Improve, 0.25% Improve and 1.0% Improve respectively was: with Weathermax®, 80 to 83%, 85 to 88%, and 85 to 86%; with Gly Star Plus®, 84 to 90%, 85 to 91%, and 88 to 90%; with Glyphomax Plus®, 86 to 91%, 85 to 90%, and 88 to 91%; and Clearout®, 86 to 90%, 90 to 93%, and 91to 95%. The only significant differences were the control of velvetleaf with Weathermax® using no additional surfactant at 80% and Clearout® with each rate of additional surfactant at 95%. All of the glyphosate formulations without additional surfactant provided excellent control of all the plant species. Although additional surfactant would not be required, it did provide slightly better control.

THE EFFECT OF CARRIER VOLUME AND NOZZLE TYPE ON COTTON DEFOLIANT EFFICIACY.
J.D. Siebert, A.M. Stewart, D.K. Miller, and C.C. Craig; Louisiana State University, Baton Rouge, LA and University of Tennessee, Jackson, TN.

ABSTRACT

One of the major limitations of effective defoliation in cotton is the inconsistent response of leaves to chemical treatment for abscission. The efficiency of a defoliant is directly related to plant condition and weather at the time of application; however, other important factors include spray coverage, canopy penetration, volatilization, photodecomposition, translocation, and absorption. Many of these factors can be manipulated by varying carrier volume and nozzle type to enhance cotton defoliant efficacy.

Field studies were conducted at the Dean Lee Research Station in Alexandria, LA (2003), the Northeast Research Station in St. Joseph, LA (2003 & 2004), and the West Tennessee Experiment Station in Jackson, TN (2004) to determine the optimum combination of carrier volume and nozzle type to maximize efficacy of defoliants with both hormonal and herbicidal modes of action. A factorial treatment arrangement was used to evaluate all combinations of flat fan, hollow cone, and air induction nozzles at carrier volumes of 5, 10, and 15 GPA with both herbicidal (tribufos) and hormonal (thidiazuron) defoliant applied alone. Spray equipment was calibrated to deliver 10 GPA at 2.0 MPH and carrier volumes were varied by adjusting ground speed to maintain a constant spray pressure. Defoliants were applied to mature cotton with approximately 70% open bolls. Visual defoliation, desiccation, and regrowth evaluations were made 3 to 35 DAT. Data were subjected to analysis of variance using the SAS Proc GLM procedure. Treatment by location interactions were noted for all variables.

At Dean Lee, averaged across defoliants and carrier volumes, flat fan and hollow cone nozzles provided significantly greater defoliation, 77.7 and 77.5%, than did air induction nozzles, 71.1%, at 14 DAT. Defoliation with flat fan and air induction nozzles was similar 21 DAT, however defoliation with hollow cone nozzles was still significantly greater than air induction nozzles. Significantly less terminal regrowth (21 DAT) was observed when using flat fan and hollow cone nozzles, 14.2 and 15.3%, when compared to air induction nozzles at 20.0%, respectively. Basal regrowth was not influenced by nozzle type. There was significantly more desiccated leaf material present 7 DAT with application at 15 GPA when compared to 5 or 10 GPA regardless of type of defoliant or nozzle used.

Studies in both 2003 and 2004 at St. Joseph showed very similar results. Regardless of defoliant and carrier volume, flat fan and hollow cone nozzles increased defoliation at least 16.3% at both 7 and 19 DAT, compared to air induction nozzles. Although the differences were not as great in 2004, flat fan and hollow cone still performed significantly better across defoliants and carrier volumes than air induction nozzles. In both years, regardless of defoliant and nozzle type, defoliation generally increased as carrier volume increased. In 2003, 15 GPA provided significantly greater defoliation levels at both 7 and 19 DAT compared to 5 GPA. In 2004, defoliation was significantly less with 5 and 10 GPA compared to 15 GPA at 12 DAT.

In Jackson, due to cool temperatures, treatments containing thidiazuron provided little defoliation activity and were omitted from the statistical analysis. Hollow cone nozzles provided significantly greater defoliation than air induction nozzles 7 DAT and were superior to both flat fan and air induction nozzles at 14 DAT, regardless of carrier volume. Leaf defoliation and desiccation was significantly greater with application at 10 and 15 GPA (7 DAT) compared to 5 GPA across all nozzle types. Leaf defoliation increased as carrier volume increased from 5 to 15 GPA. Higher levels of terminal regrowth were associated with use of flat fan nozzles and application with carrier volumes less than 15 GPA.

Enhanced defoliation and regrowth control with flat fan or hollow cone nozzles at high carrier volumes is attributed to increased canopy coverage, which was evident on water sensitive cards. These data support current defoliation application recommendations in both LA and TN (and product labels of many currently registered cotton defoliants) which advise using flat fan or hollow cone nozzles at carrier volumes no less than 10 GPA. Even though most defoliation recommendations prefer hollow cone nozzles, these data indicate that performance of flat fan nozzles can be very similar to hollow cones. In any case, the use of air induction nozzles should not be recommended for cotton defoliation due to inconsistent and generally inferior performance. These recommendations are even more crucial for producers wishing to achieve adequate defoliation for a once over harvest with a single harvest-aid application.

WEED MANAGEMENT IN REDUCED TILLAGE SUGARCANE. W. E. Judice, J.L. Griffin, C.A. Jones, and L.M. Etheredge. Louisiana State University AgCenter, Baton Rouge, LA 70803.

ABSTRACT

Sugarcane is a perennial crop and in Louisiana four to six harvests are made from a single planting. Traditionally sugarcane row shoulders and middles are tilled to promote crop growth, eliminate ruts, incorporate residue from the previous crop, 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.

In 2002, herbicides were applied in March at several locations after sugarcane was either off-barred (tillage of row shoulders and middles) or not off-barred. Sugarcane shoot population assessed around 4 weeks after herbicide application was as much as 12% greater where rows were not off-barred. Weed control was excellent in all experiments. At one site at layby in May, soil moisture was greater and sugarcane was taller in plots that had not been off-barred in March. Sugarcane height throughout the growing season was equal whether or not sugarcane had been off-barred.

Research in 2002 and 2003 evaluated the effect of off-bar tillage in March (with or without) and tillage at layby in May (with or without) on weed control and sugarcane growth. Dupont K4 (a premix of hexazinone and diuron) herbicide was used and weeds were not a detriment to sugarcane growth or yield regardless of tillage program. Soil temperature in the sugarcane drill for the March tillage and no-tillage treatments did not differ. Early-season sugarcane shoot population and late-season stalk population both years were each equivalent for the full tillage (off-bar plus layby tillage) and the no tillage program. Sugarcane and sugar yield were not negatively affected when tillage operations were eliminated.

Experiments in 2004 evaluated the possible interaction between tillage and management of sugarcane residue remaining after harvest on weed control, sugarcane growth, and sugarcane and sugar yield. This study was conducted at three locations using a randomized complete block design with a factorial arrangement of treatments. Factor A represented crop residue management (removal by burning, mechanical removal, or no removal), Factor B represented off-bar tillage in March (with or without), and factor C represented tillage at layby in May (with or without). Results of these studies confirmed those of previous research which showed that eliminating tillage is not detrimental to sugarcane growth or sugar yield when weeds are effectively controlled. Results also showed that mechanical removal of residue was as effective as burning.

EFFECT OF DRILL-SEEDED SOYBEAN AND TILLAGE ON TEMPORAL EMERGENCE OF SICKLEPOD. M.J. Oliveira and J.K. Norsworthy; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC 29634.

ABSTRACT

Sicklepod (*Senna obtusifolia*) is among the most common and troublesome weeds of agronomic crops in the southern United States. Sicklepod growth and development is well documented but little is known about its temporal emergence under different tillage systems in association with a crop. We hypothesized that sicklepod temporal emergence is influenced by the interaction of tillage intensity and crop canopy development. To test this hypothesis, the objective of this research was to characterize sicklepod temporal emergence as affected by tillage intensity and soybean presence. Sicklepod seeds were harvested in the fall of 2002 and 2003, and broadcast in the field at 2,000 seeds/m^2 on March 8, 2003 and November 20, 2003 at the Simpson Research Station in Pendleton, SC. Tillage treatments were disk harrowed on April 4, 2003 and April 17, 2004 and field cultivated on May 25 2003 and May 19, 2004 immediately prior to planting. Soybean was planted in 19-cm width rows at 432,000 seeds/ha. Sicklepod seedlings were enumerated and removed by hand at least once weekly throughout the year. Soil temperature, soil moisture, rainfall, and light quality and quantity were monitored during the season.

Initial emergence occurred in April and continued through November in both years. Sicklepod had three major emergence periods during both years; however, there was no extended period from initial to final emergence in which sicklepod did not emerge. In 2003, 56 to 58% of the total sicklepod emergence occurred following soybean emergence. Conversely, in no-tillage plots, 78 to 90% of sicklepod emergence occurred after soybean emergence. In 2004, 80 to 88% of the total sicklepod emergence in tillage plots occurred following soybean emergence. Sicklepod emergence was 87 to 96% of the total emergence in no-tillage plots following soybean emergence in 2004. Sicklepod total emergence in no-tillage plots with soybean in 2003 averaged 332 seedlings/m^2, which was 140% greater than emergence in no-tillage plots in the absence of soybean. However, in 2004, sicklepod emergence in no-tillage plots was greater the absence of soybean compared to its presence. This research indicates that sicklepod temporal emergence is influenced by the interaction of environment, tillage, and soybean canopy formation.

TOLERANCE AND WEED MANAGEMENT IN GYPHOSATE-TOLERANT ALFALFA. Z. H. Braden, J. W. Keeling, J. D. Everitt, 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, corn, and soybeans allow 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 that can reduce 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 7 x 25 ft and were arranged in a randomized complete block design with a factorial arrangement. The test consisted of three replications. Benefin at 2.0 lb ai/A preplant incorporated (PPI) was applied to the entire test area. Glyphosate application timings included: 0.75 lb ae/A at the 3 to 4 trifoliate followed by (fb) 1.5 lb ae/A at 10, 50, or 90% regrowth after the first, second, and third 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 in 2003. In 2004, herbicide applications were repeated in the same manner as 2003, with exception of the benefin application and the glyphosate application at the 3 to 4 trifoliate. Six cuttings were made approximately 28 days apart beginning on April 29, 2004.

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, 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 to 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 to 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 2004, 2,4-DB + NIS at 0.50 lb ae/A + 0.25% V/V and glyphosate at 1.5 lb ae/A were applied in mid May fb an additional application of glyphosate and 2,4-DB + NIS in early August. Plots were harvested approximately every 28 days, beginning on April 29, 2004.
In the tolerance experiment, excellent tolerance was observed in glyphosate-tolerant alfalfa to sequential applications of glyphosate. Up to 6.0 lb ae/A of glyphosate was applied at various regrowth timings and no adverse affects on alfalfa yield were observed. Total alfalfa yield from all treatments was not different from the untreated plots in both years. In the weed control experiment, no alfalfa injury was observed from any glyphosate application when compared to applications made in a conventional weed control system in both seasons. No differences in total seasonal weed dry weight were observed between systems. Benefin applied PPI combined with two in-season glyphosate applications controlled all weeds. Weed dry weight seasonal totals in 2004 were greater in the conventional system (41 lbs/A) compared to that of the glyphosate system (17 lbs/A); however, there were no differences when seasonal totals were compared. Alfalfa dry weights were similar season long and no differences in yields were observed regardless of treatment.

PALMER AMARANTH, DEVIL'S-CLAW, AND IVYLEAF MORNINGGLORY CONTROL IN ROUNDUP READY FLEX COTTON. B.L. Joy, J.W. Keeling, P.A. Dotray, and J.D. Everitt; Texas Agricultural Experiment Station and Texas Tech University, Lubbock, TX.

ABSTRACT

Glyphosate has been successful at controlling early-season weed pressure on the Texas High and Rolling Plains. Because of this success, large portions of the cotton acres are planted to Roundup Ready varieties. The current Roundup Ready technologies allow for postemergence (POST) applications through the 4-leaf (node) cotton growth stage. However, wet and windy conditions make it difficult to make timely applications, which is critical to the success of controlling weed populations such as morningglory and several perennials. Late season Palmer amaranth escapes are also difficult to control with current hooded sprayers. The development of Roundup Ready Flex varieties with increased tolerance will allow POST applications to be made through layby with the additional benefit of higher glyphosate rates for improved control of the more difficult-to-control weeds. Roundup Ready Flex lines continue to exhibit excellent tolerance to POST glyphosate applications up to the 14-leaf cotton growth stage at rates 2 to 3 times higher than the currently used rate in Roundup Ready cotton.

Field experiments were conducted in 2003 and 2004 at the Texas Agricultural Experiment Station near Lubbock to evaluate glyphosate rates and timings for optimum control of Palmer amaranth (*Amaranthus palmeri*), devil's-claw (*Proboscidea louisianica*), ivyleaf morningglory (*Ipomoea hederaceae*), and silverleaf nightshade (*Solanum elaeagnifolium*) in Roundup Ready Flex cotton. Glyphosate was applied at 0.75 and 1.5 lb ae/A. Treatments based on cotton growth stage were compared to as-needed treatments based on weed population and size. Trifluralin at 0.75 lb ai/A was applied preplant incorporated (PPI) to all test areas. Another experiment was conducted in 2004 to evaluate timing of residual herbicide use in conjunction with glyphosate to control Palmer amaranth and devil's-claw. Glyphosate was applied at 0.75 lb ae/A alone or following trifluralin PPI at 0.75lb ai/A, or in combination with metolachlor at 1.0 lb ai/A or pyrithiobac at 0.036 lb ai/A applied POST.

Excellent Palmer amaranth, devil's-claw, and silverleaf nightshade control (> 90%) was achieved with POST treatments based either on cotton growth stage or as needed applications in both years. For these weeds, effective control was achieved with 0.75 lb ae/A treatments and no benefit was observed from higher glyphosate rates. In both years, ivyleaf morningglory control was improved when glyphosate was applied at 1.5 lb ae/A compared to the 0.75 lb ae/A rate. In 2003, effective ivyleaf morningglory control was achieved with four POST applications applied as needed beginning at the 2-leaf cotton growth stage, with the last treatment applied at the 20-leaf cotton growth stage. By delaying the first application, only three POST treatments were required when applied at the 1.5 lb ae/A rate to achieve similar control. In 2004, with increased rainfall and weed pressure, five applications of glyphosate at 1.5 lb ae/A were required for effective control (> 90%). In 2004 the addition of a soil residual herbicide (trifluralin PPI, metolachlor or pyrithiobac POST) reduced the number of in-season glyphosate applications by one (from three to two) for season-long Palmer amaranth and devil's-claw control.

POSTEMERGENCE HERBICIDE PROGRAMS IN RICE FOR CONTROL OF NON-TRADITIONAL BROADLEAF WEEDS. A.T. Ellis, B.V. Ottis, and R.E. Talbert. Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

Cutleaf groundcherry (*Physalis angulata*), pitted morningglory (*Ipomoea lacunosa*), sicklepod (*Senna obtusifolia*), and Palmer amaranth (*Amaranthus palmeri*) are considered non-traditional weeds in rice because they are typically not a problem in the flooded areas of rice fields. They do pose a threat to rice weed management on levees and parts of the field where the flood is not constant. Experiments were conducted in summer 2004 to evaluate the performance of several postemergence broadleaf rice herbicides on sicklepod, cutleaf groundcherry, and pitted morningglory at the Rice Research and Extension Center, Stuttgart, AR, and the University of Arkansas Pine Bluff Experiment Station, Lonoke, AR. A separate experiment was conducted on a natural population of Palmer amaranth at the Arkansas Agricultural Research and Extension Center, Fayetteville, AR.

At Stuttgart and Lonoke, weeds were sown in rows perpendicular to the drilled rice rows. Postemergence applications were made at two separate timings, early postemergence (EP) and late postemergence (LP). All applications were applied using a CO^2 backpack sprayer calibrated to deliver 93 L/ha. Weed heights at the EP application were 2.5 to 5 cm and at LP they ranged from 30-to-35 cm. Herbicide treatments included; halosulfuron (Permit) at 0.063 kg ai/ha, acifluorfen (Ultra Blazer) at 0.105 kg/ha, carfentrazone-ethyl at (Aim) at 0.28 kg/ha, quinclorac (Facet) at 0.43 kg/ha, bentazon (Basagan) at 0.84 kg/ha, bispyribac-sodium (Regiment) at 0.071 kg/ha, imazethapyr (Newpath) at 0.071 kg/ha, triclopyr (Grandstand) at 0.28 kg/ha, propanil (Stam) at 4.48 kg/ha, penoxsulam (Grasp) at 0.035 kg/ha, and IR 5878 at 0.075 kg/ha. Visual ratings on cutleaf groundcherry, pitted morningglory, and sicklepod were taken in 1 wk intervals beginning 7 d after the EP treatments to 6 wk after the EP treatments. For Palmer amaranth ratings were taken 7 d after EP treatments until 4 wk after EP treatments by then herbicides were ineffective in control. Visual ratings were recorded on a scale of 0 to 100 % with 0% representing no control and 100% representing total control.

EP treatments of Aim, Facet, Newpath, Stam, and Grasp all controlled cutleaf groundcherry >80%. Only Aim (79%) and Newpath (82%) controlled cutleaf groundcherry at LP timing. Pitted morningglory treated EP was controlled (95%) EP by Facet only. Pitted morningglory was not controlled by any treatments at the LP timing. Facet applied EP controlled sicklepod 95%. Regiment, Aim, Stam, Facet, and Grandstand at the LP timing showed moderate control (55-65%) of sicklepod. Palmer amaranth at the EP timing was controlled by Aim (90%), Grasp (80%), Newpath (80%), Stam (100%), and Regiment (80%). Palmer amaranth at the LP timing was poorly controlled (< 40%) with all herbicide treatments.

AN ECONOMIC COMPARISON OF LIBERTYLINK, ROUNDUP READY, AND CONVENTIONAL COTTON. K.M. McCormick, P.A. Dotray, J.W. Keeling, E. Segarra, and T.A. Baughman; Texas Tech University and Texas Agricultural Experiment Station, Lubbock, TX; and Texas Cooperative Extension, Vernon, TX.

ABSTRACT

Studies were conducted in 2003 and 2004 to compare net returns above weed control costs in glufosinate-tolerant, glyphosate-tolerant, and conventional cotton weed control systems. A randomized block design with a split-plot arrangement and four replications was used in an irrigated study at the Texas Agricultural Experiment Station near Lubbock, TX. The main plot factors were the variety of cotton (FM 989, FM 989 RR, or FM 981 LL) and subplot factors were treatments within a variety (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 and were made independent of the other varieties. All plots received a blanket application of trifluralin preplant incorporated. In 2003 and 2004, the glufosinate-tolerant weed control system included two sequential applications of glufosinate at 32 oz/A postemergence-topical (POST) followed by (fb) cultivation fb hand hoeing. The glyphosate-tolerant weed control system included glyphosate at 22 oz/A POST fb glyphosate at 22 oz/A postemergence-directed (PDIR) in 2003. In 2004, a second PDIR application of glyphosate at 22 oz/A was necessary. In 2003 and 2004, the conventional cotton weed control system included pyrithiobac at 1.2 oz/A + MSMA at 16 oz/A POST (applied in 20-inch band in 2004) fb cultivation fb cultivation fb hand hoeing. A third cultivation was done prior to hand hoeing in 2004. A dryland study was conducted in a similar fashion at the same location, and a second irrigated study was repeated at the Texas Tech University Research Farm near New Deal, TX. Lint yields and weed control costs were calculated to determine net returns above weed control costs.

In 2003, all systems in the Lubbock irrigated study controlled devil's-claw and Palmer amaranth at least 95% at harvest; however, the glyphosate-tolerant weed control system achieved 90% control of silverleaf nightshade, while the glufosinate-tolerant system and the conventional system controlled silverleaf nightshade 69% and 50%, respectively. In 2004, effective weed control was achieved by all systems. In the Lubbock dryland study, similar control of Palmer amaranth and devil's-claw was observed for all systems in both years. The glyphosate-tolerant system controlled silverleaf nightshade more effectively than the other two weed management systems in 2003. In 2004, there were no differences in silverleaf nightshade control among systems. In the New Deal study, the glyphosate-tolerant system controlled common cocklebur more effectively than the other two weed management systems fb the glufosinate-tolerant system in 2003. In 2004, the glufosinate-tolerant and glyphosate-tolerant systems controlled at least 96% of common cocklebur, while the conventional system provided 33% control.

Lint yields in 2003 at the Lubbock irrigated location were greater with the glyphosate-tolerant system than the glufosinate-tolerant and conventional systems. There were no differences in lint yield across all three systems in 2004. Lint yields from the glufosinate-tolerant, glyphosate-tolerant, and conventional systems at the Lubbock dryland location in 2003 were 200 lbs/A, 224 lbs/A, and 176 lbs/A, respectively. In 2004, yields ranged from 514 to 551 lbs/A. Lint yields at the New Deal location were greatest in the glyphosate-tolerant system in 2003 followed by the glufosinate-tolerant system. Lint yields in the glufosinate-tolerant and glyphosate-tolerant systems were similar, while the conventional system produced lower yields in 2004. Weed control system costs were calculated using seed costs including technology fees, herbicide and application costs, and mechanical inputs. The net revenue above weed control costs in 2003 with the glyphosate-tolerant system was $613/A in the Lubbock irrigated study, while the glufosinate-tolerant system and conventional system were $458/A and $360/A, respectively. The net returns above weed control costs were similar and ranged from $316/A to $346/A in 2004. Net returns above weed control costs were similar for all three systems in both years at the Lubbock dryland location. The glyphosate-tolerant system had greater net returns above weed control costs when compared to the other systems in 2003 at New Deal. The glufosinate-tolerant and glyphosate-tolerant systems had similar net returns above weed control costs in 2004, which were greater than the conventional system.

The glyphosate-tolerant weed control system generated greater lint yields and net returns above weed control costs in 2003 when compared to the glufosinate-tolerant and conventional systems in the Lubbock irrigated and New Deal studies. Lint yield and net returns above weed control costs were similar between the glufosinate-tolerant and glyphosate-tolerant weed control systems in all three studies in 2004. The glyphosate-tolerant system also required less input to maintain effective weed control compared to the glufosinate-tolerant system, while the glufosinate-tolerant system required less input compared to the conventional system.

RESIDUAL CONTROL OF RED MORNINGGLORY (*IPOMOEA COCCINEA*) WITH SUGARCANE (*SACCHARUM* SPP. HYBRIDS) HERBICIDES. C.A. Jones, J.L. Griffin, L.M. Etheredge, and W.E. Judice. Louisiana State University AgCenter, Baton Rouge, LA 70803.

ABSTRACT

In 2004, field experiments were conducted in West Baton Rouge Parish, LA, to evaluate preemergence (PRE) control of red morningglory (*Ipomoea coccinea* L.) with various herbicides. In each experiment the experimental design was a randomized complete block with four replications and plot size was 10 ft by 20 ft. Herbicide treatments were applied on June 10 using a tractor-mounted, compressed air sprayer calibrated to deliver 15 GPA. To evaluate residual activity of the herbicides, red morningglory control data were collected 5, 7, 9, and 11 weeks after treatment (WAT). To eliminate weed competition as a variable, Liberty (glufosinate) was applied at 1 qt/A after each rating to control all vegetation.

In the red morningglory preemergence experiment, treatments included Spartan (sulfentrazone) at 3, 4, 5, 6, 7, and 8 oz/A; Aatrex (atrazine) at 1, 2, 3, and 4 qt/A; Valor (flumioxazin) at 2, 4, 6, and 8 oz/A; Dupont K4 (a premix of hexazinone and diuron) at 2, 3, and 4 lb/A; and Sencor (metribuzin) at 2 and 3 lb/A. Red morningglory control 5 WAT was at least 90% with Spartan at 4, 5, 6, 7 and 8 oz/A; atrazine at 3 and 4 qt/A; Dupont K4 at 3 and 4 lb/A; Sencor at 3 lb/A; and Valor at 4, 6, and 8 oz/A. Spartan at 3 oz/A, Dupont K4 at 2 lb/A, and Valor at 2 oz/A controlled red morningglory less than 80% 5 WAT. By 7 WAT, only Spartan at 4, 5, 6, 7, and 8 oz controlled red morningglory at least 90%. None of the other herbicide treatments controlled red morningglory more than 71% and atrazine at 1 qt/A, both rates of Sencor, and Valor at 2 and 4 oz controlled red morningglory no more than 50%. At 9 WAT, the five highest rates of Spartan provided at least 75% control of red morningglory and the low rate of Spartan and both rates of Dupont K4 were the only other treatments that controlled red morningglory at least 50%. At 11 WAT, the five highest rates of Spartan controlled red morningglory 71 to 76% and all other treatments provided less than 50% control.

In another experiment, treatments included Treflan (trifluralin) at 2 qt/A plus Spartan at 4, 5.3, 6.7, and 8 oz/A preplant incorporated (PPI), Treflan at 2 qt/A PPI followed by Spartan PRE at the same rates, Treflan PPI alone, and Spartan PRE alone. All PPI treatments were incorporated with a field cultivatior (Kongskilde "triple K") equipped with a rear rolling basket. Red morningglory control 5 WAT was at least 95% when Spartan was applied PRE, but was 85 to 94% when Spartan was incorporated. At 7 WAT, the 4 oz/A rate of Spartan applied PRE controlled red morningglory as well as the higher rates. By 9 WAT, red morningglory control was no more than 76% when Spartan at 4 to 6.7 oz/A was incorporated. Spartan at 4 oz/A applied PRE, however, was still providing equivalent control to the 8 oz/a rate 9 WAT. Spartan at 8 oz controlled red morningglory 9 WAT 86 to 89%, but by 11 WAT control was no more than 80%.

These results clearly show that reported red morningglory control failures with atrazine are directly related to lack of long-term residual activity. This can be attributed to a change in cultural practices where herbicides at layby are applied in early to mid May as opposed to late May and early June. Findings show that for most effective red morningglory control at layby, herbicide application should be delayed as long as possible. Under severe red morningglory infestations, Spartan should be used rather than atrazine, Valor, Dupont K4, or Sencor because Spartan provided longer residual control. Additionally, Spartan is more effective when applied to the soil surface rather than incorporated.

TEXASWEED MANAGEMENT IN TEXAS COTTON. M.E. Matocha, P.A. Baumann and F.T. Moore, Texas Cooperative Extension, Texas A&M University, College Station, Tx 77843.

ABSTRACT

Field studies were conducted in 2002 and 2004 to evaluate control of Texasweed (*Caperonia palustrus*) in Upper Texas Gulf Coast cotton (*Gossypium hirsutum*, L.) near Danevang, TX. The experimental design for the studies was a randomized complete block with 3 replications. Plot size was 4 (40”) rows by 30 ft, and the soil type was a Lake Charles clay.

The study in 2002 employed POST treatments to Texasweed in FM 832 cotton. Treatments included Staple® (pyrithiobac-sodium) (1.2 oz/A) + MSMA (1 pt/A), DSMA (1 qt/A), Staple® (pyrithiobac-sodium) (1.2 oz/A) + DSMA (3 pt/A), Cotoran (4 pt/A) + MSMA (1.33 pt/A), and Staple® (pyrithiobac-sodium) (1.8 oz/A). All treatments included 0.25% NIS. The treatments were applied broadcast OTT to Texasweed at two timings. Crop injury was assessed in addition to weed control. Initial ratings for the 1-3” timing, made 8 days after treatment (DAT) showed no treatment achieved better than 58% control and injury ranged from 1-18%. By 32 DAT injury to the cotton was slight to none. Texasweed control significantly increased to 96% from the Cotoran (fluometuron) + MSMA treatment. Staple® (pyrithiobac-sodium) provided poor control (42%) at this date. When evalueated 52 DAT, Staple® (pyrithiobac-sodium) combined with either MSMA or DSMA provided 82% control of Texasweed. The DSMA and Cotoran (fluometuron) + MSMA treatments provided control of 72 and 78%, respectively at 52 DAT (1-3” timing). All treatments at the 6-12” timing resulted in less than 70% control of Texasweed at 30 DAT.

Treatments applied in 2004 consisted of a program approach in Stoneville 5599BR cotton with various combinations of PRE, EPOST (cotton 1-2 leaf), MPOST (cotton 5-6 leaf), and Post-Directed (PDIR) applications. All POST treatments with Envoke or MSMA included 0.25% V/V nonionic surfactant (NIS), while the Suprend treatments included 1% V/V crop oil concentrate (COC) as a spray additive. PRE treatments utilized were Caparol (prometryn)(2 pt/A) or Caparol (prometryn) (2 pt/A) + Dual Magnum (metolachlor) (1.0 pt/A). Neither of these PRE treatments provided sufficient control alone, but with a sequential treatment of Envoke (trifloxysulfuron) at 0.10 oz/A (5-6 leaf cotton) improved control (78-82%) was observed at 13 DAT. Excellent control was achieved (92%) when Touchdown (glyphosate) at 1 qt/A (1-2 leaf cotton) was followed by (fb) Envoke (trifloxysulfuron) at 0.10 oz/A (5-6 leaf cotton) when evaluated at 13 days after the 5-6 leaf timing. Another noteworthy treatment was Dual (metolachlor) + Caparol (prometryn) (PRE) fb Touchdown (glyphosate) at 1 qt/A (1-2 leaf) fb a PDIR application of glyphosate (0.60 qt/A) + Envoke (trifloxysulfuron) (0.10 oz/A). This treatment resulted in 88% control of Texasweed 21 days after the PDIR timing. This treatment still provided 87% control at 52 DA-PDIR timing. Touchdown (glyphosate) (1 qt/A) (1-4 leaf) fb a PDIR application of Suprend (Prometryn + trifloxysulfuron) (1.25 lb/A) + MSMA (1.33 qt/A), achieved control of 85% at 21 DA-PDIR, and 90% at 52 DA-PDIR.

Yield was taken in 2004, and although numerical differences existed between treatments, only two treatments were not significantly greater than the untreated check. These included the Touchdown (glyphosate) (1 qt/A) + Dual Magnum (metolachlor) (1.0 pt/A) (1-2 leaf cotton) fb Envoke 0.10 oz/A (PDIR), and Staple 1.8 oz/A + MSMA 8 oz/A (1-2 leaf cotton) treatments.

WEED SPECIES COMPOSITION IN A LONG-TERM COTTON EXPERIMENT WITH GLYPHOSATE AND CONVENTIONAL HERBICIDE TREATMENTS. B.J. Fast, D.S. Murray, R.B. Westerman, J.C. Banks; Oklahoma State University, Stillwater, OK, E.W. Palmer; Syngenta Company, Greenville, MS, S.W. Murdock; Monsanto Company, Lubbock, TX.

ABSTRACT

A long-term cotton experiment began in 1998 at the Agronomy Research Station near Chickasha, Oklahoma and was still ongoing in 2004. The experiment was comprised of treatments for conventional cotton and treatments for glyphosate-resistant cotton. The weed species composition, weed density, and cotton lint yield were recorded for the treatments each year. The objectives of the experiment were: 1) to determine if repeated use of a herbicide treatment on the same area over a period of years affected the weed species composition and density and 2) to determine which herbicide treatments resulted in the lowest weed populations and highest cotton lint yields.

Typical agronomic practices of cotton production were used in the experiment. Cotton was planted on raised beds with 40 inch centers in plots that were 40 feet (12 rows) wide by 100 feet long. Although some of the cotton was treated as if it were a conventional variety, the entire experiment was planted to a glyphosate-resistant variety. Herbicide application timings included preplant incorporated (PPI), preemergence (PRE), first postemergence (POST1), and second postemergence (POST2). Conventional treatments consisted of several combinations of the following herbicides: pendimethalin applied PPI, prometryn applied PRE, prometryn + pyrithiobac applied PRE, and pyrithiobac applied PRE and/or POST1 or POST2, while glyphosate-resistant treatments included pendamethalin applied PPI, pyrithiobac applied PRE and/or POST1 or POST2, glyphosate applied POST1 and/or POST2, glyphosate + pyrithiobac applied POST2, and quizalofop applied POST1 and/or POST2. All herbicides were applied at labeled rates and all years included an untreated check.

The Palmer amaranth population was reduced by greater than 99 percent in treatments that included pendamethalin applied PPI. Devil's-claw was largely eliminated by glyphosate applied POST1 or by pyrithiobac applied PRE or POST1. Treatments not containing pyrithiobac and/or glyphosate resulted in a dramatic increase in the devil's-claw population. Johnsongrass was mostly eliminated when treated with glyphosate applied POST1 or POST2 or quizalofop applied POST1 and/or POST2. The common cocklebur population was reduced by 90 percent in treatments that contained glyphosate applied POST1 followed by glyphosate + pyrithiobac applied POST2. Treatments that did not include glyphosate resulted in a substantial increase in the common cocklebur population. In 2004, three treatments looked very promising. Those treatments were as follows: 1) glyphosate POST1 followed by glyphosate POST2, 2) glyphosate POST1 followed by glyphosate + pyrithiobac POST2, and 3) pendamethalin PPI followed by pyrithiobac PRE followed by glyphosate POST1 followed by pyrithiobac POST2. Considering the chemical costs and application costs, two applications of glyphosate was the most effective treatment.

ECONOMIC EVALUATION OF FALLOW FIELD WEED CONTROL PROGRAMS IN LOUISIANA SUGARCANE. L.M. Etheredge, Jr., J.L. Griffin, M.E. Salassi, C.A. Jones, and W.E. Judice; Louisiana State University Ag Center, Baton Rouge, LA 70803.

ABSTRACT

Sugarcane is a subtropical, perennial crop and three to five harvests are made from a single planting. After three to five years of production, sugarcane plant populations are reduced and infestation of perennial weeds such as bermudagrass [*Cynodon dactylon* (L.) Pers.] and johnsongrass [*Sorghum halapense* (L.) Pers.] has increased to the point that replanting is warranted. A producer then makes the decision to fallow the field. This decision will cost the grower a year of production but is necessary to maintain a profitable production system. During the fallow period problems with drainage and perennial weeds can be addressed. Ineffective control of perennial weeds in fallow can have an economic impact in both the plant cane crop (first production year) and in successive crops. Input cost minimization and maximization of total net profit are two concepts that have been accepted and implemented with other crops, but adoption has been slow in Louisiana sugarcane because of industry stability. A study was conducted in St. Gabriel, LA, 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 study conducted in Henderson, LA, evaluated only the conventional programs. At planting, at both locations, DuPont K4 (4 lb/A) was applied broadcast across all treatments and the effects of the various weed control programs implemented during the fallow period were evaluated in sugarcane during the first production year.

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 and 247 days after planting (DAP) was not negatively affected by any of the conventional fallow programs. Bermudagrass ground cover 86 and 247 DAP showed that tillage alone provided little control of bermudagrass (45 and 73% ground cover, respectively). Bermudagrass control, however, was excellent throughout the first production year following all the other conventional programs where tillage and Roundup UltraMAX were used. By August 2004, sugarcane height and stalk population were less where tillage alone was used in fallow compared to the other programs. These plant growth reductions were reflected in reduced sugarcane and sugar yields of approximately 40% compared with the other conventional programs. Even though the tillage alone program was the lowest input cost program ($34.00/A), net returns were $216 to $291/A greater for the other programs. This was due to the significant sugar yield reduction observed where a tillage alone program was used in the fallow period.

At the St. Gabriel location differences in shoot population, sugarcane height, sugarcane or sugar yield were not observed among any of the fallow treatments. Results indicate that if weeds are not a limiting factor then fallow field weed control programs should be based on economics. For this experiment, based on inputs and yields the most economical program for fallow would be a combination of tillage and glyphosate applications. 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 and can be economically competitive.

Other experiments were conducted at St. Gabriel, LA, to evaluate control of sugarcane with glyphosate at various rates and at Henderson, LA, to evaluate glyphosate formulations. Maximum control 45 days after treatment (DAT) was achieved when Roundup UltraMAX was applied at 1.0 lb ai/A to 6 to 12 inch tall sugarcane (94%). When application was delayed until sugarcane was 18 to 24 inches tall, 2.0 lb /A was needed to obtain 95% control. At the Henderson location at 68 DAT sugarcane was controlled 91 to 95% when Roundup WeatherMAX, Roundup OriginalMAX, Roundup UltraMAX, Mirage, or Honcho Plus was applied at 2.0 lb /A to 8 to 10 inch tall sugarcane. Results from these experiments show that in a no-till system less expensive glyphosate formulations could be used to decrease input cost without sacrificing sugarcane destruction.

COMPARISON OF CHLORACETIMIDE AND DINITROANALINE HERBICIDES IN TRANSGENIC COTTON WEED CONTROL PROGRAMS. M.T. Kirkpatrick, D.B. Reynolds, D.M. Dodds, and J.J. Walton; Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762..

ABSTRACT

With an increase in transgenic-cotton, broad spectrum herbicides such as glyphosate or glufosinate are being used more frequently. These herbicides posses many strengths, among which is their lack of residual activity. This attribute allows great flexibility regarding replanting failed acres or rotating to other crops. This attribute can also be considered a weakness because of its inability to control weeds that germinate following its application. Experiments were conducted to address the need for residual herbicides in conjunction with transgenic cotton weed control programs. Experiments were designed to address Roundup Ready_ and Liberty Link_ cotton. Roundup Ready_ experiments were conducted in 2003 and 2004 at the Black Belt Branch Experiment Station in Brooksville, Mississippi and at the Plant Science Research Center in Starkville, Mississippi. Stoneville 4892 BR cotton was planted in 2003 and DP 444 BR was planted at both locations, in 2004. Liberty Link_ experiments were conducted in 2004 at the Black Belt Branch Station using Fibermax LL958. All herbicide applications were made with a tractor-mounted sprayer at 15 GPA. Treatments were applied as a preemergence (PRE), postemergence over-the-top (POT) at 1-leaf, or a POT at 4-leaf cotton for the Roundup Ready_ experiments, and at 1-, 4-, and 7-leaf cotton in the Liberty Link_ experiment. The following treatments were applied at each timing in combination with Roundup Weathermax at 22 fl oz/A: no residual herbicide; Prowl 3.3EC at 1 lb ai/A; Prowl 3.3EC at 2 lb/A; Prowl H20 at 1 lb ai/A; Prowl H20 at 2 lb/A; Dual II Magnum at 1.26 lb ai/A; and Outlook at 0.75 lb ai/A. In the Liberty Link_ experiment Ignite was applied at 32 fl oz/A in conjunction with: Prowl H20 at 0.75 lb/A; Prowl H20 at 1.5 lb/A; Prowl 3.3EC at 0.75 lbs/A; Prowl 3.3EC at 1.5 lbs/A; Dual II Magnum at 1.26 lb/A; and Outlook at 0.75 lb/A. The results of the Roundup Ready experiments showed that pitted morningglory (*Ipomoea lacunosa*) control was 70 to 80% with all herbicides applied to 1- and 4-leaf cotton. Hemp sesbania (*Sesbania exaltata*) control was 80 to 85% with all herbicides applied to 1-leaf cotton. However, withhin the Liberty Link experiment, pitted morningglory and hemp sesbania control was unaffected by the addition of residual herbicides with approximately 85 and 95% control for all application timings, respectively. Large crabgrass (*Digitaria sanguinalis*) control ranged from 85 to 95 and 82 to 90% when applied to 1- and 4-leaf cotton, respectively and was not improved by the addition of a residual herbicide within the Roundup Ready experiments. However, Roundup alone following a residual herbicide resulted in approximately 70% control compared to 25% control if a residual herbicide was not used PRE. Ignite applied alone at 1- and 7-leaf cotton provided poor large crabgrass control (55 and 53%, respectively), while the addition of 0.75 or 1.5 lb/A of Prowl H2O increased control to 83 and 92%, respectively, at the 1-leaf application timing. These data show that the use of residual herbicides in conjunction with applications of glyphosate or glufosinate applied early can be effectively utilized to control grasses that continue to emerge later in the season.

WEED MANAGEMENT WITH NON-TRANSGENIC, CLEARFIELD, LIBERTYLINK, AND ROUNDUP READY CORN SYSTEMS. W.E. Thomas, W.J. Everman, J.D. Wilcut, J.W. Wilcut, and J. Allen*; Department of Crop Science, North Carolina State University, Raleigh, NC; * Bayer CropScience, Research Triangle Park, NC.

ABSTRACT

Studies were conducted at the Central Crops Research Station near Clayton, NC, the Peanut Belt Research Station near Lewiston, NC, the Upper Coastal Plain Research Station near Rocky Mount, NC, and the Caswell Research Station near Kinston, NC to evaluate weed management systems in Clearfield, Roundup Ready, LibertyLink, and non-transgenic corn. Corn hybrids were 'Pioneer 34A55 LL', 'DKC 69-71 RR', 'Garst 8222 IR', and 'Pioneer 3394'. Preemergence (PRE) options for all systems included no herbicide or Dual Magnum at 1.68 kg ai/ha. For Clearfield systems, postemergence (POST) options included no herbicide, Lightning at 0.063 kg ai/ha, Lightning at 0.063 kg/ha plus Dual Magnum at 1.12 kg/ha, or Lightning at 0.063 kg/ha followed by (fb) Lightning at 0.031 kg/ha. Ammonium sulfate (AMS) at 2.8 kg/ha and a non ionic surfactant (NIS) (Induce) at 0.25% v/v were included with all Lightning treatments. Roundup Ready POST options included no herbicide, Roundup WeatherMax at 0.84 kg ae/ha, Roundup WeatherMax at 0.84 kg/ha plus Dual Magnum at 1.12 kg/ha, or Roundup WeatherMax at 0.84 kg/ha fb Roundup WeatherMax at 0.84 kg/ha. AMS at 3.36 kg/ha was included with all Roundup WeatherMax treatments. Similarly, LibertyLink POST options included no herbicide, Liberty at 0.47 kg ai/ha, Liberty at 0.47 kg/ha plus Dual Magnum at 1.12 kg ai/ha, or Liberty at 0.47 kg/ha fb Liberty at 0.47 kg/ha. AMS at 3.36 kg/ha was included with all Liberty treatments. For non-transgenic systems, POST options included no herbicide, Steadfast ATZ at 0.98 kg ai/ha, Steadfast ATZ at 0.98 kg ai/ha plus Dual Magnum at 1.12 kg/ha, or Steadfast ATZ at 0.98 kg/ha fb Steadfast at 0.98 kg/ha. AMS at 2.24 kg/ha and a crop oil concentrate (COC) (Agridex) at 1.0% v/v were included with all Steadfast ATZ treatments. LAYBY options for all systems were no herbicide or Evik at 1.12 kg ai/ha plus NIS at 0.25% v/v. Systems were evaluated for early, mid, and late season corn injury, weed control, and yield. Weeds present included yellow nutsedge (*Cyperus esculentus*), common lambsquarters (*Chenopodium album*), common ragweed (*Ambrosia artemisiifolia*), Palmer amaranth (*Amaranthus palmeri*), entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula*), pitted morningglory (*Ipomoea lacunosa*), large crabgrass (*Digitaria sanguinalis*), Texas panicum (*Panicum texanum*), and goosegrass (*Eleusine indica*).

Late season corn injury was minimal (< 5%) when any herbicide was applied POST. However, without a POST herbicide option, corn injury ranged from 8 to 19%, depending on location. Observed injury is likely due to increased weed competition throughout the growing season. Dual Magnum PRE, averaged over POST and LAYBY options, increased control of large crabgrass, goosegrass, Palmer amaranth, common lambsquarters, and yellow nutsedge. Regardless of corn system, sequential POST only systems controlled all weed evaluated at least 93%. Greater than 91, 94, and 92% control of pitted morningglory, entireleaf morningglory, and common lambsquarters, respectively, was obtained with any POST only systems. The addition of Dual Magnum to any single POST option significantly increased control of large crabgrass, goosegrass, and Palmer amaranth in Liberty Link systems; control of Palmer amaranth and pitted morningglory in Roundup Ready systems; control of large crabgrass, goosegrass, yellow nutsedge, and Palmer amaranth in Clearfield systems; and control of goosegrass and Palmer amaranth in non-transgenic systems. Regardless of corn system, the addition of Evik at LAYBY increased control of large crabgrass, pitted morningglory, entireleaf morningglory, common lambsquarters, Palmer amaranth, and yellow nutsedge. Yield protection was evaluated as a percentage of the weed free for each location, replication within location, and hybrid. No differences in crop yield protection were observed with any treatment that received a POST herbicide. The inclusion of Dual Magnum PRE, averaged over POST and LAYBY options, increased yield in all corn systems.

EVALUATION OF SEQUENCE APPLIED POST-EMERGE IN EARLY-MATURING MISSISSIPPI SOYBEAN. T.W. Eubank*, D.H. Poston, C.H. Koger, C.J. Gray, D.R. Shaw, and E.W. Palmer. Delta Research and Extension Center. Mississippi State University. Stoneville, MS.

ABSTRACT

The planting trend for Mississippi soybean (*Glycine max* (L.) Merr.) has been to plant to an early maturing, herbicide resistant variety. The earliness of planting may promote late season annual grass resurgence. Annual grasses at harvest may reduce yields and combine efficiency.

The objective of this study was to evaluate the benefits of Sequence applied postemergence to Mississippi soybean as compared to glyphosate only systems.

Research was conducted in 2004 at the Delta Research and Extension Center in Stoneville, Mississippi to evaluate the benefits of Sequence applied post-emerge to early-maturing Roundup Ready soybean. The study was conducted using a randomized complete block design. Plots were 10 x 40 feet for herbicide treatment and harvest purposes. DK4868RR soybeans were planted on April 5 using 30-inch row spacing. Treatments were applied at V3-V4, and V5-V6 vegetative growth stage using a tractor-mounted sprayer applying 15 GPA @ 38 psi with Teejet XR11003VS nozzles including none, Sequence @ 1.64 lb ai/acre, 1.97 lb ai/acre, and 2.29 lb ai/acre; Dual Magnum @ 0.95 lb ai/acre; Touchdown Total @ 0.75 lb ae/acre; and Touchdown Total followed by Touchdown Total @ 0.75 ae/acre. Soybean yield and net returns were calculated.

Noticeable injury in the form of stunting and crinkled leaves was noted on soybean plants, at the V5-V6 growth stage, with Sequence at the highest rate although damage was less than 15%. Sequence applications made at the V5-V6 growth stage provided better late-season annual grass than applications made at V3-V4. Annual grass control was similar with sequence across all rates evaluated. Yields were similar in plots treated with 1 or 2 applications of glyphosate vs. Sequence, however, Sequence treated plots were cleaner at harvest than plots treated with glyphosate alone. In narrow rows, early-planted Mississippi soybean, Sequence can provide season-long annual grass control and possibly eliminate the need for a second application of glyphosate.

WEED MANAGEMENT IN LIBERTY-LINK CORN. W. J. Everman, W. Barker, J. W. Wilcut[1], and J. Allen[2]
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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 Central Crops Research Station, near Clayton, North Carolina in 2004. 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), Liberty postemergence (POST) and Callisto late post-directed (LAYBY). The corn cultivar Pioneer 34A55 LL was planted between April 16 to May 10 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 ai/A, 2) Liberty plus Dual Magnum at 1.0 lb ai/A, 3) Liberty plus Aatrex at 1.0 lb ai/A, 4) Liberty plus Callisto at 0.094 lb ai/A, 5) Liberty plus Aatrex plus Dual Magnum, 6) Liberty plus Dual Magnum plus Callisto, 7) Liberty plus Aatrex plus Callisto, 8) Liberty plus Dual Magnum plus Aatrex plus Callisto, or 9) No EPOST. The POST treatment options were 1) Liberty or 2) no POST. The LAYBY treatment options were 1) no LAYBY or 2) Callisto. Early-season corn injury and discoloration was not detected at any rating. Late-season corn injury and discoloration was not detected after applications of Callisto LAYBY. Liberty EPOST controlled goosegrass [*Eleusine indica* (L.) Gaertn], large crabgrass [*Digitaria sanguinalis* (L.) Scop.], Palmer amaranth (*Amaranthus palmeri* S. Wats.), common lambsquarters (*Chenopodium album* L.), entireleaf morningglory [*Ipomoea hederacea* (L.) JACQ. var. *integriuscula* GRAY], pitted morningglory (*Ipomoea lacunosa* L.) >97% early-season alone and with the addition of Dual Magnum, Aatrex, Callisto, or their combinations EPOST. Early-season yellow nutsedge (*Cyperus esculentus* L.) control of 93% was seen regardless of the EPOST application. However, the addition of a POST application maintained late-season nutsedge species control >95%, which was 10-20% points higher compared to systems without a POST treatment. Late-season control of morningglories, large crabgrass, goosegrass, common lambsquarters, and Palmer amaranth was >95% with EPOST plus POST treatments without a LAYBY application. Based on EPOST followed by POST applications, corn yields were similar (ranging from 194-205 bushels/A) regardless of the tank-mix partner. LAYBY applications were not needed to maximize yield potential, however in many years they do improve machine harvesting due to weed biomass reduction. Timely applications of Liberty are needed for effective large crabgrass, goosegrass and yellow nutsedge control. 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.

INCORPORATING RESIDUAL HERBICIDES INTO EARLY-PLANTED GLYPHOSATE-RESISTANT SOYBEAN PRODUCTION. J.M. Prince, D.R. Shaw, C.J. Gray, W.A. Givens, and D.H. Poston; Mississippi State University, Mississippi State and Stoneville, MS.

ABSTRACT

Field experiments were conducted at sites in Brooksville, Starkville, and Stoneville, MS, to evaluate the effects of residual grass herbicides applied mid-POST in tank-mixes with glyphosate on early-planted glyphosate-resistant soybean [*Glycine max* (L.) Merr.] at two row spacings. Glyphosate was also applied alone at early or mid-POST, as well as sequential applications at these timings. It was thought that tank mixtures of glyphosate with metolachlor, flufenacet, dimethenamid, or pendimethalin might provide added residual control for subsequent weed flushes that would arise after the initial control from glyphosate. Treatments for each spacing varied by the application rate and application tank-mix. Weed control was evaluated at two and six weeks after mid-POST application. Results from Brooksville and Starkville were pooled when possible. In most instances, no significant differences were shown between row spacings.

At two weeks, no differences were noted for any tank-mix treatments on johnsongrass [*Sorghum halepense* (L.) Pers.]. Control was 98% or better for any treatment other than early-POST application of glyphosate alone at 0.69 kg ae/ha. At six weeks, at least 75% control was observed for most treatments of glyphosate plus a residual grass herbicide. The best johnsongrass control was obtained with mid-POST application of glyphosate plus 0.69 kg ai/ha pendimethalin, or glyphosate plus 1.2 kg ai/ha metolachlor. Barynardgrass [*Echinochloa crus-galli* (L.) Beauv.] control at 2 weeks was 89% or more for most tank-mix treatments. At Starkville and Brooksville, the only applications that resulted in less control were those where glyphosate was applied alone (early and mid-POST at 0.69 kg ae/ha each time). At Stoneville, however, glyphosate applied at early and mid-POST controlled barnyardgrass at least 89%. At 6 weeks, row spacing and treatment interaction effects occurred at Brooksville and Starkville. Control was 70% or more for approximately half of the treatments. The highest control resulted from 38-cm row spacing with mid-POST application of glyphosate plus metolachlor at either 1.2 or 1.5 kg ai/ha. At Stoneville, the 38-cm row spacing was better than the 76-cm row spacing for suppressing barnyardgrass. Control was 84 % for all tank-mix treatments, with the best results coming again from mid-POST application of glyphosate with either rate of metolachlor.

Soybean injury at the Brooksville and Starkville sites was as high as 32%, but most injury was below 8%. Injury at Stoneville was 16% at most, with most treatments resulting in 13% injury or less. The use of glyphosate at 0.69 kg ae/ha with flufenacet at 0.49 kg ai/ha or 0.64 kg ai/ha resulted in the highest amount of injury at both sites, with glyphosate alone at 0.69 kg ae/ha producing the lowest rates of injury. Yield differences were not significant at Brooksville and Starkville. Large populations of broadleaf weeds lowered yields. At Stoneville, the 38-cm row spacing produced higher yields than 76-cm row spacing. Yields were highest following glyphosate plus metolachlor at either rate, or glyphosate plus pendimethalin.

WEED CONTROL PROGRAMS IN CONVENTIONAL VS. ROUNDUP READY® CORN. N.V. Goldschmidt, C.E. Brewer, M.T. Bararpour, and L.R. Oliver; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72704.

ABSTRACT

A corn producer has two production system options, conventional or Roundup Ready®. In past years, the yield potential of herbicide-tolerant corn has been somewhat less than conventionally grown hybrids; however, the genetic potential relating to yield of Roundup Ready® corn has increased to average nearly the same as conventional corn. Thus, weed control programs in Roundup Ready® vs. conventional corn hybrids need to be compared.

Several herbicide options are available in conventionally grown corn. Our study focused on nicosulfuron + rimsulfuron (Steadfast) and metolachlor + atrazine (Cinch ATZ) compared to glyphosate (Roundup WeatherMax). The study was established in 2003 at the Northeast Arkansas Research and Extension center in Keiser, AR, and repeated in 2004. The experiment was a randomized complete block with 17 treatments. In 2003, Pioneer 31B13BT and DeKalb C64-10RR were chosen for yield and planted on four 38-inch beds, 24 ft long at a rate of 35,000 seeds/A. In 2004, the varieties used for the test in 2003 were unavailable, so Pioneer 32P76BT and DeKalb C69-71BT/RR were utilized and planted in the same manner. Rating data were taken at 2, 4, 7, 10, and 18 weeks after emergence (WAE). Yield was taken from the center two rows of each plot. Data were combined and subjected to analysis of variance (ANOVA), and means were separated using Fisher's Protected LSD ($\alpha = 0.05$).

Hybrid selection influenced yield potential of conventional and Roundup Ready® hybrids. At the 7 WAE rating, Steadfast applied alone to 2- to 4-inch weeds in corn provided 63 and 75% control of velvetleaf (*Abutilon theophrasti*) and pitted morningglory (*Ipomoea lacunosa*), respectively. However, when tank mixed with atrazine (AAtrex) and mesotrione (Callisto), weed control was at least 95% for pitted morningglory, velvetleaf, and broadleaf signalgrass (*Brachiaria platyphylla*). Cinch ATZ controlled pitted morningglory, velvetleaf, and broadleaf signalgrass, 95, 98, and 99%, respectively, at the 7 WAE rating. Two applications of Roundup WeatherMax at 4- and 12-inch corn gave at least 89% control of weed species in the field, while two applications at 12- and 20-inch corn gave at least 94% control. Because of the yield reduction due to weed regrowth, two applications of Roundup WeatherMax should be applied at 12- and 20-inch corn as opposed to 4- and 12-inch corn. The addition of AAtrex at 1.5 lb/A to the second application of Roundup WeatherMax or three applications of Roundup WeatherMax at 4-, 12-, and 20-inch corn did not improve control or yield.

Data suggest that the yield potential for Roundup Ready® corn is comparable to that of conventional hybrids. Weed control options for both production systems are effective; however, Steadfast should be tank mixed with another herbicide such as Callisto or AAtrex for best results.

A SEEDLING ASSAY FOR SCREENING ARYLOXYPHENOXYPROPIONIC ACID AND CYCLOHEXANEDIONE RESISTANCE IN JOHNSONGRASS (*SORGHUM HALEPENSE*). I.C. Burke, W.E. Thomas, J.D. Burton, J.W. Wilcut, North Carolina State University, Raleigh, NC

ABSTRACT

Resistance testing is very important for implementation of control strategies. When testing for resistance in weed populations, the development of rapid and reliable bioassays is essential if growers are to be advised of their herbicide options in a timely manner. The identification of resistance to ACCase-inhibiting herbicides typically involves applying herbicide to plants grown under controlled conditions although it can involve verification in the field. These methods are expensive in terms of both cost and labor, and it can also take some time before results are known. Alternative seedling assays that involve the determination of shoot length as growth parameters to discriminate between resistant and susceptible biotypes have been developed for other resistant grass biotypes but not for johnsongrass. The objectives of this study are to determine optimum concentrations for the identification of resistance to clethodim and fluazifop. Experiments were conducted on johnsongrass seedling populations previously identified as resistant and susceptible to clethodim and fluazifop. The glumes of johnsongrass seed were removed, and the seed pre-germinated in 15x300 mm round plastic petri dishes lined with germination paper in an alternating growth chamber set at 20/30 C. Johnsongrass seedlings with a root length of at least 3 mm were then place in assay dishes. Seedling assays were prepared by heating distilled water to 70 C and adding agar at 8 g/L. The agar media was then boiled and allowed to cool to 45 C. To prepare each assay, a solution of either clethodim (Select 2 EC) or fluazifop (Fusilade 2 EC) were prepared each at 0.5 g ai/L. Herbicide was then added to the agar solution and poured in 15x300 plastic petri dishes and allowed to cool. Twenty mL of solution were added to each petri dish. Clethodim assay concentrations included 0, 0.011, 0.022, 0.045, 0.09, 0.18, 0.36, 0.72, or 1.44 mg ai/L. Fluazifop assay concentrations included 0, 0.023, 0.047, 0.094, 0.18, 0.38, 0.75, and 1.5 mg ai/L. Ten pre-germinated johnsongrass seedlings were placed in each agar plate which were then placed in an alternating growth chamber set at 20/30 C. There were four repetitions of each herbicide concentration, and the experiment was conducted twice. After 5 days, the dishes were removed and coleoptile length was measured in mm.

The johnsongrass dose-response experiment showed differences in coleoptile length existed between the resistant and susceptible johnsongrass populations at most concentrations of clethodim and fluazifop. For fluazifop, coleoptile length for resistant johnsongrass at 5 days (17.2) is nearly twice that for susceptible johnsongrass (9.6). A similar trend was observed for clethodim. Predicted coleoptile length at the highest rates of clethodim was lower for the susceptible biotype (9.6 mm) than for the resistant biotype (15.9 mm). The lowest dose at which the coleoptile growth of the susceptible johnsongrass was strongly inhibited was 48 ug/L fluazifop, and at this concentration the resistant biotype was almost not affected. Therefore, fluazifop at 48 ug/L was selected as the best concentration for a reliable discrimination between the susceptible and resistant johnsongrass biotypes. With clethodim, the lowest concentration that inhibited coleoptile growth of the susceptible biotype was 90 ug/L. At this concentration, there was much less variability within each biotype and a considerable difference in response between each biotype. Therefore, 90 ug/L clethodim was selected as the best concentration for discrimination between susceptible and resistant johnsongrass biotypes.

In this study, dose-response experiments with fluazifop and clethodim were effective at differentiating susceptible and resistant biotypes of johnsongrass. The agar growth media provided a suitable substrate for growth of johnsongrass, although root lengths could not be measured. Root growth was strongly inhibited at even the lowest AOPP and CHD rates. The consistency of the method appears to be very high, as the response of the susceptible biotypes was similar to both the AOPP and CHD herbicides. Also, the dissimilar level of resistance to clethodim and fluazifop correlate well with efficacy data on the same populations (data not shown), where greater resistance was observed to fluazifop than to clethodim. The identification of concentrations effective at separating resistant and susceptible biotypes is important not only for rapid diagnosis of potential resistance, but also for screening of seed for use in experiments. Coleoptile length appears to be the appropriate growth parameter to detect resistance in johnsongrass biotypes.

EFFECT OF TIMING ON POST-DIRECTED HERBICIDE TREATMENT IN COTTON.
J.K Haas, M. G. Patterson, and W. H. Faircloth. Department of Agronomy and Soils, Auburn University, AL 36849 and USDA-ARS National Peanut Research Lab, Dawson, GA 39842.

ABSTRACT

Field studies were conducted at the Prattville Experiment Field near Prattville, AL and the Wiregrass Research and Extension Center, near Headland, AL in 2004 to evaluate several post-directed herbicide treatments applied to cotton approximately eight inches tall (fluometuron alone or in combination with mix partners) and 12 inches tall (prometryn and diuron alone or in combination with mix partners). Mix partners were glyphosate, MSMA, or pyrithiobac. Treatments were applied in 15 gallons of solution per acre using a single 15004 flat fan nozzle per middle. Plots were 4 rows (36 inches apart) and 30 ft long. Roundup Ready cotton was used in both trials and a blanket application of Roundup Weathermax was applied over both trials at the 2 L cotton stage to establish a height differential between weeds and crop prior to post-directed treatments. Weeds at Prattville included entireleaf morningglory and sicklepod. Weeds at Headland included large crabgrass and Palmer amaranth. The trial at Prattville was conventionally tilled and the trial at Headland was strip tilled. No in-crop mechanical cultivation was used with either study. Hurricane Ivan reduced yields at Prattville an estimated 60%.

Late season morningglory control at Prattville varied from 83 to 45 percent. Residual herbicides alone provided a maximum 68% control. Adding glyphosate or MSMA to the residuals tended to increase control. Adding pyrithiobac did not improve morningglory control above the residuals alone. Sicklepod control varied from 93 to 48 percent. Residuals alone gave 59 to 63 percent control. Adding glyphosate or MSMA to fluometuron or diuron tended to provide better sicklepod control than mixtures with prometryn. Adding pyrithiobac to any of the residuals did not improve late-season sicklepod control. Fluometuron with glyphosate or MSMA applied approximately one wk prior to prometryn and diuron mixes tended to provide better late-season control of both weed species. Seed cotton yield was lower for prometryn alone or prometryn or diuron with pyrithiobac

Late season large crabgrass control at Headland was good to excellent with all treatments (88 to 95%). Likewise, palmer amaranth control was good to excellent with all treatments(83 to 95%). Seed cotton yields ranged from 2009 to 2686 pounds per acre. Timing did not significantly affect weed control or yields at Headland.

INTERACTIONS IN TANK MIXTURES OF PROPANIL WITH CYHALOFOP-BUTYL. J.W. Heiser, J.A. Kendig, B.A. Hinklin, P.M. Ezell, R.M. Cobill, University of Missouri Delta Research and Extension Center, Portageville, Mo.

ABSTRACT

SuperWham is a water-based formulation of 4 lb/ gal propanil which is believed to contain a trace amount of the insecticide carbaryl. Propanil controls many common grass and broadleaf species in rice. Clincher (cyhalofop-butyl) is a post-emergence grass herbicide which controls relatively large grass with post-flood applications, but only controls small grass with pre-flood applications. Limited research has shown that possible synergism may occur when these two are used as tank mix partners.

To further evaluate synergism, a study was conducted in 2004 at the Missouri Rice Research Farm located in Glennonville, Mo. The main objectives of this study were to further evaluate mixtures for synergism and to evaluate a number of rates of SuperWham and Clincher to determine which are best.

Treatments were a factorial combination of SuperWham at 0, 3, and 5 lb ai/A (0, 3, and 5 qt/A) with Clincher at 0, 0.056, 0.093, and 0.28 lb ai/A (0,3,5,and 15 oz/A). Treatments were applied at separate application timings to 4-5 leaf grass mid post (MPOST) and pre-flood (PFD) timing. Grass larger than 3- leaf is often controlled inadequately. Crop oil concentrate was added to the treatments at 1.25% V/V. Rice was planted on May 11. Treatments were applied at the 4-5 leaf (glf) stage on June 4 and pre-flood (pfd) on June 10. Permanent flood was established on June 15.

Visual ratings were taken at 6, 25, and 52 days after treatment (DAT) of the 4-5 leaf stage for barnyardgrass (*Echinochola crus-galli*) control and rice (*Oryza sativa)* injury. Data were subjected to analysis of variance and LSD values were calculated at the 5% level of significance. Colby expected values were also calculated and compared to the visual ratings.

SuperWham alone at the 4-5 leaf barnyardgrass stage provided 50 and 78% barnyardgrass control for the 3 and 5 qt/A rates respectively. Clincher provided only 18, 23, and 33% barnyardgrass control when applied alone at 3, 5, and 15 fl oz/A. When Clincher was added to the 3qt/A rate of SuperWham, the observed control was 11, 8, and 14% higher than the Colby expected values for 3, 5, and 15 fl oz/A Clincher rates respectively. Only the 14% from the 15 fl oz/A rate of Clincher was statistically higher than the Colby value. With the 5 qt/A of Superwham, the 3, 5, and 15 fl oz/A of Clincher gave 1, 2, and 4% higher than the Colby expected value but none of these differences were statistically significant.

At the pre-flood timing, SuperWham alone provided 31 and 73% barnyardgrass control for the 3 and 5 qt/A respectively. Clincher provided 0, 10, 58% control at 19 DAT for the 3, 5, and 15 fl oz/A rates. When Clincher was added to the 3qt/A rate of SuperWham, the control was 7, and 6% higher than the expected values for the 3 and 5 fl oz/A, but decreased 5% from the expected control when 15 fl oz/A rate was used. None of the responses were significant at the 5% level. With the 5qt/A rate of SuperWham, control was 14, 9, and 7% lower than the Colby expected values at 3, 5, and 15 fl oz/A respectively.

These data suggest that SuperWham-Clincher combinations may be synergistic when grass is slightly large. However, synergism was inconsistent, and in some cases antagonism and inadequate control of tillering barnyardgrass was observed.

Additional research is needed to determine if these trends are consistent and to determine if the responses are the result of active ingredients or if they are the result of other ingredients in the formulations.

WEED MANAGEMENT IN LIBERTY LINK COTTON. W.L. Barker, W.J. Everman, J.D. Wilcut, J.W. Wilcut, and J. Collins.

ABSTRACT

Several weed management systems were evaluated in Liberty-Link cotton at four locations in North Carolina in 2004. Various herbicides systems were evaluated utilizing factorial treatment combinations of early postemergence (EPOST), postemergence (POST), and LAYBY applications. Studies were conducted as randomized complete block designs with 3 replications. Two comparison treatments were also included. An industry standard which received pendamethalin at 0.95 lb ai/A plus fluometuron at 1 lb ai/A pre-emergence, followed by (fb) glufosinate at 0.42 lb ai/A EPOST fb glufosinate POST fb prometryn at 1 lb ai/A plus MSMA at 2 lb ai/A LAYBY. The weed-free was also hand weeded as necessary. All treatments received a preemergence treatment of pendamethalin. The factorial arrangement included three EPOST levels, four POST and four LAYBY levels. The levels of the EPOST factor were glufosinate, glufosinate plus metolachlor at 1 lb ai/A, and no EPOST. Levels for the POST factor included glufosinate, glufosinate plus pyrithiobac at 0.032 lb ai/A, glufosinate plus trifloxysulfuron sodium at 0.002 lb ai/A, and no POST herbicide application. The final factor contained the levels prometryn plus MSMA, prometryn plus glufosinate, glufosinate plus flumioxazin at 0.063, and no LAYBY. AMS at 3 lb ai/A was included in all glufosinate treatments and NIS at 0.25% v/v was included with all trifloxysulfuron sodium, flumioxazin, pyrithiobac, or MSMA treatments. Cotton injury was never biologically significant (less than 5%). Weed control and cotton injury was visually evaluated early-, mid-, and late season. Regardless of herbicide option a three pass system (EPOST, POST, and LAYBY) controlled goosegrass (*Eleusine indica* L.), Palmer amaranth (*Amaranthus palmeri* S.), common ragweed (*Ambrosia artemisiiflolia* L.), common lambsquarters (*Chenopodium album* L.), pitted (*Ipomoea lacunosa* L.), ivyleaf (*Ipomoea hederacea* L.)and entireleaf (*Ipomoea hederacea* var. *integriuscula*) morningglories greater than 95%. An EPOST fb POST herbicide system had greater than 90% control of goosegrass, common ragweed, common lambsquarters, pitted, ivyleaf and entireleaf morningglories. Glufosinate provided broad spectrum control of annual grass and broadleaf weeds early season, however, continued emergence of weeds required multiple herbicide applications for season-long weed control and resulting high yields. When a LAYBY was not applied, control of Palmer amaranth was greater than 90% for all EPOST fb POST treatments except glufosinate fb glufosinate (80%). An EPOST or POST alone system gave between 45 and 80% control of goosegrass, Palmer amaranth, common ragweed, common lambsquarters, pitted, ivyleaf and entireleaf morningglories. Weed control and yield were similar for all LAYBY treatments. Cotton yield was equal to or greater than the weed-free check if the system included an EPOST fb either a POST or LAYBY and when a three pass system was utilized. A one pass system EPOST or POST yielded significantly less than the two or three pass systems.

IMPACT OF ROW SPACING AND SOYBEAN POPULATION ON WEED MANAGEMENT SYSTEM NEEDS. D.M. Dodds[1], D.R. Shaw[1], D.B. Reynolds[1], J.A. Mills[2], and W.G. Givens[1]; [1]Mississippi State University, Mississippi State, MS; and [2]Monsanto Co., Collierville, TN.

ABSTRACT

Interest in narrow row crop production has existed since 1939. Narrow row crop production offers yield advantages due to more efficient use of sunlight and quicker canopy closure. Although the proportion of soybean planted to row widths of 47 cm or less has increased since 1997, this trend has not occurred in the southeastern United States. Therefore, this study was conducted to determine the impact of various row spacings on soybean yield and weed management programs.

An experiment was conducted at the Black Belt Branch Experiment Station near Brooksville, MS to determine the effect of planting soybean on 48 cm row spacings on yield and weed management programs. A forced randomization was used to accommodate planting equipment used in this study. Plots measured 6 m by 9 m. Seeding rates used in this study were: 123500, 247100, 371000, and 494200 seeds per hectare. For each seeding rate, herbicide programs were determined in the following manner: total glyphosate program using the herbicide recommendation software HADSS (RR HADSS), total glyphosate program standard for our geographical area (RR conventional), conventional herbicide program using HADSS (conventional HADSS), and conventional program standard for our geographical area (conventional standard). Using this method the following herbicides and rates were used for each seeding rate in this study: RR HADSS – glyphosate at 1.26 kg ae/ha POST; RR conventional – glyphosate at 0.88 kg/ha POST; conventional HADSS – sulfentrazone + chlorimuron at 276 g ai/ha PRE, pendimethalin at 1.12 kg ai/ha PRE, chlorimuron at 8.8 g ai/ha POST, NIS at 0.25% v/v POST; quizalofop-p at 0.06 kg ai/ha POST, and COC at 1% v/v POST; conventional standard - sulfentrazone + chlorimuron at 276 g/ha PRE, pendimethalin at 1.12 kg/ha PRE, chlorimuron at 8.8 g/ha POST, lactofen at 0.22 kg ai/ha POST, NIS at 0.25% v/v POST; quizalofop-p at 0.06 kg/ha POST, and COC at 1% v/v POST. The PRE herbicides used in the conventional HADSS system were determined based on local standards due to HADSS being a POST-only program. Approximately 50% of the total plot area was harvested from the center of each plot.

Over 85% control of hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. ex A.W.Hill] and johnsongrass [*Sorghum halepense* (L.) Pers.] was obtained with all weed control programs regardless of seeding rate. Pitted morningglory (*Ipomoea lacunosa* L.) control was also more than 80% for all programs with the exception of the conventional standard program. Control of pitted morningglory control was variable (71 – 85%), depending on seeding rate. At least 90% sicklepod [*Senna obtusifolia* (L.) Irwin and Barnaby] control was observed with each total glyphosate program; however, control was less than 60% with both conventional programs. The highest yields were obtained using a total glyphosate program at seeding rates of 247100, 371000, and 494200 seeds per hectare.

WEED MANAGEMENT WITH NONTRANSGENIC, LIBERTYLINK, AND ROUNDUP READY COTTON SYSTEMS. S.B. Clewis[1], I.C. Burke[1], J.W. Wilcut[1]; and J. Collins[2]; [1]Crop Science Department, North Carolina State University, Raleigh, NC; and [2]Bayer CropScience, Research Triangle Park, NC.

ABSTRACT

Experiments were conducted at the Peanut Border Belt Research Station near Lewiston-Woodville, the Upper Coastal Research Station near Rocky Mount, the Central Crops Research Station near Clayton, and the Caswell Research Station near Kinston, NC in 2004. Cotton was planted on either 36 or 38 in row spacing depending on the location in 12 x 20 foot plots. The cotton varieties FiberMAX 9598LL, FiberMAX 989RR, and FiberMAX 989 were planted in late April to early-May in sandy loam soils typical of North Carolina cotton production land. The experimental design was a split-block with a factorial treatment arrangement of five postemergence (POST) and three late post-directed (LAYBY) options with 3 replications. All weed management systems received Prowl preemergence (PRE) at 1 lb ai/A. POST options varied with each cotton system. The LibertyLink system included: No early postemergence (EPOST), Ignite at 0.42 lb ai/A EPOST, Ignite + Dual Magnum at 1 lb ai/A EPOST, Ignite EPOST followed by (fb) Ignite POST, Ignite + Dual Magnum EPOST fb Ignite POST. The Roundup Ready system included: No EPOST, Roundup WeatherMAX at 0.75 lb ae/A EPOST, Roundup WeatherMAX + Dual Magnum at 1 lb ai/A EPOST, Roundup WeatherMAX EPOST fb Roundup WeatherMAX POST, Roundup WeatherMAX + Dual Magnum EPOST fb Roundup WeatherMAX POST. The nontransgenic system included: NO EPOST, Envoke at 0.0048 lb ai/A EPOST, Staple at 0.064 lb ai/A EPOST, and a tank mixture of Envoke at 0.0024 lb ai/A + Staple at 0.032 lb ai/A EPOST. Induce was included with all Envoke and Staple treatments. A mid-POST application of Select at 1 0.125 lb ai/A plus Agridex at 1% v/v was made to control annual grasses. LAYBY options were: No LAYBY, Caparol at 1 lb ai/A + MSMA at 2 lb ai/A plus Induce at 0.25% v/v, Ignite, Roundup, or Caparol plus Valor at 0.063 lb ai/A plus Induce depending on the system.

Early-season cotton injury was less than 10% with all nontransgenic systems. Envoke alone injured cotton 8%, while Staple alone injured cotton 5%. The tank mixture of Envoke and Staple alone injured cotton 9%. Roundup Ready and LibertyLink systems had less than 1% regardless of the herbicide treatment. All cotton injury was transient and not seen by the mid-season rating. Roundup Ready and LibertyLink systems provided equivalent control for goosegrass, Texas panicum, large crabgrass, common lambsquarters, common ragweed, purple nutsedge, entireleaf morningglory and Palmer amaranth. Ignite alone provided better control of pitted morningglory and sicklepod. The addition of a sequential application for both systems increased weed control. The addition of residual activity of Dual Magnum did improve control of both systems compared to one application of Ignite or Roundup. A LAYBY application increased all treatments to greater than 95%. In nontransgenic systems, Envoke alone outperformed Staple alone for all weeds. Ignite and Roundup alone yielded 650 and 698 lb/A, respectively. The addition of Dual Magnum to Ignite or Roundup alone increased yield production by 219 and 132 lb/A, respectively. A sequential application of Ignite and Roundup also increased yield production to 1239 and 1199 lb/A, respectively. The addition of a LAYBY to all treatments did significantly increased cotton yield coinciding with the increased weed control. In the nontransgenic system, Envoke alone yielded 1056 lb/A compared to Staple alone at 901 lb/A. The tank mixture of Envoke and Staple did provide a higher yield of 1083 lb/A but was not significantly different from Envoke alone. Again, the addition of a LAYBY did increase yield compared to systems without a LAYBY treatment.

The lack of residual control from POST herbicides necessitates multiple applications. A two-pass system (POST fb LAYBY) can often provide excellent weed control and high yields; a three-pass system will be required in fields with heavy weed pressure. Timely application, proper herbicide selection, and good agronomic practices that provide vigorous cotton growth are still the foundation to a profitable crop with optimum economic return.

ALTERNATIVE HERBICIDES TO CONTROL IMI-RESISTANT RED RICE IN SOYBEANS. M.A. Sales, N.R. Burgos, V.K. Shivrain and M.M. Anders; Department of Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

Two experiments were conducted to evaluate alternative herbicides for imidazolinone-resistant (imi-resistant) red rice in soybeans. Soybean cultivar DP5915RR was planted in 15 ft x 8 ft four-row plots 22 in apart at a rate of 50 lbs/A. Imi-resistant red rice was planted in a single row between two middle rows of soybeans. The two experiments followed a randomized complete block design with four replications. The first experiment evaluated 12 herbicides applied as pre-plant incorporated (PPI), pre-emergence (PRE), and post-emergence (POST) singly or in combination for a total of 24 herbicide treatments. The second experiment evaluated 10 herbicides in 28 treatments of PRE and POST single or combination applications, or PRE fb POST applications at rates similar to those in the first experiment. Application rates were as follows: pendimethalin, trifluralin and metolachlor at 1 lb ai/A; dimethenamid-p at 0.75 lb ai/A; glyphosate at 0.75 lb ae/A; metribuzin and chlorimuron-ethyl + metribuzin at 0.5 lb ai/A; clethodim and chlorimuron-ethyl + sulfentrazone at 0.25 lb ai/A; fluazifop + fenoxaprop at 0.249 lb ai/A; flumetsulam at 0.066 lb ai/A; quizalofop-ethyl at 0.063 lb ai/A; and chlorimuron-ethyl at 0.05 lb/A. Control treatment for both experiments was imazethapyr applied at two-leaf stage at a rate of 0.063 lb ai/A. Percent stand reduction was recorded at 27 DAT for PPI and PRE treatments. Weed control was evaluated 49 days after POST treatments.

Only dimethenamid-p and metolachlor applied singly as PRE and PPI treatments reduced red rice stand 100% in both experiments. PRE and PPI treatments of metribuzin applied in combination with metolachlor, or with trifluralin also reduced red rice stand >95%; applied alone as PRE treatment, however, metribuzin effected only 57 and 72% stand reduction, the least among all herbicides for both experiments. PPI treatment improved metribuzin efficacy to 88%. Trifluralin, metribuzin, flumetsulam, and pendimethalin, when applied singly, gave <90% stand reduction.

Single herbicide POST treatments of glyphosate, quizalofop-ethyl, and fluazifop + fenoxaprop controlled red rice 100% at 49 DAT. Among all the single herbicide PRE and PPI treatments, only dimethenamid-p controlled red rice 100% at 76 DAT. Other herbicide treatments which controlled red rice 100% were PPI treatment combinations of metribuzin + metolachlor or trifluralin, (chlorimuron-ethyl + metribuzin) and trifluralin, and (chlorimuron-ethyl + sulfentrazone) and chlorimuron-ethyl; PRE combinations fb POST treatments of metribuzin + metolachlor fb quizalofop-ethyl or glyphosate, (chlorimuron-ethyl + metribuzin) + pendimethalin fb glyphosate; and single PRE applications of metolachlor or dimethenamid fb POST treatments of glyphosate or quizalofop-ethyl. PRE treatments of metolachlor applied singly or in combination with metribuzin controlled red rice 98 and 99%, respectively; single metolachlor PPI treatment controlled red rice 97%. PRE combination of metribuzin + pendimethalin fb POST treatment of glyphosate also gave 97% control. PRE treatment fb POST treatment of metribuzin, pendimethalin, (chlorimuron-ethyl + metribuzin) + pendimethalin, or (chlorimuron-ethyl + sulfentrazone) + chlorimuron-ethyl fb quizalofop-ethyl controlled red rice 95%. Single PRE applications of metribuzin gave the lowest control ratings for both experiments (60 and 13.8%, respectively). Trifluralin, clethodim, metribuzin, flumetsulam and pendimethalin when applied alone gave ≤90% control.

Dimethenamid-p consistently gave 100% ratings for both stand reduction and control in both experiments. Metolachlor applied alone provided excellent red rice control but allowed a few red rice to emerge later. Applying PRE fb POST treatments of metolachlor singly or in combination with metribuzin fb quizalofop-ethyl or glyphosate, however, achieved 100% red rice control. Other herbicide treatments which gave consistent 100% ratings for both stand reduction and control were PRE fb POST treatments of dimethenamid-p fb quizalofop-ethyl or glyphosate.

SYMPOSIA

WEED MANAGEMENT IN COTTON

OVERVIEW AND APPLICATION OF WEED BIOLOGY AND INTERFERENCE RESEARCH IN COTTON. J.W. Boyd, J.D. Green, B.S. Smith, R.B. Westerman, and D.S. Murray. University of Arkansas, Little Rock, AR 72203; University of Kentucky, Lexington, KY 40546; Smith & Smith Farms, Dayton, NV 89403; and Oklahoma State University, Stillwater, OK 74078.

ABSTRACT

It is essential to have fundamental knowledge about a pest or disease organism that is being managed or treated. It is therefore no less important to know and understand fundamental information about the growth, development, reproduction, spread, and a host of other growth parameters regarding the weeds we are trying to manage or control in our crops. There is no question that growers strive to learn all they can about the crops they are producing. Would it not also seem logical that the more successful producers also know a considerable amount about the weeds they are trying to manage in their crops? This notion is not new at all. There have been numerous articles published on this topic and the northeastern states, in particular, have published several bulletins on weed biology and control. This presentation is a "brief" overview of selected biology/ecology and interference experiments conducted over the past 25 years in Oklahoma to illustrate some practical applications of this research to the management of specific weeds. In order to accomplish this overview in the time allotted, particular emphasis will be placed on examples using silverleaf nightshade as a case study. The first author of this presentation, Boyd, collected biology and growth data on silverleaf nightshade. One of the most important findings of Boyd's was the time after emergence that silverleaf nightshade seedlings require to become or behave as a perennial. Much of this information is still being used today to continue the research on this weed. Boyd's research was followed by Green's experiments which used data for silverleaf nightshade growth from Boyd. Without the growth data, Green would have likely been unable to conduct his research which concentrated on interference and water use by both the weed and cotton. Smith followed with additional interference experiments and collected data on the population dynamics of this weed. Her research clearly illustrates why this weed has become so prevalent following the introduction of the dinitroaniline herbicides and reduced use of cultivators for weed control. This weed is capable of increasing in population density at a phenomenal rate. Finally, Westerman conducted experiments on the control of silverleaf nightshade. Painted with a broad brush, this presentation has just illustrated a data supported picture of silverleaf nightshade - from growth and development, through competition and water use, and ending with control of this important weed species. Other examples could have certainly been discussed, and in part, data from other species were briefly discussed. It is the opinion of the author that information such as this is essential for making "informed decisions" and essential for developing sound, economical, and practical solutions to weed control issues.

SYMPOSIA

WEED MANAGEMENT IN COTTON

MANAGING WEEDS IN COTTON IN THE SOUTHERN DELTA REGION. S.T. Kelly, D.K. Miller and P.R. Vidrine, Louisiana State University AgCenter, Winnsboro, St. Joseph, and Alexandria, LA.

ABSTRACT

Cotton production in the south delta has seen substantial changes over the last 6 years. With the introduction of Roundup Ready technology, many producers have moved from conventional tillage systems to reduced tillage systems. While the numbers of true no-till acres have increased in some areas of the northern delta, late season rainfall often creates situations where ruts dictate a fall tillage operation to re-form rows and improve surface drainage and limits the amount of acreage that can be considered true no-till. In 1999, Roundup Ready cotton acreage comprised about 10 to 15% of the total cotton acreage in Louisiana. In 2000, Roundup Ready cotton increased to about 65% of the total acreage and has increased to 80% in 2004. As in other cotton growing areas of the mid-south, controlling weeds in Roundup Ready cotton has become a major research area.

Since the adoption of Roundup Ready Technology, many producers do not use traditional residual herbicides for early season weed control. Producers primarily rely on two timely, over-the-top glyphosate applications to accomplish early season weed control. A trend in the past two years has been to add Dual Magnum (*s*-metolachlor) to one of the two early season glyphosate applications to control weeds until the first post-direct applications. One of the potential hazards of foregoing a soil residual herbicide is, of course, timeliness of the over-the-top applications, and the potential of adverse weather conditions dictating a growers' ability to control weeds early. A potential solution to this hazard is the application of a soil residual herbicide. However, the use trend of residual herbicides has declined tremendously over the past 6 years. This trend has seen the almost discontinued use of norflurazon, fluometuron and trifluralin since 1997. These herbicides were applied on 15% or less of the cotton acreage in Louisiana in 2003. Diuron, however, has seen an increase in use in Louisiana, being applied on greater than 70% of the cotton acreage. This use though, is exclusively as a layby treatment.

With a change in tillage practices and herbicide use, come changes in weed control strategies. Sicklepod (*Senna obtusifolia*), once difficult and tedious to control using conventional cotton herbicide systems, is virtually not a problem using Roundup Ready technology. However, bermudagrass (*Cynodon dactylon*) and redvine (*Brunnichia ovata*) are becoming problematic with very little fall tillage, and removal of earlier maturing crops allowing an extended growing period into the fall and winter. Certain annual grasses are also becoming problemtatic. Broadleaf signalgrass (*Brachiaria platyphylla*) and browntop millet (*Brachiaria ramosa*) are two species that are increasing their presence in Louisiana cotton fields. Their extended germination periods and apparent tolerance to diuron are two possible reasons for this increase. In some cases, many annual grasses are allowed to go to seed in the fall following corn or soybean harvest, further increasing seed banks that have to be managed in the following crop.

Roundup Ready Flex will almost surely see widespread adoption in the southern delta region. This technology may enable producers to tank-mix glyphosate with plant growth regulators, insecticides and/or fungicides, thus reducing application costs. While growers will be afforded more flexibility with this new generation of Roundup Ready cotton, care must still be taken to control weed escapes and make precise applications to the weeds to insure thorough spray coverage. The adoption of Liberty Link cotton is currently unclear. The release of varieties containing Bt technology will certainly make it more attractive. Liberty Link technology will provide growers with another tool for managing resistance by using another mode of action. However, growers will be faced with managing two herbicide resistant technologies in a single crop.

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WEED MANAGEMENT IN COTTON

WEED MANAGEMENT ISSUES IN TEXAS AND OKLAHOMA COTTON. P.A. Baumann, J.W. Keeling, P.A. Dotray, D.S. Murray, S. Osborne, and J.C. Banks; Texas A&M University; College Station and Lubbock, TX, and Oklahoma State University; Stillwater and Altus, OK.

ABSTRACT

Weed management in Texas and Oklahoma cotton has traditionally been accomplished through the use of soil applied herbicides, post and post-directed herbicides, and cultivation. The recent introduction of herbicide tolerant cotton varieties has made it possible to use non-selective herbicides such as glyphosate and glufosinate to control weeds not previously controlled by traditional methods, without having deleterious effects on the crop when used properly. Pigweed (Amaranthus) species remain the most common troublesome weeds in Texas and Oklahoma cotton production. Although easily controlled by the dinitroaniline herbicides, improper incorporation, sub-lethal use rates, and occasional flooded soil conditions keep this weed at the top of the list. Controlling pigweed escapes has been enabled through the use of postemergence applications of glyphosate and glufosinate in tolerant cotton varieties. Morningglory (Ipomoea) species (ivyleaf, sharppod, pitted, red, entireleaf) are also troublesome competitors in cotton. The use of post-emergence and post-directed herbicide programs following pre-emergence herbicide applications have been successful in keeping these weed species in check, however, sequential postemergence glufosinate and glyphosate applications have proven even more effective when used in a timely manner. Russian thistle (Salsola kali) and red sprangletop (Leptochloa filiformis) are often a problem because of ill-timed applications of herbicides that would normally be effective for controlling them. Perennial weeds such as woolyleaf bursage (Ambrosia grayi), Texas blueweed (Helianthus ciliaris) and field bindweed (Convolvulus arvensis) continue to present challenges for control and currently require both in-season and fallow period herbicide applications to keep them manageable. Another perennial weed, silverleaf nightshade (Solanum elaeagnifolium) was once a major problem in Texas and Oklahoma cotton production. However, with the development of glyphosate tolerant cotton and the widespread employment of postemergence applications of this herbicide, silverleaf nightshade has become much less of a pernicious problem.

The continued use of highly effective herbicides in transgenic cotton will likely result in weed populations that are less susceptible to either glyphosate or glufosinate. Therefore, future weed management programs must include the use of herbicides having different modes of action, and also mechanical and cultural means of control.

MANAGING WEEDS IN COTTON IN THE SOUTHEASTERN UNITED STATES. A.S. Culpepper and A.C. York, University of Georgia, Tifton, GA and N. C. State University, Raleigh, NC.

ABSTRACT

Southeastern cotton weed control has changed drastically since the commercialization of Roundup Ready cotton in 1997. Following the release and the rapid adoption of this technology, it is currently being planted on over 92% of the cotton acres throughout the Southeast. Several weed control changes and challenges have occurred, at least in part, as a result of Roundup Ready technology, including the following: 1) greater adoption of conservation tillage, with several states, including Georgia and North Carolina, producing at least 40% of their crop utilizing conservation tillage practices; 2) reduction in mechanical weed control after crop emergence, with many growers relying completely on herbicides to manage weeds; 3) reduction in the use of residual herbicides like fluometuron and norflurazon while relying very heavily on postemergence control from glyphosate; and 4) weed shifts and resistance, which have become problematic in several areas throughout the Southeast because of heavy dependence on glyphosate-based systems.

The adoption of conservation tillage has had two direct and significant effects on weed control. First, growers now must mange winter annual weeds, such as cutleaf eveningprimrose, wild radish, and horseweed (including glyphosate-resistant) with herbicides prior to planting the crop. Control of these weeds by commonly used non-selective herbicides such as glyphosate or paraquat is often not adequate. Research has shown the most effective programs often include 2,4-D or Clarity in mixture or followed by glyphosate or paraquat. Second has been the difficulty of getting soil-applied residual herbicides, especially the dinitroaniline herbicides, to the soil surface through the litter or living plant matter that is often present at time of application. Research is on-going in an attempt to determine the most effective application of these dinitroaniline herbicides in conservation tillage cotton focusing on application methods (spray compared to impregnated fertilizer), time of application relative to planting, and the need for increasing the herbicide rate to overcome the loss of activity.

Many growers once relied heavily on in-crop tillage operations to control weeds but most growers now rely on herbicides to manage these pest. The predominate choices for early in-season weed control include glyphosate, glyphosate plus pyrithiobac, and glyphosate plus *S*-metolachlor. Glyphosate alone has been the predominate choice, but without residual weed control and with several weeds tolerant to glyphosate becoming more common, research has shown that pyrithiobac added to glyphosate improves morningglory (except tall) control while providing residual control of several species. Tank mixtures of *S*-metolachlor plus glyphosate provide residual weed control of several problematic weed species, including tropical spiderwort and Palmer amaranth. Residual control from pyrithiobac or *S*-metolachlor mixed with glyphosate and applied during early season can give growers an additional 7 to 10 days before a follow-up herbicide application is needed.

Reduced use of herbicides such as fluometuron and norflurazon has accompanied increased glyphosate use. In 1996, prior to Roundup Ready cotton, weed scientist across the Southeast estimated that fluometuron was applied to at least 75% of the cotton acreage while norflurazon was applied to at least 15% of the acreage. In 2003, the same survey of scientists noted fluometuron was used on less than 30% of acres for all southeastern states and was used on less than 10% of the acreage in states such as Alabama, Georgia, and South Carolina. Use of norflurazon was essentially non-existent.

Reduced use of residual herbicides, increased conservation tillage acreages, and increased applications and dependence on glyphosate have lead to several weed shifts and resistant weed populations across the Southeast. Scientist have noted that morningglory species, dayflower species, Palmer amaranth, and winter annuals have adapted and prospered in currently used Roundup Ready systems. Additionally, glyphosate-resistant horseweed has been confirmed in at least one southeastern state, North Carolina.

In 2004, the use of conventional, BXN cotton, and Liberty Link cotton were minimal compared to today’s standard, Roundup Ready.

SYMPOSIA

WEED MANAGEMENT IN COTTON

MANAGING WEEDS IN NORTH CAROLINA COTTON: A CONSULTANT'S PERSPECTIVE.

William M. McLawhorn, Jr., McLawhorn Crop Services, Inc., Cove City, NC 28532

ABSTRACT

During the past fifteen years, weed management programs utilized by south-eastern cotton growers have evolved rapidly. New technologies with crop protection materials, bioengineered crops, and improvements in agricultural equipment have allowed producers to expand their operations and manage more acreage with less equipment, less labor, and a smaller volume of herbicides. Minimum tillage systems have become easier to manage, often providing improved moisture retention, less soil erosion, and more productive crops.

But each wave of new technology usually has brought with it a downside initially. On sandy, Coastal Plains soils, the first few years of a no-til system con sometimes create serious problems with soil compaction. And the first years of bioengineered crops, such as Buctril tolerant and Round-up tolerant varieties have typically resulted in poor variety performance costing growers substantially. As we embrace the next wave of new technology including Liberty Link and Round-up Flex varieties, growers should be encouraged to make changes gradually and deliberately, until the new varieties have been proven to have performance levels that are competitive with the best existing genetics.

SYMPOSIA

WEED MANAGEMENT IN COTTON

WEED CONTROL STRATEGIES IN THE MID-SOUTH DELTA. C.E. Snipes, H.R. Robinson and S. P. Nichols. Mississippi State University – Delta Research and Extension Center. Stoneville, MS 38776.

ABSTRACT

In 2004, the top seven cotton varieties planted in the Mid-south were stacked gene varieties and constituted approximately 82% of the total Mid-south cotton acreage planted. Economics, changes in production systems, and development of new herbicides all factor into this shift away from conventional cotton in the Mid-south. Economics and recent advances in weed control are making no-till production systems more attractive to producers in the area. In the absence of mechanical cultivation there has become a heavier reliance on herbicides. BXN cotton is still an option, however it provides little control of grasses and is not as widely used as other programs. Roundup Ready cotton provides an excellent spectrum of weed control. For the Mid-south it typically requires a residual herbicide in tough situations. The use of Staple in combination with glyphosate enhances post-over-the-top control with certain weeds in a Roundup Ready program. Currently, precise applications are important in this system. Roundup drift has become a concern in conventional or non-Roundup Ready cotton systems since they are often planted adjacent to Roundup Ready cotton. Although acreages are low, they are anticipated to increase as weed shifts dictate changes in programs. A study done in 2003 at the Delta Research and Extension Center, Stoneville, MS showed that lint yield of conventional cotton treated with Roundup at rates above 0.12 lb ai/A at the 6-7 leaf stage was lower than the untreated check. As a newer non-Roundup Ready system, Liberty Link cotton will add to current Mid-south weed control options. Based on current research, it needs a timely two-step approach for weed control, especially for pigweed and grasses. A residual herbicide should be considered for pigweed and grasses in this system.

Due to the overwhelming presence of Roundup Ready crops in the Mid-South, selection pressure on existing weed populations is heightening. To minimize the increased threat glyphosate-resistant weeds in the Mid-south, producers should implement the practice of rotating herbicide chemistries, crops, and cultural practices. Conventional, BXN, Roundup Ready and Liberty Link systems all allow Mid-south producers a broad spectrum of weed control options. The recognition of potential resistance, tailored varietal selection, and changes in herbicide selection based on anticipated weed patterns can result in optimum economic return while sustaining all existing weed control systems.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

OVERVIEW OF NEW FEDERAL FARM LEGISLATION: THE IMPACT ON CROPPING SYSTEMS MANAGEMENT. J.A.Baldwin University of Georgia Crop and Soil Science Department, Tifton, Ga..

ABSTRACT

In 2001, the farm bill changed peanut programs from the Quota/additional system to a program based on cropping history to establish farm base from the yields and acreage produced from 1998-2001 crop years. The effective price of peanuts for government support was reduced from $610.00 per ton to a price of $355.00 per ton. The results of these program changes also allowed anyone to produce peanuts without a farm base. Since 2001, many changes have occured at the farm level as it concerns peanut production, management, and marketing. In most peanut producing states, there have been numerous new growers, new production areas, more attention to reducing costs of production, and increases in acreage in the traditional peanut producing states. Producers have mainly tried to reduce input costs through reduced fungicide and herbicide use as well as increasing the number of acres planted by reduced tillage methods. There has also been a tendency to reduce rotation length due to reduced prices of other program crops.

SYMPOSIA

WEED MANAGEMENT IN PEANU

IMPACT OF CULTURAL PRACTICES ON WEED MANAGEMENT IN PEANUT. B.J. Brecke and D.O. Stephenson IV, West Florida Research and Education Center, University of Florida, Jay, FL 32565.

ABSTRACT

Within the past few years many growers in Florida, Georgia and Alabama have adopted twin-row and/or strip-tillage peanut (*Arachis hypogaea* L.) production systems because of the greater yield potential with twin-rows and potential labor savings and soil erosion reduction with reduced tillage. The twin-row pattern may also improve weed control because of the more rapid peanut canopy closure that occurs in the twin-row system. Studies were conducted at the University of Florida, West Florida Research and Education Center, Jay, FL from 2000 to 2004 to compare weed management in a twin-row planting pattern with peanut planted using a single row pattern under both conventional and strip-tillage systems. Treatments were arranged as a split-plot with planting pattern as main plots and 12 herbicide systems as split plots. Results varied with year but weed control was often better in the twin-rows than the conventional rows (7 of 10 studies). When results were averaged over all herbicide treatments, sicklepod (*Senna obtusifolia* (L.) Irwin and Barnaby) control was from 5 to 25% better, Florida beggarweed (*Desmodium tortuosum* (Sw.) DC.) and common cocklebur (*Xanthium strumarium* L.) from 5 to 15% greater, prickly sida (*Sida spinosa* L.) 20% higher and browntop millet (*Brachiaria ramosa* (L.) Stapf) 5% improved with twin-rows over conventional rows. Peanut yield was also higher in the twin-row system in 6 of 10 studies. Overall weed control was slightly less in strip-tillage than in conventional tillage but yields were similar.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

STARTING FROM SCRATCH: GROWING PEANUT WITHOUT HERBICIDES. W.C. Johnson, III; USDA-ARS; Coastal Plain Experiment Station; Tifton, GA.

ABSTRACT

There is interest among peanut growers and industry in organic peanut production in the southeastern U. S. This interest is based on increasing consumer demand for organic foods, particularly organic peanut butter. Until recently, runner-type peanut cultivars had little host plant resistance to diseases. However, peanut cultivars 'DP-1' and 'C11-2-39' have been recently released and both cultivars have excellent resistance to many peanut diseases. With effective disease management possible using resistant cultivars, the next major challenge in organic peanut production is weed management.

Trials were conducted in 2003 at the Coastal Plain Experiment Station in Tifton, GA in conventional tillage and strip-tillage production systems. The conventional tillage trial evaluated two levels of stale seedbed management, two row patterns, and five levels of weed control using propane flaming. The strip-tillage trial was conducted at a site with a senescent rye cover crop. This trial evaluated all combinations of three levels of cover crop management and nine levels of weed control using propane flaming. Both trials were conducted at sites managed for weed science research with heavy natural populations of southern crabgrass, pitted morningglory, and yellow nutsedge. In the conventional tillage trial, shallow tillage of stale seedbeds twice before planting provided better early season weed control compared to stale seedbeds flamed three times before planting. Early season ratings showed weed control was not improved by narrow row patterns over wide row patterns. Over-the-top propane flaming sequentially at peanut emergence and one week after emergence provided early season weed control nearly comparable to the standard herbicide check, when used in conjunction with shallow tillage of stale seedbeds. Peanut exhibited acceptable tolerance to over-the-top propane flaming early season. Despite the promising efficacy of multiple propane flamings for weed control, the lack of residual weed control was evident later in the season and trials were not harvested due to heavy weed infestations. In conservation tillage trials, burning, mowing, or planting directly into standing rye resulted in numerous weed escapes that could not be controlled by propane flaming after planting.

Trials were reconfigured in 2004 and were conducted using conventional tillage production practices. In one trial, weed management systems were evaluated using a factorial arrangement of row patterns (wide rows and narrow rows), OMRI-approved herbicides (Matran®, Ground Force®, and propane flaming), and sweep cultivation (cultivated two times and four times). Weed management was not improved by narrow row patterns over wide rows due difficulties in cultivating narrow row patterns. Matran® and propane flaming controlled initial flushes of dicot weeds, but did not effectively control annual grasses. Ground Force® did not effectively control any of the weeds present in these trials. Neither Matran®, Ground Force®, nor propane flaming provided residual control of weeds and subsequent weed emergence resulted in severe weed infestations by mid-season. Cultivation had the greatest effect of all treatments. However, there were fewer cultivations when peanut were seeded in narrow row patterns compared to wide rows. In subsequent weed free trials, peanut tolerated single applications of Matran® and Ground Force®, when applied no later than two weeks after emergence. Multiple applications or single applications of Matran® later than two weeks after emergence injured peanut and reduced yield.

These trials clearly show the extreme difficulty in managing weeds in organic peanut production. Matran® and propane flaming control small dicot weeds, but not annual grasses. Furthermore, none provide residual weed control. Sequential applications are costly and injurious to peanut. It is apparent that effective weed management in organic peanut production is based on cultural and mechanical weed control practices, with the foundation being long term intense weed control in organic crop production fields to deplete numbers of viable weed seed. Cultivation and timely hand-weeding supplement cultural controls. Matran®, Ground Force®, and propane flaming have limited value in organic peanut production.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

IMPORTANCE AND DILEMMA OF USING RESIDUAL HERBICIDES IN PEANUT. T.A. Baughman, Texas A&M Research & Extension Center, Vernon, TX.

ABSTRACT

Residual herbicides provide an important part of an overall peanut weed control system. However, producers are often concerned about several matters related to the use of residual herbicides. These issues include: additional cost, crop injury, herbicide carryover, herbicide activation, inconsistency, and possible weed resistance issues. Nevertheless, even with this apprehension it is estimated that 65 to 85% of the peanut acres or peanut producers use a preplant incorporated residual herbicide, 5 to 80% use a preemergence residual herbicide, and 45 to 80% use a postemergence residual herbicide. The reason for this need is the slow growing nature and competitive ability of the peanut plant especially early in the growing season. To minimize this weed competition producers rely on these residual herbicides. In many cases these residual herbicides provide broad spectrum weed control and aid in the success of follow-up postemergence applications.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

DEVELOPMENT, APPLICATION, AND MODIFICATION OF DECISION SUPPORT SYSTEMS TO CONTROL WEEDS IN PEANUT. B.L. Robinson, G.G. Wilkerson, and D.L. Jordan; Crop Science Department, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Many decision support systems (DSS) have been developed in recent years to aid growers and researchers in estimating and utilizing best management practices in crops. There are many challenges and barriers to widespread use of these systems in the weed science community. Three notable areas are changes in weed management technology, changes in computer technology, and user adoption. Some of these issues are compounded by the fact that frequent updates to herbicide databases are needed, but can be expensive and time consuming. In North Carolina, weed management decision aids were first developed in the mid 1980s. Weed management and computer technological changes have been addressed at NCSU by yearly changes to these decision aids. Currently, there are three different weed management DSS: HADSS for use on desktop computers, WebHADSS for use over the Internet, and Pocket HERB for use on handheld computers. During the past three years, integrated pest management (IPM) grants have allowed us to explore ways to increase user adoption of these DSS, in particular that of peanut extension agents. These grants have allowed purchase of handheld computers for all peanut extension agents in North Carolina. Two different scouting experiments were performed with a major objective being to familiarize the agents with Pocket HERB. A second objective was to identify effective and efficient weed scouting methods for peanut fields.

Past observations have shown that Cooperative Extension agents are more successful at adopting new technologies than growers. A total of 14 extension agents located in the peanut producing counties of North Carolina were given handheld computers and travel money to use for on-farm trials in 2002, 2003, and 2004. Extensive training sessions were conducted before and after each growing season. In addition, the second experiment involved NCSU scouts who met the agents in the field to assist in scouting. We believe that these efforts increased user adoption among the agents because the computer became integrated into their professional lives, and the scouting methods were made clear. In addition to specific DSS training, agents also received instruction on how to use other functions of the handheld computers (calendar, contacts, Pocket Word and Pocket Excel). The training sessions also served as an efficient time to deliver updates to the software, answer questions from the agents and to obtain feedback about the accuracy and usability of Pocket HERB. As a result of the training sessions, other agents with corn and cotton responsibilities became interested in the project, and applied for funding from private commodity groups to purchase their own handheld computers.

Research on different scouting methods in peanut was completed in order to increase the existing knowledge about cost and efficacy of various approaches. Peanut fields were scouted approximately three weeks after planting using a variety of methods. Agents periodically visited the fields throughout the season to monitor weed control. Scouting data were entered into Pocket HERB, and herbicide recommendations were generated. Estimations of average theoretical net return over herbicide investment were calculated using current market prices for both the crop and herbicides, as well as expected yield reductions from weed competition. The agent then communicated with the grower and recommended a herbicide program based upon the results. Follow-up questionnaires were given to each agent at the end of each field season to survey the farmers' and agents' opinion of the methods.

Modifications to the program have included changes to the screen format, additions of herbicide treatments and weeds, as well as changes to the way weed density information is entered and analyzed. Future changes to the program will include addition of preemergence and burndown herbicides in peanut. Additionally, we are continuing our efforts to encourage weed scientists in other peanut-growing states in the southeast region of the U.S. to develop and maintain versions of these DSS customized to conditions in their states. Future efforts are focused on exploring other possible applications that could be developed for the handheld computers that would aid growers and county agents with pest control.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

PEANUT WEED CONTROL IN THE SOUTHWEST-AN OVERVIEW. W. J. Grichar, Texas Agricultural Experiment Station, Beeville 78102; P. A. Dotray, Texas Agricultrural Experiment Station, Lubbock 79409; T. A. Baughman, Texas Cooperative Extension, Vernon 76385.

ABSTRACT

The incidence of weeds is an extensive problem in all peanut-growing regions of Texas. Weeds can reduce peanut yield and quality considerably, especially when allowed to compete during stand establishment and early season plant growth. Late-season weeds interfere with digging, causing further loss of yield. Therefore, efficient weed management is essential for the profitable production of peanut. It has been estimated that weed losses in peanut exceed $50 million in the three southwestern states of Texas, Oklahoma, and New Mexico. Estimated total income losses from control procedures for weeds, yield, and quality reductions, increased cultural inputs, and reduced harvesting efficiency are approximately $53/A for Texas peanut producers.

The dinitroaniline herbicides are the base for most herbicide programs in the southwest. Since these herbicides do not control yellow nutsedge (*Cyperus esculentus* L.), other herbicides such as Dual Magnum, Outlook, Pursuit, or Strongarm must be used in combination with (preplant incorporated) or following (preemergence) a dinitroaniline herbicide to improve yellow nutsedge control. Concerns about peanut injury with chloroacetamide herbicides such as Dual Magnum and Outlook applied preplant incorporated (PPI) and preemergence (PRE) on sandy soils has resulted in postemergence (POST) applications of Dual Magnum and Outlook, followed within 24 h by irrigation or rainfall, to yellow nutsedge less than 8 inches in height. This method of yellow nutsedge control has provided effective (>90%) control without peanut injury. After weed emergence, Basagran, Cadre, or Pursuit may be applied postemergence (POST) to control yellow nutsedge. Purple nutsedge (*Cyperus rotundus* L.) has become an increasing problem across the state and only Cadre (POST only), Pursuit (PPI, PRE or POST), or Strongarm (PRE only) provide effective control. Broadleaf weed control can be improved with a PRE application of Valor following a dinitroaniline herbicide while POST applications of Cadre, 2,4-DB, Storm, Ultra Blazer, or Pursuit can control many broadleaf weed escapes. Cadre will also control small-seeded annual grasses such as southern crabgrass [*Digitaria ciliaris* (Retz.) Koel.] and broadleaf signalgrass [*Brachiaria platyphylla* (Griseb.) Nash] when applied to grass less than 2 inches in height but will not effectively control taller annual grasses. Annual and perennial grass escapes can be effectively controlled with Poast Plus or Select.

Rotation restrictions with rotational crops following peanut have resulted in Cadre and Pursuit use reduced when cotton follows peanut due to an 18-month plant-back restriction.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

WEED MANAGEMENT APPROACHES IN THE SOUTHEASTERN U.S. E. P. Prostko* And N.B. Smith, University Of Georgia, Tifton, Ga 31793; W.C. Johnson, Iii, Usda/Ars, Tifton, Ga 31793; B.J. Brecke And J. A. Ferrell, University Of Florida, Milton And Gainesville, Fl 32583; And C.D. Monks And J. W. Everest, Auburn University, Auburn, Al 36849.

ABSTRACT

The southeast region has long been recognized as the leader in U.S. peanut production. In 2004, Alabama, Florida, and Georgia accounted for 67% of the total harvested acres in the country. Over the past ten years, peanut weed management systems in the southeast have changed due to the presence of tomato spotted wilt virus (TSWV) and the registration of several new herbicides. TSWV has lead to an increase in both twin row and reduced tillage production systems. Increases in reduced tillage practices have altered the typical use patterns and effectiveness of Prowl (pendimethalin) and Sonalan (ethalfluralin) resulting in more frequent problems with Texas panicum (*Panicum texanum*) and Florida pusley (*Richardia scabra*). Additionally, these tillage changes, in combination with twin row production systems and other factors, have helped contribute to a decline in mechanical cultivation. The presence of TSWV has also lead to the rapid development and release of many new peanut varieties. In 2004, twelve peanut varieties were available for planting in the southeast. Most of these varieties have not been subject to extensive herbicide tolerance trials. Since the later part of the 1990's, six new herbicides have been registered for use in peanut. These include Cadre (imazapic) - 1996, Select (clethodim) - 1998, Strongarm (diclosulam) - 2000, Valor (flumioxazin) - 2001, Spartan (sulfentrazone) - 2004, and Cobra (lactofen) - 2004. The popularity of some of these newer herbicides has lead to a reduction in the use of older products such as Dual (metolachlor), Pursuit (imazethapyr), and Classic (chlorimuron). However, an increase in the spread and distribution of tropical spiderwort (*Commelina benghalensis*) may resurrect the use of both Dual and Pursuit in peanut. Because of its low cost and broad spectrum of activity, Gramoxone Max (paraquat), applied in combination with either Basagran (bentazon) or Basagran + 2,4-DB, continues to be one of the most frequently applied herbicide treatments for peanut weed management in the southeast. Additionally, Cadre has become a grower favorite in the region despite its potential negative effects on rotational crops such as cotton or vegetables.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

WEED MANAGEMENT APPROACHES IN THE VIRGINIA-CAROLINA REGION. J.W. Wilcut, S.B. Clewis, D.L. Jordan, J.C. Faircloth, and J. Chapin. North Carolina State University, Raleigh, NC; VPI & Suffolk, VA; and Clemson University, SC.

ABSTRACT

The peanut production region of Virginia, North Carolina, and South Carolina is a production region in a state of uncertainty. Changes in the Farm Bill have resulted in production shifting out of VA and NC into the southern part of the Coastal Plain of SC. Production in NC is shifting from the northeastern corner of the state into the central and southern Coastal Plain. Changes in the Farm Bill have also caused increased economic pressures on producers, particularly in regions with heavy soil-borne disease pressure. Peanut producers in this region face a multitude of annual grass and broadleaf weeds plus perennial sedges that must be managed for profitable production. Compared to the southeastern production area, VA and NC producers have less sicklepod and Texas panicum, with Florida pusley and Florida beggarweed being problems only in the southeastern corner of NC. Major grass and broadleaf problems in VA and NC included broadleaf signalgrass, fall panicum, foxtails, goosegrass, large crabgrass, common lambsquarters, common ragweed, eclipta, *Ipomoea* morningglories including pitted, entireleaf, ivyleaf, red, and tall morningglories; prickly sida, tropic croton, and some velvetleaf. SC has more sicklepod, Florida beggarweed, Texas panicum, Florida pusley, and goosegrass than the two other states.

The differences in weed species between the three states result in some differences in herbicide use. Valor is used more preemergence (PRE) in SC because of Florida beggarweed, while Strongarm PRE or preplant incorporated (PPI) is used more in NC and VA because of common ragweed and eclipta. Gramoxone Max is used less in VA and NC because of injury perceptions but is more widely used in SC. Storm is widely used in NC and VA as it provides broad-spectrum postemergence (POST) control of most broadleaf weeds, especially common lambsquarters, common ragweed, eclipta, and tropic croton; four weeds not adequately controlled by Cadre POST. The voluntary removal of Tough by the agrichemical industry from VC peanuts has made common lambsquarters control more problematic. Tough was removed for financial reasons as it is not widely used outside of VA and NC. Cadre POST is the standard for purple and yellow nutsedge control in all three states and its suppression of peanut internode-length, does help improve row definition for digging. Strongarm if registered for POST applications, would increase application flexibility for common ragweed and *Ipomoea* morningglories with very good crop tolerance. Cobra was recently registered for POST use in peanuts and will control large ragweed, however, crop tolerance needs to be more fully investigated.

Use of the dinitroaniline herbicides PPI (Prowl and Sonalan) is required in fields infested with Texas panicum and helps improve common lambsquarters control. Dual Magnum and Outlook are often used for annual grass control in fields that are not infested with Texas panicum. Palmer amaranth is a major problem in SC and has increased rapidly in NC over the past 10 years. ALS-resistant Palmer amaranth is a major issue in SC and infests approximately 40% of the crop acreage in NC. Reduced tillage (strip tillage) is slowly and steadily increasing in NC and SC.

SYMPOSIA

WEED MANAGEMENT IN PEANUT

UNIVERSITY RESPONSE TO ISSUES ASSOCIATED WITH PEANUT INJURY AND USE OF STRONGARM AND VALOR. P.A. Dotray and E.P. Prostko. Texas Tech University, Texas Agricultural Experiment Station, and Texas Cooperative Extension, Lubbock and The University of Georgia, Tifton.

ABSTRACT

University response to peanut injury is not different from the response by industry. Questions such as "Did I overlook something?" and "Is this a local, regional, or beltwide problem?" are universal following peanut injury. Herbicide induced peanut injury is not a new problem. In fact, previous research indicates that peanut was injured following applications of acifluorfen, metolachlor, paraquat, 2,4-DB, imazapic, imazethapyr, and several dinitroanilines. Peanut injury following diclosulam (Strongarm) was observed before its launch year in 2000 in plots that received excessive rates. In 2000, plants were slower to emerge and were chlorotic in many areas in west Texas. This injury was not observed across the peanut belt and was not uniform across west Texas. A supplemental label was issued in 2001 for Texas, Oklahoma, and New Mexico limiting applications to soils with a pH below 7.2. Studies conducted since 2000 suggest that Flavor Runner 458 was more susceptible to diclosulam than Tamrun 96. One of the major differences between the 1999 and 2000 growing season was an increase in the amount of Flavor Runner 458 that was planted in place of Tamrun 96. Diclosulam has good activity when applied POST and little injury has been observed following this application timing. Unfortunately, diclosulam POST is not allowed for general use across all peanut producing states. Flumioxazin (Valor) induced peanut injury was observed in North Carolina, Georgia, and Oklahoma in 2001, which was the year this herbicide received a Federal 3 label. Intensive rainfall at ground crack was suggested as the primary cause of peanut injury. Some areas received a second untimely and intensive rainfall, which set back plants that were recovering from the initial injury. Studies conducted since 2001 suggest that peanut injury is more likely to occur when applications are made one or more days after planting as opposed to preplant and at planting applications. The current flumioxazin label states that applications should be made within 48 hours after planting. Peanut injury following diclosulam and flumioxazin was observed in their first year following registration, even though a significant amount of field testing was conducted during product development. In the future, research prior to product registration must include testing for differential varietal tolerance and crop tolerance by environment interactions.

SYMPOSIA

WEED MANAGEMENT IN REDUCED TILLAGE

OVERVIEW OF TILLAGE SYSTEMS IN THE SOUTHERN UNITED STATES. D. Jordan, North Carolina State Univ., Raleigh.

ABSTRACT

Tillage systems can have a major impact on the weed management approaches required to optimize crop yield. Additionally, sustainability of production systems is also influenced by tillage, especially in certain regions of the southern United States. Production in conservation tillage has generally increased over the past few decades for several of the major agronomic crops. A survey of 2004 crop production in the United States by the Conservation Technology Information Center, through contacts with the USDA-NRCS and local Conservation Partnerships, revealed that approximately 48% (corn), 62% (full-season soybean), 74% (double crop soybean), 22% (cotton), 29% (summer wheat), 32% (grain sorghum), 18% (peanut), 52% (sugarcane), 5% (rice), and less than 2% (tobacco) of planted acres were in some form of conservation tillage in the United Sates. Understanding the diversity of tillage systems and issues associated with their implementation can assist weed scientist in setting priorities on research and extension efforts.

SYMPOSIA

WEED MANAGEMENT IN REDUCED TILLAGE

APPROACHES TO WEED MANAGEMENT IN THE NORTHERN PART OF THE SOUTHERN REGION. J.D. Green and J.R. Martin, Department of Plant and Soil Sciences, University of Kentucky, Lexington, KY 40546

ABSTRACT

No-till crop production systems have become a common practice throughout Kentucky and other surrounding states within the northern areas of the Southern region. Typical crop production cycles within this area of the country consist of a corn/soybean rotation (soybean grown as a full-season crop) or a corn/wheat/soybean rotation system whereby three crops are grown within a two year cycle. Double-cropped soybeans are planted immediately following wheat harvest. Notill production methods consist of crops planted directly into the soil with little soil disturbance except where the seed are placed. In many cases, the existing vegetation at time of planting is killed by a foliar "burndown" application using glyphosate or paraquat. Other herbicide options may be applied if vegetation is sparse at time of planting or fall applications and early preplant treatments are sometimes used. Because of the availability of herbicide tolerant crop technology, at planting applications may be delayed until after the crop has emerged, particularly for double-cropped soybean behind wheat. In some cases, 2,4-D is applied as a "burndown" herbicide when needed to address particular weed problems.

In Kentucky approximately 60% of the corn and over 80% of the soybeans are grown using notill production methods. As tillage and weed management practices have changed during the past 30 years, the predominate weed species of concern have also changed. During the 1970's and 1980's johnsongrass, common cocklebur, annual morningglories, giant ragweed, eastern black nightshade, and shattercane were considered to be the predominate weeds. By the late 1990's johnsongrass continued to be present in field crops, but has become less of a concern following the introduction of several postemergence graminicides in the 1980's for soybean and the introduction in the 1990's of herbicides that provide postemergence johnsongrass control in corn. As tillage has declined weeds such as broadleaf signalgrass in corn and horseweed (marestail) has become more prominent in soybean. Presence of perennial dicots such as common pokeweed, trumpetcreeper, and honeyvine milkweed has also increased. Whereas, some annual weeds such as common cocklebur have decreased in importance. Heavy reliance on some herbicide chemistries has resulted in resistant weed biotypes such as triazine and ALS-resistant smooth pigweed, and more recently horseweed (marestail) tolerance to glyphosate. Other ALS-resistant weeds have also been reported.

Introduction of herbicide tolerant crops such as Roundup Ready^{TM} soybean varieties and Clearfield^{TM} and Roundup Ready^{TM} corn hybrids have provided additional weed management tools to combat weeds such as broadleaf signalgrass, johnsongrass, common pokeweed, and trumpetcreeper. Therefore, uses of herbicide tolerant crops have increased to approximately 30% of the crop acres for corn production and over 80% for soybean. Most corn acres are currently treated with a soil-applied herbicide at planting followed by a postemergence treatment at three to five weeks after emergence, whereas, postemergence glyphosate applications is the primary source of weed control for most soybeans. For a few problem weeds in soybean, such as horseweed (marestail) and yellow nutsedge, other herbicide treatment are occasionally used.

SYMPOSIA

WEED MANAGEMENT IN REDUCED TILLAGE SYSTEMS

WEED MANAGEMENT IN REDUCED TILLAGE COTTON IN TEXAS AND OKLAHOMA.
J.W. Keeling, Texas Agricultural Experiment Station, Lubbock.

ABSTRACT

Cotton is produced in Texas and Oklahoma under a wide range of tillage systems ranging from conventional to no-till. The trend over the last 10 to 15 years has been toward more reduced tillage systems utilizing crop residue when crops such as wheat, corn, or sorghum are rotated with cotton, or use of a terminated small grain cover crop in continuous cotton. With the widespread planting of Roundup Ready cotton varieties, this trend has increased with less reliance on tillage or cultivation for weed control.

In the Texas High and Rolling Plains and Southwest Oklahoma, a significant amount of cotton is grown in a terminated small grain crop system. Glyphosate is used to terminate the cover crop 2 to 3 three weeks prior to planting. If winter weeds such as horseweed, mustard, kochia, or Russian thistle emerge, 2,4-D is often used for control while the cover crop continues to grow. Trifluralin or pendimethalin are used for Palmer amaranth control, and are applied by chemigation (trifluralin) or surface applied and water incorporated (pendimethalin). These herbicides may be mechanically incorporated in strip-till situations. Glyphosate is used POST or PDIR as needed to control annual and perennial weeds in season. Residual herbicides such as pyrithiobac or metolachlor are tank-mixed with glyphosate POST to improve Palmer amaranth or yellow nutsedge control. Diuron is tank-mixed with glyphosate PDIR for late-season Palmer amaranth and morningglory control. With these herbicide programs, excellent season-long control of most annual and perennial weeds can be achieved with no cultivation.

In the Blacklands, Brazos bottoms, and Coastal Bend areas of Texas, cotton is commonly rotated with high residue crops such as corn or sorghum. Cotton is no-till planted into crop residue using trash managers to move residue from the row and improve cotton emergence. Henbit, ryegrass, sowthistle, and cutleaf evening primrose are winter weed problems under reduced or no-till systems. Prometryn is commonly used in the fall for henbit control, while paraquat is used to burndown these weeds in the spring. At planting, prometryn is applied in a band for residual Palmer amaranth and morningglory control, with 2 POST (1 to 2 leaf and 4 leaf) glyphosate treatments. Glyphosate PDIR, alone or tank-mixed with diuron, is used in place of cultivation.

The introduction of Roundup Ready Flex cotton should improve weed control in reduced tillage cotton systems, although PPI, PRE, and POST residual herbicides will still be valuable for Palmer amaranth and morningglory control.

SYMPOSIA

WEED MANAGEMENT IN REDUCED TILLAGE SYSTEMS

RECENT HISTORY OF CONSERVATION TILLAGE IN THE DELTA. J.A. Kendig, M.S. DeFelice, D.K. Miller and J.D. Byrd. Plant Science Division, University of Missouri Delta Center, Portageville, MO 63873, Pioneer Hybrid, Louisiana State Agricultural Center and Mississippi State Univeristy.

ABSTRACT

While no-tillage methods have greatly reduced runoff erosion in hilly areas, soil erosion is significantly less in the Delta flatlands and tillage is much more common. However, the combination of labor shortages, higher equipment and fuel costs, lower burndown herbicide prices and weed control improvements from glyphosate-tolerant systems has made reduced tillage systems economically attractive. This has lead to significant tillage reductions in the Delta in recent years.

Pure, no-tillage systems are less common, but a variety of reduced tillage or conservation tillage systems are now common. On many soils, deep tillage will increase yield. Fields are occasionally rutted due to wet harvest conditions. Also, many parts of the Delta are under furrow-type irrigation, which often requires the maintenance of a significant bed and furrow. Crops (especially Cotton) benefit from good drainage, consequently soils are usually bedded in the Delta. Hilly areas tend to be naturally well drained. There have been significant reductions practices such as moldboard plowing, repeated disking, and the total flattening and reestablishment of beds. Those types of operations were frequently used together in the same field as part of normal seedbed preparation, and these types of intensive, multiple preplant tillage systems have largely disappeared. Reduced and conservation tillage includes a large number of named tillage systems, including stale seedbed, ridge tillage, strip tillage. Stale seedbed and ridge-till methods are popular in the Delta; however, systems tend to be fluid, with growers adjusting their tillage practices year to year based on situations in individual fields. Some growers in extremely sandy areas use cover-crop systems to reduce wind and sand-blasting damage. Growers on heavy clay soils will till when moisture allows (typically during the Fall, but sometimes in the Late Winter or Early Spring) and then plant into a stale-seedbed. Due to the great variety and fluidity of tillage systems, it is difficult to give a precise estimate of tillage reductions; however, overall tillage operations have been reduced.

In the last 10 years, conservation tillage has grown more rapidly due to lower glyphosate prices and the availability of glyphosate-resistant crops. In the 1980's a full-rate glyphosate treatment cost about the same as three or four tillage operations. Today, glyphosate costs are similar to one or two tillage operations. Before glyphosate-tolerant crops, an important no-till rule of thumb was to have an essentially perfect burndown with a seedbed free of all live vegetation. Today, growers still need to use an effective burndown; however, burndown escapes easier to control in the glyphosate-tolerant crops. A common recommendation before glyphosate tolerant crops was a full rate of glyphosate one to three weeks before planting followed by a full rate of paraquat at planting to control escapes. The paraquat follow up treatment is now rare due to the ability to control larger, difficult escapes in the crop.

Years with low commodity prices and / or years with exceptionally wet weather will cause increases in reduced tillage systems and extended dry periods will often increase the amount of tillage used, especially if ruts were formed during wetter times. Since 2002, glyphosate-resistant horseweed has spread rapidly across the North Delta and has resulted in some reduced-tillage fields receiving thorough tillage treatments. However, many Delta growers have a history of making early burndown treatments of herbicides like 2,4-D and dicamba, which are effective at controlling horseweed. And additional herbicide treatments may provide control of new horseweed emergence. Because the Delta tends more towards a "till-as-needed" approach, the impact of glyphosate-resistant horseweed on tillage systems may be lessened. However, with concerns of widespread, repeated glyphosate use, even in rotated glyphosate-resistant crops, it should be noted that reduced tillage usually results in additional glyphosate applications to a field.

Burndown alternatives exist; however, they usually control a narrower spectrum of weeds. Paraquat mixtures with preemergence, photo-synthetic-electron-transport-inhibiting herbicides control a broad spectrum of weeds; however, grasses and large broadleaf weeds will escape more often than with glyphosate burndowns. Also, a number of PPO preemergence herbicides work well in glyphosate tank mixtures; however, the use of preemergence herbicides is extremely low due to their expense and other complications.

SYMPOSIA

WEED MANAGEMENT IN REDUCED TILLAGE SYSTEMS

MANAGING WEEDS IN REDUCED TILLAGE SYSTEMS IN THE MID-SOUTH: A CONSULTANT'S PERSPECTIVE. S.H. Crawford; Crawford AG, Inc., St. Joseph, LA 71366

ABSTRACT

Crawford AG, Inc. provides weed control, plant growth regulator and general agronomic consulting services to growers in Tensas and nearby parishes in central northeast Louisiana. Crops in 2004 included approximately 20,000 acres of cotton (~98% glyphosate-resistant), 5,000 acres of corn (~40% glyphosate-resistant), and 3,000 acres of soybeans (100% glyphosate-resistant). Soils are primarily alluvial clay and mixed with relatively poor internal and surface drainage. The predominant tillage system is fall bedding with stale seedbed planting four to six weeks following destruction of multi-species native covers. Raised beds, which are essential for cotton and corn, are formed with disk or sweep bedders, rolled in the fall and/or spring, and planted with little or no soil disturbance. Complete no till is used as a fall-back option.

Concurrent developments in herbicides, planting equipment and production technology facilitated the transition from conventional spring tillage to the conservation tillage approach described above in the late 1980s.

Availability of a broad array of herbicides is essential for functional weed control without tillage. The most commonly used herbicides and applications in cotton include glyphosate, paraquat, 2,4-D and thifensulfuron/tribenuron in preplant burndown applications; paraquat and glyphosate in at-planting postemergence applications; fluometuron and diuron in at-planting residual applications; pyrithiobac sodium and glyphosate in early-season over-the-top applications; diuron, prometryn, MSMA and glyphosate in postemergence directed applications; and over-the-top gramminicides, when needed, for control of escaped annual and perennial grasses. Dominance of glyphosate-resistant cotton varieties, low cost of glyphosate, and relative ease of execution of weed control programs in these cultivars has greatly reduced dependence upon herbicides other than glyphosate, particularly residual herbicides. Preplant burndown applications for corn and soybeans are basically the same as those used in cotton. In-season herbicide applications for corn include maximum rates of atrazine, often in combination or sequence with nicosulfuron in conventional corn and glyphosate in glyphosate-resistant corn. In-season weed control in soybeans consists of multiple applications of glyphosate in combination with chlorimuron, flumiclorac pentyl ester or fomesafen.

Disk and sweep bedders have been developed for reforming seedbeds in the fall without additional tillage. Heavy rollers are used to shape beds after they are formed. Planters with double-disk openers, extra heavy-duty down-pressure springs, and seed-furrow closing wheels provide the means to plant for rapid emergence in a variety of conditions.

Technological improvements have enhanced the productivity and profitability of conservation tillage systems in the mid-south. Forming well-defined, smooth seedbeds in the fall is essential to timely and uniform spring planting. Burndown of native winter cover crops four to six weeks prior planting to facilitate decay of surface and root biomass is essential to conserve moisture and facilitate timely and uniform planting. Inter-row cultivation has been found to be of little value and is seldom used.

Crawford AG promotes a weed control philosophy based upon these tenets: (1) Manage for clean fields, (2) Manage so that one success builds upon another, (3) Manage with a backup plan in place, and (4) Manage against resistance.

Even though glyphosate-resistant crops have been widely grown for less than ten years, there are already definite changes in the weed spectrums encountered. Most obvious is a rapid buildup of small-seeded grasses and broadleaf weeds that have previously been controlled, for the most part, with residual herbicides: annual grasses, pigweeds, purslane, and horse purslane. Then there are increases in weeds that tend to escape glyphosate treatments: coffee bean, prickly sida, and pitted morningglory. Finally, glyphosate resistance is on the horizon. The problem is documented in horseweed in states to the north, and random escapes in glyphosate-resistant crops here in Louisiana suggest that the problem may have arrived.

Conservation tillage will likely remain the preferred system because it minimizes costs and maximizes productivity and profitability on our soils and in the crops that we produce. Glyphosate-resistant varieties will soon dominate every crop, partially because of the ease and economics of production, but also as protection against glyphosate drift. Weed shifts will continue and become more challenging and more expensive to counter. Herbicide resistance, particularly glyphosate-resistance, will no-doubt complicate weed management.

SYMPOSIA

WEED MANAGEMENT IN REDUCED TILLAGE SYSTEMS

WEED MANAGEMENT ISSUES IN REDUCED TILLAGE SYSTEMS IN THE SOUTHEAST. S. Culpepper and E. Prostko, University of Georgia, Tifton; B. Brecke, University of Florida, Jay; J. Norsworthy, Clemson University, Clemson; and A. York and D. Jordan, North Carolina State University, Raleigh.

ABSTRACT

Several weed scientists from the southeastern region of the Southern Weed Science Society were asked questions concerning conservation tillage issues in their states. The percentage of acres currently in reduced tillage production in Georgia included: corn at 30%, cotton at 40%, peanut at 25 to 30%, soybean at 30 to 40%, tobacco at less than 1%, and wheat at less than 10%. In North Carolina, the estimated percentage of acres in reduced tillage production for these respective crops was 45%, 41%, 15 to 20%, 65%, less than 1%, and 40%. The estimated percentages of reduced tillage production in Florida for cotton, corn, peanut, and soybean was 60%, 75%, 35%, and 75%, respectively. Major concerns listed by weed scientists in Georgia included: activation of dinitroaniline and other herbicides with residual activity, figuring out the best methods and rates of herbicides to apply in reduced tillage systems, issues associated with planting into dead and living plant residue, and failure of growers to apply 2,4-D to control primrose and wild radish in a timely manner. In North Carolina, the requirement to make timely burndown applications and shifts to perennial weeds in reduced tillage in the Piedmont region of the state was listed as important issues. Heavy reliance on postemergence herbicides and potential for weed shifts were major concerns in Florida. All weed scientists voiced concerns about weeds developing resistance to glyphosate. Major weeds in reduced tillage systems in Georgia included: primrose, radish, and annual ryegrass for burndowns and bermudagrass, Florida pusley, Texas panicum, morningglories, Palmer amaranth, tropical spiderwort, and annual grasses after the crops were established. In North Carolina, similar problems in reduced and conventional tillage generally exist except in the case of perennial weeds such as milkweed, dogbane, and horsenettle after a few years of continuous no till. Major weeds in Florida included tropical spiderwort, nutsedges, sicklepod, morningglories, Florida beggarweed, Florida pusley, and bermudagrass. Typical burndown/weed management programs for crops grown in reduced tillage systems for cotton in Georgia included: 2,4-D applied in February/March followed by non-selective herbicides (90% glyphosate) near planting. Burndown herbicides used in corn included glyphosate or paraquat with 2,4-D or atrazine depending upon the weed complex. In soybean, glyphosate or paraquat and 2,4-D were often used, while typical burndown programs in North Carolina included glyphosate alone and in some cases mixed with Valor, 2,4-D, or Harmony GT. Paraquat was also used in some instances in all states. Glyphosate was the primary burndown in Florida, although 2,4-D was included with glyphosate when primrose was present.

WINTER WEED CONTROL WITH ALS-INHIBITING HERBICIDES IN BERMUDAGRASS TURFGRASS. J.M. Taylor, J.D. Byrd, K.C. Hutto, and D.W. Wells. Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Eight sulfonylurea and one imidazolinone herbicide were evaluated for winter weed control in non-overseeded bermudagrass turfgrass. The herbicides and rates were: 0.56 or 0.28 oz pr/A Monument 75 WG (trifloxysulfuron), 3 or 1.5 oz pr/A Katana 25 DG (flazasulfuron), 2.6 or 1.3 oz pr/A Certainty 75 DF (sulfosulfuron), 2 or 1 oz pr/A TranXit 25 DF (rimsulfuron), 11 or 9 oz pr/A Image 70DF (imazaquin), 3 or 1.5 oz pr/A Corsair 75 DF (chlorsulfuron), 1.33 or 0.66 oz pr/A Manage 75 DF (halosulfuron), 1 or 0.5 oz pr/A Manor 60 DF (metsulfuron), 26 or 13 oz pr/A Revolver 0.19L (foramsulfuron). These treatments were compared to 1.5 lb pr/A Kerb 50 WSP (pronamide). All treatments were applied with 0.25% V/V non-ionic surfactant except Revolver and Kerb. Treatments were evaluated for annual bluegrass (*Poa annua*) and lawn burweed (*Soliva pterosperma*) control and common bermudagrass (*Cynodon dactylon*) regrowth following dormancy at West Point County Club in 2003 and 2004 which had a soil pH of 5.6. The same treatments were evaluated for henbit (*Lamium amplexicaule*) control in the same years at the Plant Science Research Center at Mississippi State University which had a soil pH of 7.4. Treatments were applied March 11 both years at West Point C.C. and on March 11, 2003 and March 10, 2004 at the Plant Science Research Center. At 2 weeks after treatment (WAT), all treatments except both rates of Image resulted in bermudagrass density (percent green cover) equal to or greater than the untreated. Averaged over years, bermudagrass density following Image was 15% for both treatments while density for the untreated and the other treatments was 28 to 44%. Both rates of Katana, Manage, or 1 oz/A Manor increased bermudagrass density compared to the untreated (40 to 44% compared to 28% for the untreated). At 4 WAT, both rates of Revolver, Image, or TranXit provided 80% or greater control of annual bluegrass both years. The higher rates of Monument, Katana, or Certainty provided 80% or greater control in both years. A rate response was observed between the high and low rate of Certainty both years and Monument in 2004. In 2004, Monument at 0.56 oz/A controlled annual bluegrass 88% while 0.28 oz/A provided 68% control. Certainty at 2.6 oz/A provided 100 and 88% control in 2003 and 2004, respectively and 1.3 oz/A provided 75 and 68% control in 2003 and 2004, respectively. In both years all treatments provided equivalent control of lawn burweed except Revolver or Kerb. Control was 88% for both rates of Revolver and 5% for Kerb in 2003 while other treatments controlled lawn burweed 98 to 100%. In 2004, Revolver controlled lawn burweed 45 to 60% while Kerb provided 13% control. All other treatments controlled lawn burweed 83 to 100%. Averaged over years all treatments provided 88 to 100% control of henbit except Manage, Certainty, or Kerb which provided only 38 to 48% control.

RESPONSE OF SEASHORE PASPALUM TO FORAMSULFURON AND FLAZASULFURON. T.R. Murphy; Crop and Soil Sciences, University of Georgia, Griffin, GA 30223-1797.

ABSTRACT

Compared to other turfgrass species, very few herbicides are registered for use in seashore paspalum (*Paspalum vaginatum* O. Swartz). Currently, only three preemergence (prodiamine, dithiopyr and oxadiazon) and two postemergence (halosulfuron, carfentrazone + 2,4-D + MCPP + dicamba) herbicides are labeled for this turfgrass. While these herbicides are useful, additional herbicides will be necessary to control the wide range of weed species that potentially will be found in seashore paspalum. Two separate experiments were conducted with foramsulfuron and flazasulfuron on 'Sea Isle I' seashore paspalum in Griffin, GA in 2004. Flazasulfuron at a rate range of 0.5 to 3.0 ozs. product/acre was applied to separate plots on May 5 and July 6, 2004. Foramsulfuron at rates that ranged from 4.4 to 52.4 fl. ozs. product/acre was applied as a single application on May 5 and as a repeat application on July 6 fb July 13, 2004. Flazasulfuron at rates $\leq$ 1.5 ozs./product acre caused only minor (< 12%) injury for two to three wks to seashore paspalum. Seashore paspalum tolerance to foramsulfuron was highly rate dependent. Foramsulfuron rates above 8.8 fl. ozs. product/acre injured seashore paspalum > 35% for 2 to 3 wks following single or repeat applications. Seashore paspalum seedhead emergence was suppressed > 80% for approximately four wks with flazasulfuron at rates > 1.0 oz./acre. Single and repeat applications of foramsulfuron at rates of $\geq$ 17.4 ozs./acre were highly effective for seedhead suppression up to 6 wks after application. Rates as low as 8.8 ozs./acre applied July 6 fb July 13 suppressed seedhead emergence for up to 5 wks after application. 'Sea Isle I' seashore paspalum exhibited excellent tolerance to metsulfuron at 1.0 oz. product/acre. Metsulfuron did not suppress seedhead emergence.

YELLOW NUTSEDGE (*CYPERUS ESCULENTUS*) AND FALSE-GREEN KYLLINGA (*KYLLINGA GRACILLIMA*) CONTROL WITH FLAZASULFURON. G. K. Breeden and J. S. McElroy, University of Tennessee.

ABSTRACT

Yellow nutsedge (*Cyperus esculentus*) and false-green kyllinga (*Kyllinga gracillima*) [Cyperaceae] are troublesome weeds for turfgrass managers in Tennessee and many other states. Both species are found throughout the Southeastern U.S. and predominately found in above average soil moisture conditions. The sulfonylurea herbicide flazasulfuron has been reported to provide control of *Cyperus* spp. and *Kyllinga* spp. Field research was initiated in 2004 to evaluate flazasulfuron as a control option for yellow nutsedge and false-green kyllinga in bermudagrass (*Cynodon* spp.) turf compared to standard treatments.

Research was conducted in Knoxville (yellow nutsedge) and Loudon (false-green kyllinga), TN. The experiment was replicated 4 times in a randomized complete block design. Experimental units were 5 by 10 feet. Treatments included in this research were flazasulfuron (0.125, 0.25, 0.375, and 0.75 oz ai/a), trifloxysulfuron (0.42 oz ai/a), halosulfuron (1.0 oz ai/a), and MSMA (32 oz ai/a) + imazaquin (8.0 oz ai/a). Herbicides were applied in a water carrier volume of 30 GPA with a CO_2 pressurized sprayer. Weed control and turf injury were evaluated visually utilizing a 0 (no weed control or turf injury) to 100 (complete control of all weeds or turf) % scale.

No bermudagrass injury was observed at anytime by any herbicide treatment. Flazasulfuron at 0.375 and 0.75 oz ai/a, trifloxysulfuron, and MSMA + imazaquin controlled yellow nutsedge ≥ 86% at 2 weeks after application (WAA). Control of yellow nutsedge was ≤ 80% for all other treatments at 2 WAA. Flazasulfuron at 0.75 oz ai/a, trifloxysulfuron, halosulfuron, and MSMA + imazaquin controlled yellow nutsedge ≥ 93% at 4 WAA. Control for all other treatments was ≤ 80% at 4 WAA. Trifloxysulfuron and MSMA + imazaquin controlled yellow nutsedge ≥ 95% at 6 WAA. While flazasulfuron at 0.75 oz ai/a controlled yellow nutsedge 73% at this rating date. All other treatments controlled yellow nutsedge ≤ 60% at 6 WAA. Flazasulfuron at 0.75 oz ai/a and MSMA + imazaquin controlled false-green kyllinga ≥ 91% at 2 WAA. All other treatments controlled false-green kyllinga ≤ 72% at 2 WAA. All treatments controlled false-green kyllinga ≥ 95% at 4 WAA except halosulfuron. Halosulfuron controlled false-green kyllinga 79% at this rating date. However, ≥ 93% control of false-green kyllinga was observed at 6 WAA with all treatments. Flazasulfuron reached the 90% control level faster than trifloxysulfuron and halosulfuron at 2 WAA. However, the other sulfonylureas controlled these species equal or better than flazasulfuron.

ANNUAL BLUEGRASS (*POA ANNUA*) AND LAWN BURWEED (*SOLIVA PTEROSPERMA*) CONTROL IN NON-OVERSEEDED BERMUDAGRASS (*CYNODON DACTYLON* x *C. TRANSVAALENSIS*) IN FLORIDA. D.O. Stephenson, IV, B J. Brecke, and J.B. Unruh. University of Florida, Milton, FL.

ABSTRACT

Annual bluegrass (*Poa annua*) and lawn burweed (*Soliva pterosperma*) are two of the most common and troublesome weeds in turfgrass in Florida. Left uncontrolled, they can decrease quality by invading desired turfgrass. An experiment was conducted in 2004 at the West Florida Research and Education Center near Jay, FL to document control of annual bluegrass and lawn burweed by trifloxysulfuron-sodium alone or tank-mixed with glyphosate or diquat. Treatments were applied March 17, 2004 to dormant Tifsport bermudagrass included: 1) trifloxysulfuron-sodium (17 g/ha); 2) glyphosate (840 g/ha); 3) diquat (280 g/ha); 4) trifloxysulfuron-sodium + glyphosate (17 + 840 g/ha); 5) trifloxysulfuron-sodium + diquat (17 + 280 g/ha); 6) formasulfuron (18 g/ha); and 7) nontreated. Annual bluegrass and lawn burweed control were visually rated 1 and 5 wk after treatment (WAT). Bermudagrass injury was visually rated 1, 5, and 11 WAT. Data were subjected to ANOVA and means separated using Fisher's Protected LSD at p = 0.05.

Trifloxysulfuron-sodium controlled annual bluegrass and lawn burweed greater than 85% 5 WAT. Glyphosate and diquat provided excellent control of both weeds 1 WAT, but diquat control decreased to 19% 5 WAT. Trifloxysulfuron-sodium and formasulfuron injured bermudagrass less than 15% at all rating dates. All treatments containing glyphosate and diquat injured bermudagrass greater than 49% 1 WAT, indicating that bermudagrass was not dormant at time of herbicide application.

Due to observed bermudagrass injury and emergence of southern crabgrass (*Digitatia ciliaris*) 9 WAT, which was differentiated by herbicide treatment, bermudagrass and southern crabgrass data was collected 9 and 11 WAT. Bermudagrass density and southern crabgrass plot cover were rated 9 WAT. Bermudagrass visual injury and southern crabgrass visual control were rated 11 WAT.

No differences in bermudagrass density were documented 9 WAT. Southern crabgrass cover following glyphosate, diquat, and formasulfuron was 80% or greater 9 WAT which was equal to the nontreated check. Cover was reduced to 58% following trifloxysulfuron-sodium alone or in combination with glyphosate or diquat, indicating possible residual control of southern crabgrass by trifloxysulfuron-sodium.

Southern crabgrass control 11 WAT by treatments that contained trifloxysulfuron-sodium was greater than any other treatment. Trifloxysulfuron-sodium + glyphosate or diquat controlled southern crabgrass less than trifloxysulfuron-sodium alone. Differences may have been due to glyphosate and diquat injuring bermudagrass, thus decreasing bermudagrass competitive ability with southern crabgrass and possible residual control by trifloxysulfuron-sodium.

Trifloxysulfuron-sodium alone on in combination with glyphosate or diquat is effective for control of annual bluegrass and lawn burweed. However, to avoid bermudagrass injury, glyphosate or diquat should not be applied to non-dormant bermudagrass. Data indicate that trifloxysulfuron-sodium may provide residual control of southern crabgrass.

TURFGRASS RENOVATION WITH GLYPHOSATE. F.C. Waltz Jr.*, and T.R. Murphy; Department of Crop and Soil Sciences, The University of Georgia, Griffin, GA 30223.

ABSTRACT

Weedy grass species, like common bermudagrass (*Cynodon* sp.) a warm-season perennial that reproduces by seed, stolons, and rhizomes, is difficult to selectively control in centipedegrass (*Eremochloa ophiuroides*) and tall fescue (*Festuca arundinacea*). Common bermudagrass is throughout the Southeastern United Sates and is used along roadsides, as a forage, for soil stabilization, and a fine turfgrass. For long term control of bermudagrass and efficacy on reestablishment of other turfgrass species into a previously infested area, two field experiments were initiated to evaluate multiple applications of glyphosate prior to turfgrass establishment.

Study 1: Long-term bermudagrass control was evaluated following two and three sequential applications of Roundup Pro (glyphosate – IPA 4 SL) prior to reestablishment with seeded tall fescue. The study was established in existing stand of common bermudagrass. Plots were 10 ft × 16 ft in a randomized complete block design with 3 replications. Initial postemergence applications were applied on June 3, 2002 and sequential applications were made on July 16, 2002 and August 28, 2002. Roundup Pro (RUP) was applied at 3 qts / acre as either 2 or 3 applications 4- to 6-weeks apart at a spray volume of 20 gpa. On September 30, 2002, the center 5-ft of each plot was seeded with 'Kentucky-31' tall fescue at 8-pounds / 1000 ft^2 using a Ryan Mataway overseeder. Irrigation was applied for germination and as needed to prevent drought stress, thereafter. Plots were maintained at a 3-inch clipping height with a rotary mower, clippings were returned, and fertilized two times annually at a rate of 1-pound nitrogen / 1000 ft^2 using a 15-5-15 analysis. For 2-years, plots were evaluated for bermudagrass control and tall fescue density. All evaluations were visual assessments of percent control and density relative to the nontreated.

Study 2: Roundup Pro (glyphosate – IPA 4 SL) and glyphosate + diquat (QuikPRO – 73.3% glyphosate-AMS + 2.9% diquat dibromide) were evaluated for renovation of an existing common bermudagrass stand to centipedegrass or tall fescue. Main plots were 6 ft × 20 ft established as a randomized complete block with a strip plot layout, subplots of bermudagrass, centipedegrass, and tall fescue were 6 ft × 6 ft with four replications. Herbicides were applied at 50 gpa on July 16, 2003 and August 27, 2003. RUP followed by (fb) RUP at 3.0 qts / acre or QP at 3.0, 6.0, and 9.0 lbs / acre was applied on July 16, 2003 fb August 27, 2003. RUP at 3.0 qts / acre and QP at 9.0 lbs / acre were applied as single treatments on August 27, 2003. On September 9, 2003, subplots were sodded with 'TifBlair' centipedegrass and 'Millennium' tall fescue. For each treatment a subplot was prepared and not reestablished, allowing common bermudagrass to return from non-killed rhizomes. Three days prior to establishment, plots were mowed to 1-inch with clipping removed, rototilled to 4-inches in two directions, and hand-raked level. Irrigation was applied for establishment and as needed to prevent drought stress, thereafter. Mowing and fertility were maintained according to proper management for either centipedegrass or tall fescue. Through 2004, plots were evaluated for bermudagrass control; all evaluations were visual assessments of percent control and density relative to the nontreated.

One year after seeding tall fescue, bermudagrass control was 98% in plots where three applications of RUP were applied prior to seeding. Bermudagrass control in plots treated with two applications of RUP was no different than the nontreated control or plots which were not seeded. At 2, 9, and 12 months after seeding, tall fescue density was greater in plots treated with three applications of RUP than plots treated twice. Tall fescue stand density was 87% twelve months after seeding after three applications; density was 20% and 10% for twice treated and nontreated respectively.

Herbicide application did not inhibit centipedegrass or tall fescue establishment from sod. Improved bermudagrass control was observed in plots reestablished into another turfgrass species, indicating that competition is important in long-term suppression of bermudagrass. In plots which were treated and prepared for sodding but not planted, RUP 3.0 fb QP 3.0 had 61% bermudagrass control 59 weeks after initial treatment, which would be considered unacceptable. All other treatments had less than 45% control. From these studies, effective bermudagrass control can be achieved with three applications of RUP. However, one year's data indicate that improved control can be achieved when two applications of glyphosate are followed by turfgrass establishment.

VIRGINIA BUTTONWEED (*DIODIA VIRGINIANA*) RESPONSE TO DIFFERENT MOWING HEIGHT AND FREQUENCIES. J.W. Robison, J.S. McElroy, G.K. Breeden. University of Tennessee.

ABSTRACT

Virginia buttonweed (*Diodia virginiana* L.) is a perennial herbaceous dicot weed in turfgrass systems in the Southeastern United States. Virginia buttonweed has become an increasingly serious weed due to its vegetative reproduction traits and a lack of effective chemical control measures. It is a prolific seed producer and can withstand golf course fairway level mowing heights. However, mowing stress can reduce a weeds ability to compete with turfgrass. Little is known about the influence of mowing on the vegetative growth and development of Virginia buttonweed. Like other weed species, Virginia buttonweed persistence in turf may be influenced by mowing height and frequency. Research was initiated to evaluate the combined influence of mowing heights and frequency on Virginia buttonweed vegetative growth and seed production.

Experiments were conducted at the Knoxville Experiment Station in an Etowah silt loam (fine-loamy, siliceous, thermic Typic Paleudults) soil with 1.7% organic matter and pH of 6.1. Virginia buttonweed plants were propagated from seed and maintained in a greenhouse environment for six weeks prior to planting in a bare ground site. Plants were allowed to acclimate for two weeks after planting prior to first mowing. Mowing with a rotary mower was initiated on June 7th and continued for 12 weeks. Plots were mowed at 0.8, 1.8, and 2.8 inches. An unmowed check was included for statistical comparison. Plots were mowed once per week (Monday) or three times per week (Monday, Wednesday, Friday). All plots were periodically sprayed with fluazifop at 0.25 lb ai/a to eliminate grass competition. Number of stolons was counted, maximum single stolon length, and plant diameter were measured every four weeks for 12 weeks. After 12 weeks plants were excavated from the soil. Roots were washed and a maximum rooting depth measurement was taken. Stolons and roots were dried at 80 C for 48 h and dry mass was recorded. Fruit was harvested from dried stolons. The experiment was conducted as a randomized complete block with three replications per treatment and three subsamples per experimental unit. Data were subjected to analysis of variance (P=0.05) according to factorial arrangement and subsamples structure. Fisher's least significant difference was utilized for mean separation.

Analysis of variance revealed a significant ($P<0.05$) mowing height main effect for total stolons, stolon length, rooting depth, root mass, and stolon mass. Mowing frequency and mowing height by frequency interaction were non-significant for these factors. Unmowed plants yielded maximum stolon length, rooting depth, and root mass. However, mowing at 2.8 inches yielded maximum number of stolons and stolon mass. Further decreasing mowing heights resulted in decreased number of total stolons, stolon length, rooting depth, stolon mass, and root mass over unmowed plants. A mowing height by mowing frequency interaction was observed for plant diameter and fruit production. Increased mowing height resulted in increased plant diameter and fruit production. Maximum plant diameter and fruit production occurred in the unmowed check. Mowing at 0.8 inches once or three times per week produced a plant diameter of approximately seven inches and approximately one fruit. However, when mowed at 1.8 and 2.8 inches plant diameter and fruit production were greater when mowed once per week. While a mowing height by frequency interaction was observed, when comparing similar mowing heights, only at the 1.8 inch mowing height were plant diameter differences observed between frequency levels.

KENTUCKY BLUEGRASS CONTROL WITH ALTERNATIVES TO GLPHOSATE. D.B. Ricker, J.B. Willis, and S.D. Askew, Virginia Tech, Blacksburg; and D.C. Riego, Monsanto Company, St. Louis, MO.

ABSTRACT

Glyphosate-resistant turfgrass species have been developed to aid turf managers in the control of weeds on highly valued golf course turf. Glyphosate-resistant creeping bentgrass (GRCB) was the first turf species to undergo field evaluations to determine if this variety of creeping bentgrass can compete with other creeping bentgrass varieties currently on the market. Even before GRCB is available for sale in the United States, Monsanto and The Scotts Company have developed glyphosate-resistant Kentucky bluegrass (GRKB). The reasoning behind glyphosate-resistant turfgrass is to provide turf manages the ability to control difficult grassy weeds, such as annual bluegrass (*Poa annua* L.) and bermudagrass [*Cynodon dactylon* (L.) Pers], more effectively. These transgenic species have the potential to lower herbicide use, simplify weed control programs, and improve the health of desired turf. By combining GRCB and GRKB tee to green on a golf course, application of glyphosate can be applied over the entire golf course controlling any potential weed problem. As with any biologically-engineered organism there is a potential for transgenic traits to be passed on to undesired species or escape into the environment. Chemical treatments must be evaluated to provide control options if an escape situation occurs. In this study, a variety of ALS inhibitors, graminicides, and non-selective herbicides were evaluated to provide recommendations for long term control of KBG plants.

A 10-year old stand of ‘Kelly’ KBG located at the Virginia Tech Turfgrass Research Center was chosen for this trial. The experimental design was a randomized complete block with four replications and had twenty treatments and one nontreated control. Treatments included single applications of glyphosate (Roundup Pro at 1.5 lb ae/A), fluazifop (Fusilade II at 0.38 lb ai/A), clethodim (Envoy at 0.25 lb ai/A), sethoxydim (Vantage at 0.47 lb ai/A), foramsulfuron (Revolver at 0.03 lb ai/A), trifloxysulfuron (Monument at 0.03 lb ai/A), rimsulfuron (Tranxit at 0.03 lb ai/A), glufosinate (Finale at 1.0 lb ai/A), sulfometuron (Oust at 0.047 lb ai/A), imazapyr (Arsenal at 0.25 lb ai/A) and imazapic (Plateau 0.043 at lb ai/A). Sequential applications were made 4 weeks after initial treatment (WAIT) for glyphosate, fluazifop, clethodim, sethoxydim, foramsulfuron, trifloxysulfuron, and rimsulfuron. A sequential application was made 6 WAIT for glufosinate and one herbicide rotation treatment consisted of sequential fluazifop treatments followed by a final treatment of clethodim applied on 4 week intervals. All treatments were made with proper surfactant as indicated by the label.

Generally, repeated applications of ALS inhibitors controlled KBG better than a single application 60 DAT. Foramsulfuron applied twice controlled KBG better long term than a single foramsulfuron application 100 DAT. Imazapyr controlled KBG 75%. Both trifloxysulfuron treatments (repeated applications and a single application) controlled KBG 100% 100 DAT. Graminicide treatments controlled KBG better than 50% 60 DAT. At 100 DAT, only repeated application of fluazifop coupled with a final treatment of clethodim controlled KBG 75%. All other graminicide treatments failed to effectively control KBG 100 DAT. Single and repeated application of glyphosate controlled KBG 75 and 100%, respectively 100 DAT. Glufosinate applied twice controlled KBG 75% 100 DAT. A single application of glufosinate controlled KBG 100% 16 DAT but did not provide long term KBG control.

Trifloxysulfuron controlled KBG 100% 100 DAT when applied once or twice and is therefore recommended for long term KBG control. Glufosinate applied twice and imazapyr applied once also showed promise for KBG control, although more applications will be needed to completely control KBG.

CRABGRASS CONTROL WITH HOMEOWNER WEED AND FEED PRODUCTS. D.W. Wells, J.M. Taylor, and J.D. Byrd; Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

A replicated experiment was conducted in Tifgreen bermudagrass (*Cynodon dactylon* x *C.* transvaalensis) to evaluate season-long crabgrass (*Digitaria ciliaris*) control with selected ready-to-apply preemergence herbicide weed and feed fertilizer products that are readily obtainable by homeowners. The treatments were applied at (a) the 1X rate listed on the product labels, (b) a 2X rate and (c) 1X followed by a 1X sequential rate 6 weeks after the initial application. Most of these products suggest a 1X sequential when there are heavy weed infestations. The fertilizer products evaluated included Sta-Green Crab-Ex 30-2-5 plus dithiopyr 0.17G at 0.25 lb ai/A, 0.5 lb ai/A, and 0.25 lb ai/A + 0.25 lb ai/A; Howard Johnson's 15-5-10 with prodiamine 0.20G at 0.35 lb ai/A, 0.7 lb ai/A, and 0.35 lb ai/A + 0.35 lb ai/A; Ferti-lome Weed and Feed 10-0-14 with simazine 0.63G at 1.75 lb ai/A, 3.5 lb ai/A, and 1.75 lb ai/A + 1.75 lb ai/A; Miracle Gro 30-3-4 plus pendimethalin 1.12G at 1.5 lb ai/A, 3.0 lb ai/A, and 1.5 lb ai/A + 1.5 lb ai/A; Scott's Turf Builder 30-3-4 with pendimethalin 1.29G at 1.5 lb ai/A, 3.0 lb ai/A, and 1.5 lb ai/A + 1.5 lb ai/A. Pendulum (pendimethalin) 2G at 3.0 lb ai/A and an untreated control were also included for standards. Crabgrass control and bermudagrass turf density were evaluated 36, 65, 99, 128, and 160 days after the initial applications on March 10, 2004. The Ferti-lome with simazine product provided acceptable crabgrass control (>70%) only to the first evaluation date (36 DAT). All other treatments provided acceptable control through the 99 DAT evaluations. Of the 1X single applications Scott's pendimethalin 1.29G (88%), Pendulum 2G (75%), and Howard Johnson's prodiamine 0.2G (70%) gave acceptable control to 128 DAT and only the Scott's (88%) and Pendulum (75%) provided acceptable control through 160 DAT. Of the 2X and sequential applications only Miracle Gro sequential (68%) and the Ferti-lome 2X and sequential applications (<25%) failed to give greater than 83% control through the 160 DAT evaluation. Bermudagrass density was acceptable with all treatments with the exception of the untreated standard and the Ferti-lome with simazine treatments due to crabgrass competition.

DALLISGRASS MANAGEMENT WITH TRIFLOXYSULFURON. R.E. Strahan, B. H. Fletcher, and D. J. Lee; Louisiana State University Agricultural Center, Baton Rouge, LA. 70803.

ABSTRACT

Dallisgrass (*Paspalum dilatatum*) is one of the most difficult weeds to manage because it tolerates most selective herbicides. Standard herbicide treatments MSMA + Sencor and repeated applications of MSMA usually provide only moderate success. No single selective herbicide application has been able to control this troublesome perennial because of the enormous supply of carbohydrates in its short stubby rhizomes and extensive anchoring root system. Monument (trifloxysulfuron) is a new herbicide manufactured by Syngenta and released for use in bermudagrass and zoysiagrass for 2004. The herbicide provides excellent control of several sedge species, broadleaves, and grasses. Dallisgrass is listed as a suppressed species on the Monument label.

A dallisgrass control experiment was conducted at Sugarland Country Club in Raceland, LA on a common bermudagrass fairway with a very heavy natural population of dallisgrass. The purpose of this experiment was to evaluate Monument applied in single and sequential applications, and tank-mixed with MSMA versus standard treatments for improved dallisgrass control. The study was initiated on May 26. Sequential MSMA applications occurred approximately 14 days after the initial application (DAI) and sequential Monument or Monument + MSMA was applied approximately 28 DAI. A third application of MSMA was applied to burn back dallisgrass regrowth approximately 20 days after 2nd application. Herbicide treatments were replicated 3 times in the fairway.

Acceptable turfgrass injury was observed for all treatments of Monument, MSMA, or tank-mixes of the two herbicides. A single application of Monument at 0.50 oz/A or MSMA at 40 oz/A provided no greater than 33% dallisgrass control 80 days after initial treatment. A single application of Monument + MSMA tank-mix controlled approximately 30% of dallisgrass. However, three applications of MSMA or two applications of Monument + MSMA provided excellent control (95%) and were visually more effective than two sequential Monument applications (72%). A single application of Monument + MSMA controlled approximately 50% of dallisgrass. However, three applications of MSMA or two applications of Monument + MSMA provided excellent control (95%) and were visually more effective than two sequential Monument applications (77%) or two sequential applications of MSMA + Sencor (73%). Although two applications of Monument + MSMA provided excellent dallisgrass control, MSMA applied in three correctly timed applications provided an equivalent level of control and cost significantly less.

EFFICACY OF RECENTLY REGISTERED SULFONYLUREA HERBICIDES FOR BROADLEAF WEED CONTROL IN WARM SEASON TURF. L.S. Warren, T.W. Gannon, and F.H. Yelverton; Department of Crop Science, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Trials were conducted to evaluate postemergence applications of trifloxysulfuron (Monument 75WG), foramsulfuron (Revolver), rimsulfuron (TranXit GTA), and metsulfuron (Manor) for their effects on winter annual, and cool and warm season perennial broadleaf weeds in warm season turfgrass stands. Trials were initiated in July 2000 on Virginia buttonweed (*Diodia virginiana*), March 2003 on corn speedwell (*Veronica arvensis*), June 2003 on wild violet (*Viola* sp.), and November or December 2003 on Carolina geranium (*Geranium carolinianum*), henbit (*Lamium amplexicaule*), ivyleaf speedwell (*Veronica hederifolia*), lawn burweed (*Soliva pterosperma*), and white clover (*Trifolium repens*). In 2004, trials were initiated in January on lawn burweed, and March or April on catsear dandelion (*Hypochoeris radicata*), common chickweed (*Stellaria media*), corn speedwell, facelis (*Facelis retusa*), field pansy (*Violarafinesquii Greene*), lawn pennywort (*Hydrocotyle sibthorpioides*), mouseear chickweed (*Cerastium vulgatum*), and yellow woodsorrel (*Oxalis stricta*).

Trifloxysulfuron was applied at 0.33 ounces of product per acre (oz/A) with the following exceptions; 0.47 oz/A 2X on Virginia buttonweed, 0.47 oz/A 1X on 2004 lawn burweed and wild violet, 0.56 oz/A on Carolina geranium and lawn pennywort, and 0.59 oz/A on 2003 corn speedwell. The foramsulfuron rate was 17 fluid ounces of product per acre (fl oz/A) on all weed species tested. Rimsulfuron was applied at 1 oz/A with the following exceptions; 2 oz/A on Carolina geranium, 2003 corn speedwell, henbit, ivyleaf speedwell, and white clover. Metsulfuron was applied at 0.5 oz/A with the following exceptions; 0.33 oz/A on catsear dandelion, 0.75 oz/A on wild violet, and 1 oz/A on 2003 corn speedwell, and Virginia buttonweed. All treatments except foramsulfuron received a nonionic surfactant at 0.25% (v/v).

Winter weed percent control data are presented from late season evaluations in April or May of 2003 or 2004, before weed death or dieback. Summer weed percent control data for Virginia buttonweed are from evaluations 12 and 62 WAT. Wild violet percent control data are from 9 WAT evaluations. Catsear dandelion and lawn pennywort percent control data are from evaluations 8 WAT.

Trifloxysulfuron provided 99 to 100% control of common chickweed, 2004 corn speedwell, henbit, ivyleaf speedwell, lawn burweed, lawn pennywort, mouseear chickweed, and white clover. Two 0.33 oz/A applications at 4-wk intervals were needed for total lawn pennywort control. Trifloxysulfuron provided excellent control (94 to 97%) of 2003 corn speedwell, lawn pennywort, and Virginia buttonweed (12 WAT). 94% lawn pennywort control was achieved with a single application at 0.56 oz/A. Two applications of trifloxysulfuron were needed at 0.47 oz/A each for 97% Virginia buttonweed control. At 62 WAT, Virginia buttonweed control was 93%. Field pansy was controlled 79% with 0.33 oz/A of trifloxysulfuron. Trifloxysulfuron provided no control of Carolina geranium or facelis. Foramsulfuron provided total control of henbit. Common and mouseear chickweed were controlled 62 and 81%, respectively. Foramsulfuron provided 61% lawn burweed control when applied in November 2003 when weeds were young and actively growing. No control was observed on lawn burweed when applied in January 2004. Foramsulfuron provided poor control (9 to 26%) of field pansy, white clover, and wild violet. No control was observed on Carolina geranium, corn speedwell, facelis, and ivyleaf speedwell. Rimsulfuron completely controlled common chickweed, henbit, lawn burweed treated in November 2003, and mouseear chickweed. 98% control occurred on lawn burweed treated in January 2004. Poor control (3 to 23%) was achieved with 2 oz/A rimsulfuron on 2003 corn speedwell, and 1 oz/A on field pansy and wild violet. Rimsulfuron did not affect Carolina geranium, 2004 corn speedwell, facelis, ivyleaf speedwell, or white clover. Metsulfuron provided 99 to 100% control of Carolina geranium, catsear dandelion, common chickweed, facelis, field pansy, henbit, ivyleaf speedwell, mouseear chickweed, white clover, wild violet, and yellow woodsorrel. Excellent control (93%) was observed on lawn pennywort. Virginia buttonweed control at 12 WAT was 75% with 1 oz/A metsulfuron, dropping to 61% at 62 WAT. Metsulfuron controlled corn speedwell only 33% in 2003 when applied at 1 oz/A and 0% in 2004 when applied at 0.5 oz/A.

These data suggest that recently registered sulfonylurea herbicides, though they target annual bluegrass control and perennial ryegrass removal, can possibly be incorporated into a total grass and broadleaf weed management program, solving multiple weed problems with a single application.

LATERAL MOBILITY OF TRANSITION-ASSISTING HERBICIDES VIA RUNOFF WATER. S.D. Askew, J.B. Willis; and D.B. Ricker, Virginia Tech, Blacksburg; and M.D. Grove, ISK Biosciences Corporation, Houston, TX.

ABSTRACT

Increased use of sulfonylurea herbicides in managed turfgrass has lead to concerns over down-slope movement in watershed and injury to neighboring sensitive turfgrass. Studies were conducted in Blacksburg, VA at the Turfgrass Research Center and Charlottesville, VA on a fairway at Farmington Country Club on overseeded bermudagrass (*Cynodon dactylon*) maintained at 1.5 cm to evaluate injury to perennial ryegrass (*Lolium perenne*) down slope of plots treated with transition-assisting herbicides.

‘Vamont’ bermudagrass was overseeded with ‘Prosport’ perennial ryegrass in Blacksburg and ‘Transist’ intermediate ryegrass in Charlottesville. Randomized complete block trials with three replications were initiated on June 24, 2003 in Blacksburg and May 18, 2004 in Charlottesville. One by four meter plots were treated with flazasulfuron (flazasulfuron 25DF) at 0.0078, 0.023, and 0.047 lb ai/A, metsulfuron (Manor™) at 0.019 lb ai/A, pronamide (Kerb™) at 0.5 and 1.0 lb ai/A, rimsulfuron (Tranxit™) at 0.016 lb ai/A, and trifloxysulfuron (Monument) at 0.014 and 0.028 lb ai/A. Each plot was oriented such that sideward slope was less than 1% and down slope was between 7 and 11%. At application, soil was between 19 and 24% moisture at Blacksburg, VA in 2003 and between 28 and 38% moisture in Charlottesville, VA in 2004. Treated plots were allowed to dry for 2 hours at each location and irrigation was applied over a period of 8 hours with repeated passes of walking irrigators at Blacksburg and over 6 hours with Toro sprinkler heads for the first 30 minutes followed by a natural rainfall event at Charlottesville. Containers were placed at the top edge of each plot during irrigation or rainfall and plots received between 50 and 70 mm of water on all plots at both locations. Perennial ryegrass injury was visually estimated at 0 to 15, 15 to 30, and 30 to 45 cm below treated plots. In addition, the distance of perceived perennial ryegrass injury below treated plots was measured. Data were subjected to ANOVA and means were separated using Fisher’s Protected LSD at P=0.05.

Only trifloxysulfuron and pronamide injured perennial ryegrass appreciably in 2003 while all herbicides showed evidence of mobility in the first 0.5 meters in 2004. In 2003, trifloxysulfuron injured perennial ryegrass 23% or less in the first 15 cm below the treated plot while pronamide injured ryegrass 50% or greater between 0 and 45 cm below treated plots. In 2004, trifloxysulfuron and pronamide injured perennial ryegrass at least 80% up to 45 cm below treated plots while metsulfuron and rimsulfuron injured perennial ryegrass less than 50% between 15 and 45 cm below plots. However, rimsulfuron and metsulfuron did not injure perennial ryegrass at distances greater than 45 cm in either study while trifloxysulfuron injured perennial ryegrass at 1 meter or less compared to pronamide, which injured perennial ryegrass 3 to 4 meters below treated plots. In a separate study, flazasulfuron injured perennial ryegrass at 2.0, 2.25, and 5.1 meters below plots treated at 0.0078, 0.023, and 0.047 lb ai/A, respectively. By comparison, trifloxysulfuron at 0.014 lb ai/A and pronamide at 1.0 lb ai/A injured perennial ryegrass at 1.25 and 3.25 meters below treated plots, respectively. Thus, mobility of sulfonylurea herbicides seems rate dependent and is more likely on saturated soils. Although sulfonylurea herbicides are prone to down slope movement, they do not seem to cause turfgrass injury as far down slope as pronamide when used at recommended rates.

TRACKING OF FLAZASULFURON, FORAMSULFURON, AND METSULFURON ON CREEPING BENTGRASS. S.D. Askew, D.B. Ricker, and J.B. Willis, Virginia Tech, Blacksburg; and M.D. Grove, ISK Biosciences Corporation, Houston, TX.

ABSTRACT

Flazasulfuron (Flazasulfuron 25DF) is an experimental herbicide under evaluation for use in U.S. turfgrass. Like other sulfonylurea herbicides, flazasulfuron may injure sensitive turfgrass when dislodged from the treated area and deposited by equipment tires or foot traffic. In previous studies at Virginia Tech, foramsulfuron (Revolver™ .188 SC) has caused injury tracks when deposited to creeping bentgrass while metsulfuron (Manor™ 60DF) has not. Thus, these two herbicides represent a high and low tracking potential, respectively.

Research has not been previously conducted to evaluate the effect of time after treatment on likelihood of track injury. In addition, little is known about the ability of flazasulfuron to cause injury tracks when dislodged and deposited on creeping bentgrass. Therefore, two studies were conducted to evaluate flazasulfuron, metsulfuron, and foramsulfuron tracked at three timings after treatment for effects on neighboring creeping bentgrass and to determine the distance of visible track caused by three rates of flazasulfuron. Our objectives were to evaluate three flazasulfuron rates compared to metsulfuron and foramsulfuron for effects on creeping bentgrass when dislodged by mower tires, evaluate mower tracking at 6 h, 1 d, and 3 d after herbicide treatment and determine linear distance of visible track caused by three rates of flazasulfuron.

Studies were conducted as randomized complete block designs with three replications. Two separate field trials were established in Blacksburg, VA on June 17 (timing study) and Oct 4 (distance study). Flazasulfuron was applied as a 25DF formulation at 0.5, 1.5 and 3.0 oz product/A, foramsulfuron was applied as Revolver .188 SC at 17.4 fl oz product/A, and metsulfuron was applied as Manor 60 DF at 1 oz product/A. Chemical treatments were applied to 6 x 6’ perennial ryegrass plots and tracked to 6 x 6’ (timing study) and 6 x 50’ (distance study) creeping bentgrass plots. A riding fairway mower was driven over plots at 6 h, 1 d, and 3 d after treatment (timing study) and at 1 d after treatment (distance study). The 6 h timing was in the afternoon on dry turfgrass while all other timings were in the morning while dew was present on the turfgrass. No irrigation or rainfall was allowed on plots for at least 4 d. Cumulative length of tracks caused by all three mower tires was assessed in the timing study while total linear distance of the longest visible track was measured in the distance study.

When applied 1 DAT, flazasulfuron caused increasing track injury with increasing rates between 0.5 and 3.0 oz/A when assessed 8 d after tracking. Foramsulfuron caused significant track length regardless of track timing while flazasulfuron only caused bentgrass injury when tracked 1 DAT and metsulfuron never injured creeping bentgrass. In the distance study 10 d after tracking, flazasulfuron-treated plots tracked the morning after treatment caused visible tracks on creeping bentgrass between 6 and 18 feet from the treated plot as rate increased from 0.5 to 3.0 oz/A.

Based on a tire circumference of 3 feet, each 1 oz/A increase of Flazasulfuron 25DF rate resulted in two additional tire revolutions of creeping bentgrass injury. Turfgrass chlorosis also increased at rates of 8.7, 8.7, and 4.8% with each oz/A increase in Flazasulfuron 25DF rate when assessed at 1, 6, and 12 feet away from treated plots, respectively. Foramsulfuron caused more injury when tracked 1 DAT than when tracked at 6 h or 3 d after treatment. Since the typical use rate of flazasulfuron is 1.5 oz/A, it can be reasoned that flazasulfuron is less likely to cause tracks than foramsulfuron but more likely than metsulfuron. These data indicate that tracking of sulfonylurea herbicides is dependent on herbicide rate, time of tracking relative to herbicide treatment, and sensitivity of neighboring grasses to the herbicide in question.

WEED CONTROL DURING ESTABLISHMENT OF HEAT-TOLERANT BLUEGRASS (*POA PRATENSIS X POA ARACHNIFERA*) FROM SEED. G. K. Breeden and J. S. McElroy, University of Tennessee.

ABSTRACT

Spring establishment of cool season grasses is problematic due to the intense competition from crabgrass (*Digitaria* spp.) and other competitive weed species. Quinclorac is useful in controlling crabgrass during seeded establishment, however injury to bluegrass (*Poa* spp.) can occur during the initial stages of seedling development and the spectrum of broadleaf weed control is minimal. Mesotrione is a new herbicide that is currently being adapted to the turfgrass market. Heat-tolerant (HT) bluegrass (*Poa pratensis x P. arachnifara*) is a new turfgrass that is being grown in the transition zone where tall fescue (*Festuca arundinacea*) is widely grown. Field research was initiated in 2004 to evaluate HT-bluegrass tolerance to mesotrione and quinclorac during seeded establishment.

Research was conducted in Knoxville, TN at Knoxville Experiment Station - Plant Science Unit. HB-129 ‘Thermalblue’ HT bluegrass was seeded on March 24, 2004 with a broadcast spreader at a rate of 3 lbs/1000 sq. ft. and cotton germination blanket was applied for two weeks. A complete starter fertilizer (24-6-12) was applied at planting at a rate of 1lb N/1000 sq. ft., with additional applications made throughout the experiment every 28 days. Treatments were replicated four times in a randomized complete block design. Herbicides were applied with a CO_2 pressurized sprayer and a 4 ft. boom with a pressure of 26 PSI and 8002XR flat fan nozzles. Mesotrione treatments included were 0.125 and 0.25 lb ai/a applied in a single application at 14 days after emergence (DAE), applied twice at 28 and 42 DAE, and applied three times at 14, 28 and 42 DAE. Quinclorac treatments were 1.5 lb ai/a and 0.75 lb ai/a applied in a single application at 14 DAE. All mesotrione treatments contained 0.25 % v/v NIS and quinclorac treatments had 1.5 pt/a MSO. Experimental units were 5 ft. by 5ft. Weed control and turf injury were evaluated visually utilizing a 0% (no weed control or turf injury) to 100% (complete weed control or turf injury) scale.

Mesotrione applied 14 DAE at 0.125 lb ai/a and 0.25 lb ai/a injured HT bluegrass < 15% at 7 days after treatment (DAT). No injury was observed from these treatments by 14 DAT or throughout the rest of the study. Quinclorac applied 14 DAE at 0.75 lb ai/a and 1.5 lb ai/a injured HT bluegrass ≤ 3% at 7 DAT. Quinclorac injury increased to 25-30% by 14 DAT. Injury from these treatments decreased to ≤ 10% by 21 DAT and continued to decrease throughout the rest of the study. Injury from single applications of mesotrione was moderate and did not persist as long as injury from quinclorac. Sequential mesotrione applications at 0.125 lb ai/a and 0.25 lb ai/a injured HT bluegrass < 30% by 21 days after initial treatment (DAIT). No injury was observed from these treatments at any other time during the study. Sequential applications of quinclorac at 0.75 lb ai/a injured HT bluegrass 24% at 14 DAIT. Quinclorac injury decreased to 6% by 21 DAIT and continued to decrease throughout the study. Injury from sequential applications of mesotrione was higher than single applications of mesotrione. Injury from sequential applications also did not persist as long as injury from quinclorac. Mesotrione injury often had dissipated by 14 DAT. All treatments controlled smooth crabgrass ≥ 88% at 13 weeks after emergence (WAE) except mesotrione at 0.125 lb ai/a (single and double applications). Mesotrione applied twice at 0.125 lb ai/a controlled smooth crabgrass 81% at 13 WAE. Single application of mesotrione at 0.125 lb ai/a was the only treatment below 70% at 13 WAE. Single and sequential applications of mesotrione and single applications of quinclorac are both effective in controlling smooth crabgrass. However, a mesotrione rate of 0.25 lb ai/a is essential for acceptable control.

REDUCING WEED POPULATIONS IN SEASHORE PASPALUM WITH THE USE OF SALTWATER.
N.B. Pool, B.J. Brecke, J.B. Unruh, G.E. MacDonald, L.E. Trenholm, and J.A. Ferrell; 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, and has been recently developed for commercial use. The plant spreads vegetatively by rhizomes and stolons to form a deep fibrous root system. The texture is slightly coarser than bermudagrass unless mowed at less than an inch in height. Seashore paspalum thrives in moist soils and has a high tolerance to salinity, which makes it an attractive turf in the coastal areas of Florida where saltwater intrusion is a major concern. The objectives of this research were to: 1) determine salinity tolerance of established and newly sprigged seashore paspalum; 2) determine the sensitivity of common turfgrass weeds to levels of salinity.

Experiments were conducted at the University of Florida, Milton Campus and the West Florida Research and Education Center in 2003 and 2004. Saltwater treatments consisting of 34,000ppm (1x), 25,500ppm (3/4x), 17,000ppm (1/2x), 8,500ppm (1/4x), and untreated (0x) were applied to established and newly sprigged Seashore paspalum in 4L pots under greenhouse conditions. Treatments were applied 2 times per week for a total of 8 weeks. In the second study, dollarweed, Florida pusley, Virginia buttonweed, common bermudagrass, goosegrass, large crabgrass, torpedograss, tropical signalgrass, and purple nutsedge were transplanted into 4L pots under greenhouse conditions and allowed to establish for 3 weeks. Saltwater treatments (1x, 3/4x, 1/2x, 1/4x and 0x) were applied to each weed 2 times per week for a total of 4 weeks. Large crabgrass and annual kyllinga were also tested under field conditions in an established stand of 'Sea Isle 1' Seashore paspalum. Individual plot size was 1.5 m^2. Plots were treated for 4 weeks with a 1/4x or 1/2x concentration of salt applied as a liquid solution or as a granule. All experiments were replicated 4 times. Visual evaluations of turfgrass injury were based on quality assessments where 0 = injury and 9 = healthy plant. Visual evaluations of weed control were based on 0 to 100 scale, where 0 = no control and 100 = complete control.

Quality was compromised (ratings < 7) at the 3/4x and 1x rates of saltwater for established Seashore paspalum while all levels of salt caused unacceptable injury to newly sprigged Seashore paspalum. Florida pusley was completely controlled at all rates of saltwater while Virginia buttonweed was completely controlled at 1/2x and greater rates of saltwater. Crabgrass and tropical signalgrass were adequately controlled at the 3/4x and 1x rates of saltwater while the 1x rate was needed to provide acceptable control of purple nutsedge and dollarweed. Bermudagrass and torpedograss exhibited high levels of tolerance at all salt concentrations. In the field study, crabgrass was effectively controlled at 1/2x rate of saltwater applied as a solution and as a granular salt. The 1/4x rate was also effective granularly applied, but not applied as a solution. Kyllinga was adequately controlled at the 1/2x rate as a granular and solution, but the 1/4x rate was not effective using either method. In both studied the granular application method provided better control of crabgrass and kyllinga compared to salt applied in solution.

SELECTIVE ANNUAL BLUEGRASS CONTROL IN COOL SEASON TURF WITH VELOCITY (BISPYRIBAC-SODIUM). **A. G. Estes and L. B. McCarty; Clemson University, Clemson, SC 29634-0319**

ABSTRACT

Annual Bluegrass (*Poa annua)* a widely distributed prolific seed producer, with a tufted growth habit and non-uniform color makes for an unsightly appearance in highly maintained turf areas. Traditionally, selectively controlling annual bluegrass post-emergently in cool-season grasses has been obscure The purpose of this research was to investigate the efficacy of Velocity (bispyribac-sodium) for annual bluegrass control in overseeded perennial ryegrass and bentgrass fairways.

In the spring of 2004, two studies were conducted by Clemson University, evaluating annual bluegrass control with Velocity. The first study, which was located in Pickens, SC at "The Rock at Jocassee" golf course, was conducted on bermudagrass fairways overseeded with perennial ryegrass at 300 lbs/A maintained at 0.5 inches. The second study, which was at "Wade Hampton Golf Club", was conducted on a creeping bentgrass fairway maintained at 0.5 inches. 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 one included: Velocity 80 WSP at 0.022 (lb ai/a), 0.033, 0.066, 0.099, and 0.132 applied in either February, March, and/or April and Prograss 1.5 EC applied at 1.5 lb ai/a in February and/or March. Treatments for study two included: Velocity at 0.066 lb ai/a and 0.132 lb ai/a applied in April, May, and/or June; along with, Trimmit (2SC) at 0.375 lb ai/a, Primo Max (1L) at 0.086 lb ai/a, Primo Maxx + Cutless (50WP) at 0.039 lb ai/a and 0.156 lb ai/a, Proxy (2L) at 3.4 lb ai/a all applied in April and May.

Visual annual bluegrass control and seedhead control ratings were taken throughout the study along with perennial ryegrass and creeping bentgrass phytotoxicity. Ratings for annual bluegrass control and seedhead control were based on a scale of 0-100% with 0% representing no control and 100% representing complete control. Ratings for perennial ryegrass and creeping bentgrass phytotoxicity were on a 0– 100% scale with 0% representing no turf injury and 100% representing dead turf.

On the overseeded perennial ryegrass study, 98 percent control of annual bluegrass followed 2 applications 4 weeks apart starting in Mid February at 0.099 lb ai/a or a 2 week split application 3 times at 0.066 lb ai/a starting in Mid February. Perennial ryegrass phytotoxicity throughout study was less than 15 percent, for all treatments. On the creeping bentgrass study, 100 percent control followed 2 week split applications 3 times at 0.066 lb ai/a and 0.132 lb ai/a starting in Mid May. Creeping bentgrass phytotoxicity was less than 17 percent. Dollar spot disease was reduced following Velocity treatments in the creeping bentgrass study.

Future research, at Clemson University, will be to investigate the use of various fertilizers such as N and Fe in conjunction with Velocity, to potentially reduce ryegrass phytotoxicity. Evaluate timing rates for optimum annual bluegrass control. Investigate further Velocity's potential to reduce dollar spot.

DALLISGRASS CONTROL IN BERMUDAGRASS TURF WITH FORAMSULFURON. G.M. Henry and F.H. Yelverton, North Carolina State University, Raleigh, NC, 27695.

ABSTRACT

Currently, chemical control of dallisgrass (*Paspalum dilatatum* Poir.) is neither efficient, nor cost effective. Typical programs include multiple applications of MSMA, which can be phytotoxic to warm-season turfgrass, or applications of glyphosate, which can be even more harmful to bermudagrass (*Cynodon dactylon* [L.] Pers.). Furthermore, these control methods are not entirely effective in eliminating dallisgrass from turf. Revolver™, which contains the sulfonylurea active ingredient foramsulfuron, was recently introduced. Although Revolver is labelled for the control of certain weeds in warm-season grasses, preliminary studies suggest that Revolver might help control dallisgrass in bermudagrass turf. Therefore, Field experiments were conducted at Hidden Valley Golf Club located in Fuquay Varina, NC, and Garner Country Club located in Raleigh, NC in the summer of 2004 to quantify the efficacy of several herbicides (including foramsulfuron) and herbicide programs to control dallisgrass present in bermudagrass rough. Studies were located on established infestations of dallisgrass present in a common bermudagrass rough cut to a height of 5.0 cm. Plots measured 1.2 m x 3.0 m and were arranged in a randomized complete block design, with four replications of treatments. Treatments were applied using a CO_2 backpack sprayer equipped with XR8004VS nozzle tips and calibrated to deliver 304 L/ha at 220 kPa. Treatments were initiated on June 10 and consisted of MSMA (2.5 kg ai/ha) followed by (fb) foramsulfuron (45, 90, 108, or 145 g ai/ha) 1 week after initial treatment (WAIT), MSMA (2.5 kg ai/ha) fb foramsulfuron (45, 90, 108, or 145 g ai/ha) 2 WAIT, MSMA (2.5 kg ai/ha) fb foramsulfuron (45, 90, 108, or 145 g ai/ha) 2 WAIT fb MSMA (2.5 kg ai/ha) 3 WAIT, MSMA (2.5 kg ai/ha) fb MSMA (2.5 kg ai/ha) 1WAIT, MSMA (2.5 kg ai/ha) fb MSMA (2.5 kg ai/ha) 1 WAIT fb MSMA (2.5 kg ai/ha) 2 WAIT, 2 applications of foramsulfuron (45, 90, 108, or 145 g ai/ha) applied one week apart, foramsulfuron (108 g ai/ha) fb MSMA (1.25 kg ai/ha) 1 WAIT, MSMA (1.25 kg ai/ha) fb foramsulfuron (108 g ai/ha) 1 WAIT, metribuzin (0.4 kg ai/ha) fb foramsulfuron (108 g ai/ha) 1WAIT, MSMA (1.25 kg ai/ha) fb MSMA (1.25 kg ai/ha) 1WAIT, and a non-treated check. Initial percent dallisgrass infestation was recorded for each plot prior to the initiation of the experiment. Visual estimates of percent dallisgrass control and bermudagrass phytotoxicity were taken 1, 2, 4, 6, 8, and 12 WAIT. Data were subjected to analysis of variance (ANOVA) and means were separated using Fisher's Protected LSD at the 0.05 significance level. Data were combined over locations.

Dallisgrass control declined as rates of foramsulfuron declined; therefore results are given for treatments containing the highest rate of foramsulfuron (145 g ai/ha). MSMA (2.5 kg ai/ha) fb foramsulfuron 1 WAIT treatments gave moderate control (65%) of dallisgrass 4WAIT, but control declined to 40% 12WAIT. MSMA (2.5 kg ai/ha) fb foramsulfuron 2 WAIT treatments gave good control (85%) of dallisgrass 4WAIT, but control declined to 64% 12WAIT. MSMA (2.5 kg ai/ha) applied 3 times gave good control (89%) of dallisgrass 4WAIT, but control declined to 73% 12 WAIT. Foramsulfuron fb foramsulfuron 1 WAIT treatments gave moderate control (61%) of dallisgrass 4WAIT, but control declined to 39% 12WAIT. MSMA (2.5 kg ai/ha) fb foramsulfuron 2 WAIT fb MSMA 3WAIT treatments provided the highest levels of observed control (95%) of dallisgrass 4WAIT and control levels remained high (93%) 12 WAIT. No other treatments provided adequate control of dallisgrass 12 WAIT. The results from this study suggest that dallisgrass may be controlled with applications of MSMA fb foramsulfuron 2WAIT fb MSMA 3WAIT applied during early to mid summer with minimal phytotoxicity to bermudagrass.

GOOSEGRASS (ELEUSINE INDICA) CONTROL IN COMMON BERMUDAGRASS (CYNODON DACTYLON). J.K. Higingbottom, A.G. Estes, and L.B. McCarty; Clemson University, Clemson, SC 29634.

ABSTRACT

Goosegrass (*Eleusine indica*) continues to plague many golf courses and athletic fields throughout the Southeast. Since goosegrass can live under low-oxygen conditions, it often concentrates near cart paths and of areas of heavy traffic. Herbicide resistance has been observed in goosegrass to Dinitroanaline herbicides. Many turf managers have continued to use Dinitroanaline herbicides and have strictly used postemergence as their lone source for goosegrass control. Recently, new postemergence herbicides have been introduced into the turf industry that may have promise to effectively control goosegrass in common bermudagrass (C*ynodon dactylon*) turf.

In 2004, Clemson University performed two trials located at the The Rock at Jocassee golf course to evaluate products to control goosegrass. A preemergence trial was initiated in March 2004 to evaluate selected preemergence herbicides for control of goosegrass in a common bermudagrass rough mowed at 2 in. Treatments (lb ai/a) included: Single and sequential applications of Pendulum (3.0; 1.5 fb 1.5), Barricade (0.75; 38 fb 0.38), Dimension (0.5; 0.25 fb 0.25), Ronstar (3.0; 2.0 fb 1.0), Surflan (3.0; 1.5 fb1.5), Regal Star II (3.0; 1.5 fb 1.5). Initial treatments were applied on March 30th and sequential applications were applied 8 weeks later on May 21st. A postemergence trial was initiated in July 2004 to evaluate selective postemergence control of mature goosegrass in a common bermudagrass rough mowed at 2 in. Treatments (lb ai/a) included: Revolver (0.039), Revolver (0.025), Monument (0.03), Illoxan (1.0), MSMA + Sencor (2.0 + 0.25), Revolver + Sencor (0.039 + 0.25), Monument + Sencor (0.03 + 0.25). All treatments had a non ionic surfactant added at a rate of 0.25 % v/v. Initial treatments were applied on July 6th with each treatment receiving a second application 17 days after initial treatment (DAIT) on July 23rd. Turf injury >30% was deemed unacceptable.

Preemergence Trial. All Dinitroanaline herbicides failed to provide adequate control. The split rate of Surflan at 1.5 lb ai/a and the single application of Pendulum at 3.0 lb ai/a provided the greatest control at ≈30% of all the Dinitroanaline herbicides. Ronstar provided 97% control with 3.0 lb ai/a followed next by the split rate at 2.0 fb 1.0 lb ai/a at 95%. The combination product Regal Star II, also provided excellent control at 92% with the single application of 3.0 lb ai/a. However when Regal Star II was applied at the split rate of 1.5 fb 1.5 lb ai/a, control was 80%.

Postemergence Trial. With a single application, the MSMA plus Sencor treatment provided 72% control at 7 DAIT. Although excellent control was observed with the MSMA plus Sencor tank mix, unacceptable bermudagrass turf injury was also observed at 43% but recovered by 44 DAIT. Also at 7 DAIT, the high rate of Revolver at 0.039 lb ai/a and the Revolver plus Sencor tank mix provided 20 and 25% control, respectfully. Reduced injury was observed with the Revolver plus Sencor at 28%. By 23 DAIT, MSMA plus Sencor and Revolver plus Sencor treatments provided 98% control with injury at 23 and 20%, respectfully. MSMA plus Sencor and Revolver plus Sencor provided ≥97% control 44 DAIT with no injury present at that time. Revolver, at 0.025 lb ai/a, provided 87% control by 44 DAIT with a maximum of 5% injury occurring at 23 DAIT. Illoxan provided good control at 89% after two applications at 44 DAIT with minimal turf injury at 5% at 23 DAIT. Monument provided minimal (<3%) control throughout the trial and when tanked mixed with Sencor, provided a maximum of 45% control at 23 DAIT. By 44 DAIT, all treatments that initially injured the bermudagrass had fully recovered.

In conclusion, Ronstar applied at a single application of 3.0 lb ai/a or a split rate of 1.5 fb 1.5 lb ai/a was the most effective preemergence option. Excellent control was also provided by Regal Star II, containing oxadiazon and prodiamine, when applied at a single application of 3.0 lb ai/a. No advantage was observed by applying split applications of any products for season long control as compared to a single full initial rate. The standard tank mix of MSMA and Sencor continued to provide excellent postemergence control, however unacceptable turf injury followed this application. Interestingly, the Revolver and Sencor tank mix provided equivocal control as the MSMA and Sencor application with half the initial injury. Even though when applied alone, Revolver and Illoxan did not totally eradicate the goosegrass, both products provided excellent results with little to no injury. Revolver alone or tank mixed with Sencor demonstrated promise in providing excellent control and would be a suitable replacement to Illoxan or MSMA plus Sencor tank mix for postemergence control of goosegrass.

'TIFWAY' BERMUDAGRASS RESPONSE TO PRIMO AND CUTLESS. F.W. Totten*, B.T. Bunnell, L.B. McCarty. Clemson University, Department of Horticulture, Clemson, SC. 29634-0319.

ABSTRACT

'Tifway' Bermudagrass (*Cynodon dactylon* x *transvaalensis* 'Tifway') is a popular turfgrass utilized on golf course fairways and athletic fields. Aggressive summer growth habit, fine leaf texture, and dark green color attribute to the popularity of 'Tifway'. In order to reduce mowing requirements, suppress seedheads, enhance color, and to sustain a uniform playing surface, plant growth regulators (PGRs) have been widely used on 'Tifway' bermudagrass.

The study was performed for 12 weeks from 10 July to 4 October, 2004 on Clemson University's registered Tifway bermudagrass [*Cynodon dactylon* (L.) x *C. transvalensis* Burtt-Davy] research plot. The study evaluated Primo Maxx 1EC (trinexapac-ethyl) and Cutless 50W (flurprimidol) applied exclusively and as a tank mix at three rates. The rates for Primo were 0, 6, and 12 oz A^{-1} (0, 0.052, and 0.105 kg ai ha^{-1}). The rates for Cutless were 0, 4, and 8 oz A^{-1} (0, 0.14, and 0.28 kg ai ha^{-1}). Exclusive applications and tank mixes of Primo and Cutless resulted in nine treatments total. Applications were made every three weeks for the duration of the study.

Clippings were harvested at 4, 8, and 12 weeks after initial treatment (WAIT) using a walk mower set to a 16mm height. Clipping weights for all Primo and Cutless treatments were compared to untreated plots to calculate percent clipping reductions. Percent horizontal regrowth was measured biweekly. Tifway bermudagrass injury was evaluated weekly. Injury was rated visually on a scale from 0-100% with 30=maximum level of acceptable injury.

Statistical analysis showed that a Primo x Cutless interaction was not significant for clipping yield, percent lateral regrowth, or injury data. This implies that the two products were acting independently. At 8 WAIT, a linear decrease in clipping yield was observed as the rate of Primo and Cutless increased. Primo at 12 oz A^{-1} reduced clipping yield 49% 8 WAIT. Cutless at 4 oz A^{-1} and 8 oz A^{-1} reduced clipping yield by approximately 60% 8 WAIT.

Acceptable injury to 'Tifway' bermudagrass was observed with all tank mixes. With Primo, a linear increase in injury was observed with increasing rate 1 and 2 WAIT. At both dates the greatest injury was observed with Primo at 12 oz A^{-1}. Injury from Cutless increased linearly as rate increased 1 WAIT. Cutless at 4 oz A^{-1} and 8 oz A^{-1} produced the greatest amount of injury 1 WAIT. All plots had rebounded from injury 3 WAIT.

Percent lateral regrowth was reduced by Cutless 2 WAIT. As rate of Cutless increased, a linear decrease in lateral regrowth of 'Tifway' bermudagrass was observed. Reductions were 13% for Cutless at 4 oz A^{-1} and 26% for Cutless at 8 oz A^{-1}.

In summary, acceptable visible injury was recorded 1 and 2 WAIT, and the greatest clipping reduction was recorded 8 WAIT on 'Tifway' bermudagrass. In both cases, the highest recorded values were for the high rates of both Primo and Cutless. Percent lateral regrowth was reduced by Cutless 2 WAIT, as the high rate of 8 oz A^{-1} yielded the greatest reduction. Future research should continue evaluating new rates and application timings for Primo/Cutless tank mixes. Also, the residual activity of these tank mixes should be further explored.

SEEDED BERMUDAGRASS RESPONSE TO PRE AND POST HERBICIDES. J.B. Willis, D.B. Ricker, and S.D. Askew. Virginia Tech, Blacksburg, VA.

ABSTRACT

As seeded bermudagrass (SB) (*Cynodon dactylon*) varieties continue to perform well in variety trials, more fine turf managers are considering SB for fairways and athletic fields. Riviera is one seeded variety that has cold-tolerance, color, and quality characteristics equivalent to popular vegetative varieties. These characteristics make Riviera SB a suitable fairway and athletic field turf in the colder areas of the transition zone, where previously not possible with SB cultivars. If turfgrass managers adopt this variety, information will be needed to aid weed control efforts during establishment. The objective of these studies where to determine weed control options for establishing SB and evaluate response of Riviera SB to various herbicides applied pre- and post-seeding.

Two field studies were conducted in Blacksburg, VA to evaluate the following herbicides effects on Riviera SB: foramsulfuron at 0.03 lbs ai/A, trifloxysulfuron 0.42 oz ai/A, metsulfuron 0.60 oz ai/A, rimsulfuron 0.50 oz ai/A, sulfosulfuron 0.48 oz ai/A, and flazasulfuron 0.50 oz ai/A. These herbicides were applied at timings relative to bermudagrass seeding. In one field trial Riviera SB was seeded on June 21 treated with the above herbicides one and three weeks preplant, the other field trial was planted June 7 and treated with the above herbicides one and three weeks after seeding.

When applied at any timing, foramsulfuron, sulfosulfuron, and metsulfuron caused little SB injury. Trifloxysulfuron, rimsulfuron, and flazasulfuron applied 1 week preseeding injured SB 24, 13, and 36 percent, respectively one month after seeding. This injury resulted in a cover reduction of 15 to 30 percent, 2 months after treatment. Trifloxysulfuron, rimsulfuron, and flazasulfuron caused slight stunting and chlorosis when applied 3 weeks preseeding, but did not cause significant reduction in SB cover. When herbicides were applied one week after seeding, SB was most sensitive to injury. At this timing, many seed are initiating germination and existing seedlings are extremely small. Herbicides are best applied three weeks before seeding or three weeks after seeding to avoid injury. In the case of the more injurious products rimsulfuron, trifloxysulfuron, and flazasulfuron, herbicides should be applied 3 weeks after emergence (about 6 weeks after planting).

DALLISGRASS CONTROL WITH FORAMSULFURON. D.B. Ricker, J.B. Willis, D.S. McCall, and S.D. Askew, Virginia Tech, Blacksburg; and D.R. Spak, Bayer Environmental Science, New Holland, PA.

ABSTRACT

Dallisgrass (*Paspalum dilatatum* Poir.) is a difficult turf weed to control because of its ability to survive under stress, grow in poor soils, and adapt to low mowing heights. Chemical treatments on the market today do not offer effective control of dallisgrass in bermudagrass (*Cynodon dactylon)* turf. Preemergence herbicides offer minimal protection prior to bermudagrass plants entering the primary growing season and dallisgrass is controlled most effectively when treated postemergence. Foramsulfuron (Revolver^{TM}) applied at proper rates, correct timings, and in some situations mixed with other herbicides may control dallisgrass in bermudagrass turf.

A field trial was conducted on 'Tifway' bermudagrass at Hanover Country Club in Ashland, VA. Due to close proximity of the trial area to pool and tennis facilities, no scheduled fertilizer or pesticide applications were made to the trial area by maintenance staff. The experimental design was a randomized complete block with three replications and ten treatments, including one nontreated control. Treatments were applied in summer and fall with sequential applications and rotational treatments made 2 weeks after initial treatment (WAIT) and 3 WAIT. Plots were 0.6 x 1.8 m and dallisgrass cover exceeded 65% of total plot area. Foramsulfuron was applied as a sequential treatment, in rotation with MSMA, and as a mixture with MSMA. Each treatment included foramsulfuron applied at high (0.066 lbs ai/A) or low (0.044 lbs ai/A) rates. MSMA application included high (1.6 lbs ai/A) or low (1.0 lb ai/A) rates either as a tank mix or a single treatment on a rotational schedule.

Fall applications increased dallisgrass control 7 WAIT compared to the same treatment applied during the summer. Foramsulfuron applied sequentially at 0.044 lbs ai/A in summer or fall reduced dallisgrass stands by 50% but resulted in poor long term. MSMA applied at 1.6 lbs ai/A or 1.0 lbs ai/A followed by a sequential foramsulfuron application applied at 0.044 lbs ai/A or 0.066 lbs ai/A controlled dallisgrass 85% or greater 5 WAIT when applied in summer or fall. Fall applications of MSMA applied at 1.6 lbs ai/A or 1.0 lbs ai/A followed by foramsulfuron applied at 0.044 lbs ai/A or 0.066 lbs ai/A controlled dallisgrass more effectively compared to summer applications 7 WAIT. Two applications of MSMA (1.6 lbs ai/A) tank mixed with foramsulfuron (0.044 lbs ai/A), followed by a final application of foramsulfuron applied at 0.044 lbs ai/A on a 2-week interval controlled dallisgrass between 80 and 90% for both summer and fall application timings. No rate effect was observed as increased foramsulfuron rates or reduced MSMA rates showed no significant differences in dallisgrass control 7 WAIT. Bermudagrass was injured 1 WAIT when treatments were applied in the summer months but recovered 3 WAIT to acceptable levels. Bermudagrass was not injured during fall treatments.

BERMUDAGRASS REMOVAL IN ZOYSIAGRASS. A.C. Hixson, L.S. Warren, and F.H. Yelverton. North Carolina State University, Raleigh, NC 26795.

ABSTRACT

Bermudagrass (*Cynodon dactylon* (L.) Pers.) infestation of zoysiagrass (*Zoysia japonica* Steud.) turf is a continuing problem for sod farmers, homeowners, golf course superintendents, and athletic field managers. Due to the ability of bermudagrass reproduce in a multitude of ways, it is considered one of the most difficult weeds to effectively control and eradicate. Several selective postemergence herbicides can provide varying degrees of selective bermudagrass control in established turfgrass stands. Typically, multiple herbicide applications per year for at least two years are necessary for effective control. Fenoxaprop-ethyl, fluazifop-P-butyl, and triclopyr are registered for use in zoysiagrass. However, triclopyr labels warn against applying to zoysiagrass unless injury can be accepted. Effective herbicide programs for the control of bermudagrass from established zoysiagrass are lacking. Therefore, a two-year study during the summers of 2003 and 2004 was initiated.

Experiments quantified the two year effects of repeat applications of fenoxaprop-ethyl, fluazifop-P-butyl, and triclopyr applied alone or tank-mixed on ‘Meyer’ zoysiagrass infested with common bermudagrass and ‘El Toro’ zoysiagrass infested with ‘Tifway 419’ bermudagrass. Research was conducted at two zoysiagrass locations with natural infestations of bermudagrass. The ‘Meyer’ zoysiagrass site was located at Winslow Turf Farms near Scotland Neck, NC, and the ‘El Toro’ zoysiagrass site was located at the Sandhills Research Station near Jackson Springs, NC. At the ‘Meyer’ site, treatments were initiated on 19 June and 7 June in 2003 and 2004, respectively. At the ‘El Toro’ site, treatments were initiated on 23 June and 1 June in 2003 and 2004, respectively. Herbicide treatments included two application timing schedules consisting of either two total applications at 8 week intervals or four total applications at 4 week intervals per year of the following herbicides: fluazifop-P-butyl (70.1 g ai/ha), fenoxaprop-ethyl (99.9 g ai/ha), and triclopyr (1.12 kg ai/ha) applied alone, and fluazifop-P-butyl (70.1 g ai/ha) or fenoxaprop-ethyl (99.9 g ai/ha) tank-mixed with triclopyr (0.56 kg or 1.12 kg ai/ha). All treatments containing fluazifop-P-butyl included a nonionic surfactant applied at 0.25% v/v. Treatments were applied using a CO_2 backpack sprayer calibrated to deliver 304 L/ha at 193 KPa at 1.3 m/s. The four-nozzle boom was equipped with Teejet XR 8002VS flat fan nozzles spaced 25.4 cm apart and set 25.4 cm above the ground. Individual plot sizes were 1.5 m $\times$ 3 m with the center 1 m treated. The experimental design was a randomized complete block design with four replications. Measurements were taken for bermudagrass control and zoysiagrass phytotoxicity at approximately two-week intervals beginning two weeks after initial applications and ending two weeks after final applications. Visual ratings were on a percent basis for both control and phytoxicity, with 0 = no bermudagrass control or zoysiagrass phytotoxicity, and 100 = total bermudagrass control or zoysiagrass phytotoxicity. Statistical analysis was performed using an ANOVA procedure to test significance levels of main effects, and subsequently, herbicide treatment means were separated using the lsd procedure at the $p = 0.05$ significance level.

In 2003, measurements taken 14 weeks after initial treatment (WAIT) showed that across both locations four applications of fluazifop-P-butyl or fenoxaprop-ethyl applied alone provided more bermudagrass control (70% or 61%) when compared to two applications (8% or 28%). Tank mixes of fluazifop-P-butyl or fenoxaprop-ethyl plus triclopyr (1.12 kg ai/ha) applied four times provided 91% bermudagrass control compared to 64% control when applied twice. In 2003, zoysiagrass phytoxicity 2 WAIT was <20% for all treatments and locations. In 2004, herbicide treatment main effects excluding the timing and location effects determined that fluazifop-P-butyl alone, and fluazifop-P-butyl or fenoxaprop-ethyl tank mixed with triclopyr (1.12 kg ai/ha) provided 72% to 78% bermudagrass control. In addition, triclopyr alone and fluazifop-P-butyl or fenoxaprop-ethyl tank mixed with triclopyr (1.12 kg ai/ha) provided 88% to 98% control. After two consecutive years of herbicide treatments, the two application per year treatment schedule provided only 45% common bermudagrass control, while the four application schedule provided 87% common bermudagrass control. ‘Tifway’ bermudagrass control followed a similar trend with 83 and 97% control after two and four applications per year treatment schedules, respectively. In 2004, ‘Meyer’ or ‘El Toro’ zoysiagrass phytotoxicity never exceeded 20% for any of the treatments at either location. Excellent control (>90%) of common or ‘Tifway’ bermudagrass with ≤10% zoysiagrass phytotoxicity can be achieved with a two-year herbicide program consisting of four applications per year of triclopyr applied alone, and fluazifop-P-butyl or fenoxaprop-ethyl tank mixed with triclopyr (1.12 kg ai/ha).

SELECTIVE DALLISGRASS (*Paspalum dilatatum*) CONTROL IN BERMUDAGRASS TURF. L.R. Hubbard, A.G. Estes and L.B. McCarty; Department of Horticulture, Clemson University, Clemson, SC 29634.

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 bermudagrass turf.

In summer of 2004, a study was conducted by Clemson University on bermudagrass golf course rough in Anderson, SC, investigating postemergence dallisgrass control. Treatments were applied with a CO2 backpack sprayer calibrated at 20 GPA, at 31 PSI, using 8003 flat fan spray tips. Plot sizes measured 2.0 m by 3.0 m. Treatments were replicated three times. Treatments included: MSMA (6.6 SC) at 2.0 lb ai/A (0 fb 7 fb 14 DAI); MSMA + Sencor (75 DF) 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 28 DAI); Plateau + MSMA at 0.09 lb ai/A + 2.0 lb ai/A (0 fb 28 DAI); Monument (75 WG) at 0.03 lb ai/A (0 fb 14 fb 28 DAI); Monument + MSMA at 0.03 lb ai/A + 2.0 lb ai/A (0 fb 14 fb 28 DAI); Katana (25 DG) at 0.09 lb ai/A (0 fb 14 fb 28 DAI); Katana + MSMA at 0.09 lb ai/A + 2.0 lb ai/A (0 fb 14 fb 28 DAI); Revolver (0.19 SC) at 0.04 lb ai/A (0 fb 14 fb 28 DAI); and Revolver + MSMA at 0.04 lb ai/A + 2.0 lb ai/A (0 fb 14 fb 28 DAI). Initial applications were made on June 23, 2004. All treatments received non-ionic surfactant at 0.25% V/V.

Visual ratings were taken 7 DAI, 21 DAI, 28 DAI, 35 DAI, and 42 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 containing MSMA provided good (≥70%) dallisgrass control at 28 DAI and excellent (≥90%) control at 42 DAI. All three sulfonylureas in the study (Monument, Katana and Revolver) tank-mixed with MSMA (2.0 lb ai/A) provided excellent (>90%) control at 42 DAI, but provided significantly less control (<70%) at 42 DAI when applied at the same rates and timings without MSMA. Bermudagrass injury was acceptable (<5%) with all treatments during entire study, except for Plateau and Plateau + MSMA.

Future research will continue screening new and experimental herbicides, applied with and without MSMA, for dallisgrass activity. Research with herbicides in this study will continue to evaluate additional combinations and timings. Future research will examine staggered treatment timings with MSMA followed by various sulfonylurea herbicides.

WEED CONTROL AND MANAGEMENT OF TURFGRASS LAWNS WITH WET BLADE TECHNOLOGY. J.B. Willis, D.B. Ricker, and S.D. Askew, Virginia Tech, Blacksburg, VA.

ABSTRACT

Wet Blade (WB) Technology directs chemical to the cut portion of the leaf surface during mowing. This dual action of mowing and applying product eliminates the need for separate chemical application. Applying chemical to the cut portion of the leaf allows the product to move directly into the plant via xylem and phloem tissue. This action also limits the likelihood of herbicide movement from spray drift. Four field trials were conducted in 2004 in Blacksburg, VA to evaluate WB for herbicide, fertilizer, and plant growth regulator (PGR) application in comparison to traditional application methods. Smooth crabgrass (*Digitaria ischaemum*) control was evaluated with WB and foliar spray with single applications of quinclorac at 0.75 and 1.5 lbs ai/A, fenoxaprop at 0.06 and 0.11 lbs ai/A, MSMA at 2 lbs ai/A, and mesotrione at 0.5 lbs ai/A. White clover (*Trifolium repens*), dandelion (*Taraxacum officinale*), and broadleaf plantain (*Plantago major*) control was evaluated with WB and foliar spray with single applications of quinclorac at 0.38 and 0.75 lbs ai/A, a premixture of 2,4-D, dicamba, and mecoprop-p at 2.38, 0.22, and 0.63 lbs ai/A, respectively, and a premixture of 2,4-D, clopyralid, and dicamba at 2.25, 0.28, and 0.28 lbs ai/A, respectively, and a premixture of clopyralid and triclopyr at 0.09 and 0.28 lbs ai/A, respectively. Tall fescue (*Festuca arundinacea*) color, quality, and clipping weight was evaluated with several turfgrass fertilizers and biostimulants applied weekly at 0.25 lbs N/1000 sq. ft, including liquid urea 33-0-0, Ferromec 15-0-0, Peters 20-20-20, 28-0-0 slow release formulation, TurfVigor 9-3-6, and 46-0-0 granular application applied biweekly at 0.5 lbs N/1000 sq. ft. for comparison. Tall fescue color, quality, and clipping weight was evaluated with trinexapac-ethyl at 0.38 lbs ai/A, ethephon at 3.4 lbs ai/A, and mefluidide at 0.13 lbs ai/A, all of these treatments were applied with and without a turfgrass biostimulant (Ferromec) which contains a 15-0-0 nutrient analysis, sulphur, and iron.

Herbicides in the smooth crabgrass trial did not injury or reduce color of turfgrass. A test site with heavy infestation of smooth crabgrass was chosen and herbicides did not control crabgrass greater than 50 percent. Spray applications did not differ from WB application for smooth crabgrass and white clover control. All treatments controlled clover between 85 and 60 percent. Both application methods failed to control broadleaf plantain and dandelion regardless of herbicide and data for these two species were highly variable between plots. The pre-mixture of 2,4-D, mecoprop-p, and dicamba controlled broadleaf plantain 50 percent when applied as foliar spray and 25 percent when WB was used and constituted the only statistical difference between application method in the study. WB fertilizer applications did not affect turf color, quality, injury, and clipping weight. WB PGR treatments were not significantly different from foliar spray treatments for clipping weight. Trinexapac-ethyl, ethephon, and mefluidide reduced clipping weight compared to the nontreated. Mefluidide significantly injured turf at 25 percent when applied with WB and 85 percent when foliar applied.

WB herbicide applications were not statistically different from foliar spray application, however trends indicate only a slight reduction in control when using WB technology. Weed control with WB technology is a practical option, and holds potential for use in turfgrass. Similar trends were observed for PGR applications in that WB applications numeric trends tended to favour foliar spray over WB for turf growth regulation. Mefluidide applications with WB had significantly less injury than foliar spray applications. Even though this injury is unacceptable, this evidence indicates that mefluidide is more effectively delivered by foliar spray applications than WB, which could be true with other products not evaluated. Although WB applications might occasionally be less effective that an equivalent foliar spray, the ease of operation associated with WB outweighs the potential minor reduction in efficacy. The lack of statistical differences between WB and foliar spray techniques proves that WB can control white clover and smooth crabgrass and regulate turfgrass equivalent to conventional foliar spray technology.

CONTROLLING BERMUDAGRASS (CYNODON DACTYLON) IN TURF-TYPE TALL FESCUE (FESTUCA ARUNDINACEA SCHREB). T.G. Willis, A.G. Estes and L.B. McCarty; Clemson University, Clemson, SC 29634.

ABSTRACT

Tall fescue (*Festuca arundinacea* Schreb.) is a cool-season perennial grass with year-round color and good heat tolerance. Therefore, it is commonly grown in the mid-Atlantic region, transition zone, and the upper portion (upper Piedmont and mountains) of the warm-humid zone of the mainland United States. Being a cool-season grass, tall fescue's optimum temperature for growth is between 65 and 75°F, whereas bermudagrass (*Cynodon dactylon*), a warm-season grass, is best adapted to temperatures between 80 and 95°F. Therefore, during the hot summer months, tall fescue is at its weakest and begins to decline with growth slowing considerably. Meanwhile, bermudagrass and crabgrass grow very aggressively during summer and possess the ability to crowd out the tall fescue during this time.

In 2004, Clemson University performed a trial at the Clemson University turfgrass research area to evaluate the selective control of bermudagrass in turf-type tall fescue by various postemergence herbicides. The trial was initiated on May 4, 2004 with 5 sequential applications being made every 30 days. Treatments (oz/a) included: Fusilade II T&O 2EC (6), Acclaim Extra 0.57L (24), Turflon Ester 4EC (32), Prograss 1.5EC (174), Fusilade II + Prograss (6 + 174), Acclaim Extra + Prograss (24 +174), Turflon Ester + Prograss (32 + 174) and Acclaim Extra + Turflon Ester (24 + 32). All treatments including Fusilade had a non-ionic surfactant added at a rate of 0.25 % v/v. Turf quality ratings included any turf injury that may have occurred as a result of the herbicide treatments. Turf quality <7 was deemed unacceptable.

Results
After two monthly applications, Fusilade II, Fusilade + Prograss, Acclaim Extra + Prograss, Turflon Ester + Prograss and Acclaim Extra + Turflon Ester provided >73% bermudagrass control. After four monthly applications, Fusilade and Fusilade + Prograss provided >85% control. After six monthly applications (24 WAIT), excellent control (>93%) was provided by Fusilade, Fusilade + Prograss, Turflon Ester, Turflon Ester + Prograss and Acclaim Extra + Turflon Ester. Turfgrass quality remained at or above the minimum acceptable rating of 7 throughout the trial for all herbicide treatments.

SYMPOSIA

USE & IMPACT OF TRANSGENIC TURFGRASS SPECIES IN THE SOUTHEASTERN US

CONTROL OF CREEPING BENTGRASS WITH HERBICIDES OTHER THAN GLYPHOSATE. F.H. Yelverton and S. Hart; North Carolina State University, Raleigh, NC and Rutgers University, New Brunswick, NJ.

ABSTRACT

Glyphosate resistant creeping bentgrass may soon be available for commercial use on golf courses. In other agricultural areas, transgenic crops have provided a comprehensive weed management solution; however, there are potential management challenges. A specific concern with glyphosate resistant creeping bentgrass is control in the event it escapes a managed environment. The objective of this research was to evaluate various herbicides for bentgrass control.

Replicated research trials were initiated on non-transgenic ‘Penncross’ creeping bentgrass on 10 April or 22 May 2002 at Jackson Springs, NC. Evaluated treatments included: glyphosate as a standard (1.7 kg/ha), fluazifop (0.4 kg/ha), glyphosate + fluazifop (1.7 + 0.4 kg/ha), clethodim (0.3 kg/ha), sethoxydim (0.4 kg/ha), sulfometuron (0.05 kg/ha), imazaquin (0.06 kg/ha), imazaquin + MSMA (0.06 kg/ha + 2.2 kg/ha), atrazine (2.2 kg/ha), metribuzin + MSMA (0.3 + 2.2 kg/ha), isoxaflutole (0.1 fb 0.1 or 0.2 kg/ha), rimsulfuron (0.05 or 0.1 kg/ha), and sulfosulfuron (0.1 kg/ha). Glyphosate and fluazifop applied alone or as a tank-mix as well as clethodim and sethoxydim were evaluated as single applications or with one sequential applied four weeks after initial treatment. Fluazifop, clethodim, sethoxydim, and atrazine were applied with a crop oil concentrate (1% v/v) while imazaquin, MSMA, rimsulfuron, sulfometuron, and sulfosulfuron were applied with a non-ionic surfactant (0.25% v/v). All treatments were applied with a backpack sprayer calibrated to deliver 304 l/ha. Visual estimates of bentgrass control were taken at four and eight weeks after initial treatment and were subjected to ANOVA and means were separated according to Fisher’s protected LSD (P=0.05).

At four weeks after initial treatment, one or two applications of glyphosate provided excellent bentgrass control when initiated in April but only fair control when initiated in May. Similarly, one or two applications of glyphosate plus fluazifop provided excellent control when initiated in April but only good control when initiated in May. Additionally, atrazine provided excellent bentgrass control, while fluazifop, clethodim, sethoxydim, sulfometuron, imazaquin, imazaquin + MSMA, metribuzin + MSMA, isoxaflutole, rimsulfuron, or sulfosulfuron provided poor control at four weeks after initial treatment.

At eight weeks after initial treatment, single applications of glyphosate provided good to excellent bentgrass control, dependent upon initiation time, while two applications provided excellent bentgrass control. One or two applications of glyphosate + fluazifop provided excellent bentgrass control. Two applications of fluazifop provided good to excellent bentgrass control while single applications provided poor control. Additionally, two applications of clethodim provided excellent control while two applications of sethoxydim ranged from good to excellent, dependent upon initiation time. Atrazine provided excellent control while sulfosulfuron control ranged from good to excellent. Sulfometuron, imazaquin, imazaquin + MSMA, metribuzin + MSMA, isoxaflutole, and rimsulfuron provided poor control. In conclusion, atrazine, fluazifop, clethodim, or sethoxydim offer non-glyphosate options for bentgrass control; however, it is likely repeat applications will be needed.

SYMPOSIA

USE & IMPACT OF TRANSGENIC TURFGRASS SPECIES IN THE SOUTHEASTERN US

BIOTECHNOLOGY IN TURFGRASSES: THE ROAD TO MARKET. D.L. Suttner, E. Nelson and D.H. Williamson: Monsanto Company, St. Louis, MO, The Scotts Company, Marysville, OH and Monsanto Company, Charleston, SC. (218)

ABSTRACT

The development and commercialization of transgenic turfgrass products is a complex and expensive process that requires careful coordination among an array of functional areas of expertise and multiple regulatory agencies. The process should begin with analysis of market fit/value along with consideration of vulnerabilities and opportunities. Elucidation of stakeholders who may be affected by the product will define vulnerabilities and should be accompanied by a detailed plan to describe gain for each of the stakeholder groups. Consultation with regulatory agencies should begin as early in the process as the technical product concept will allow. FDA, USDA and EPA may be involved in aspects of the regulatory process. USDA plays the lead role with deregulation and approaches it from the perspective of it's jurisdiction over the release of potential pests. Since many turfgrass species are open pollinated perennials there will be unique requirements for regulatory approval. These requirements will include collection of data over multiple years and complete characterization of pollen and its movement. The ecological fitness profile will include full evaluation of the transformed plant against suitable controls over the life cycle of the plant from establishment through growth, flowering/reproduction to seed production and beyond. Studies will need to reflect all geographical and environmental conditions where the plant could occur. The data profile for molecular will require sophisticated skills in molecular biology and protein biochemistry as well as the ability to conduct studies under GLP. A well executed project plan can assist in coordinating the laboratory portion of the package and avoid unnecessary delays. Timelines for turfgrass projects can range from less than six years to more than eight years depending on the issues and the course the process takes. The need for an Environmental Impact Statement can lengthen the process significantly. An eight to ten year regulatory cycle can place severe pressure on project financials. The need for product stewardship during the R&D stage as well as during production and commercial use, especially with a perennial grass, will also challenge the financials for the project. Development costs range widely for projects depending on whether the project involves new genes or ones already in use in other crops. Investments can go from as little as $8M to as much as $12M or more to bring a new product to market. These figures ignore the facility and human resource development costs associated with having a competent organization capable of doing the work. Stamina will be required to sustain the project through a range of challenges including negative media attention and even litigation because the technology is controversial. The prospect of commercialization can be equally daunting. Turfgrass markets are not accustomed to the products of modern biotechnology. Channel partners will have to be recruited. Training of both end users and the channel will demand planning and flawless execution. The threat of technology piracy will be real and a strategy to prevent piracy developed. Value capture approaches will need to be developed that address the unique issues presented by perennial crops. All of these issues and many more will need to be melded into a coherent business model for the product. Commercial success will accrue to those who have compelling product concepts and the technological, regulatory and commercial acumen to plan, coordinate, execute and deliver transgenic turfgrass to the market.

SYMPOSIA

USE & IMPACT OF TRANSGENIC TURFGRASS SPECIES IN THE SOUTHEASTERN US

GENE FLOW FROM TRANSGENIC TURFGRASSES: OCCURRENCE VERSUS CONSEQUENCE. C.A. Mallory-Smith; Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331.

ABSTRACT

The introduction of transgenic turfgrasses has raised concerns within the agricultural and environmental communities. Issues include: a) gene flow out of the production fields via pollen, seed, or vegetative propagules and the impact in managed and nonmanaged systems; b) cross-contamination of other crops; and c) production of a resistant volunteer plant. However, the real issue is not whether gene flow will occur, because it will, but rather are there negative consequences when it occurs. The introduction of Roundup Ready™ creeping bentgrass (*Agostis stolinifera*) seed production into Oregon provided a unique opportunity to assess gene flow and its consequences. Creeping bentgrass is an outcrossing perennial species that crosses with related species. Its pollen can move long distances and its seeds are extremely small (8 million seeds/lb). In addition, it reproduces vegetatively. Creeping bentgrass is found in noncultivated areas and can be weedy in its own right. These biological factors make it more difficult to manage than other Roundup resistant crops such as corn and soybeans. In addition, the seed is being produced for propagation of turf rather than being processed into oil or meal. Therefore, viable seed will be transported and planted on golf courses throughout the United States. In Oregon, about 400 acres of Roundup Ready™ creeping bentgrass were planted in 2002. Management strategies were put in place to specifically address gene containment and mitigation of gene movement. Studies were conducted to evaluate gene flow via pollen and seed movement and the effectiveness of the management strategies. The Roundup Ready gene moved via both pollen and seed. Seed collected from related species tested positive for the resistance trait. Although, there was hybridization with related species, no negative consequence has been documented as yet. It is unknown whether the hybrids will be fertile and retain the resistance gene over subsequent generations which could then produce a resistant species. The seed moved into other production fields and along irrigation canals and ditches. This movement required increased inputs by growers to control the resistant plants. A mitigation program for this movement is now underway and its effectiveness will be assessed over the next several growing seasons.

SYMPOSIA

WEED CONTROL OPTIONS DURING ESTABLISHMENT & GROW-IN OF WARM-SEASON TURF SPECIES

SEEDED BERMUDAGRASS RESPONSE TO HERBICIDES AND WEED CONTROL DURING ESTABLISHMENT

ESTABLISHMENT. S.D. Askew, Virginia Tech, Blacksburg.

ABSTRACT

Newer seeded bermudagrass cultivars have improved turfgrass quality and cold tolerance compared to older seeded types. However, weed control recommendations in fine turfgrass situations is lacking for seeded bermudagrass establishment. Several field trials were conducted in Blacksburg, VA to evaluate herbicides for effects on 'Riviera' seeded bermudagrass and weed control.

Herbicides included foramsulfuron (Revolver) at 0.4, 0.8, and 1.2 fl oz/1000 square feet, metsulfuron (Manor) at 1 oz/A, rimsulfuron (Tranxit) at 2 oz/A, sulfosulfuron (Certianty) at 0.64 oz/A, flazasulfuron at 2 oz/A, trifloxysulfuron at 0.56 oz/A, carfentrazone (Quicksilver) at 2 fl oz/A, and quinclorac (Drive) at 1 lb/A. Herbicides were applied at 3 and 1 wk before and after seeding. Bermudagrass was seeded at 1 lb pure live seed per 1000 square feet. Data consisted of visual estimation of percentage bermudagrass cover and injury and percentage weed control.

Injury to bermudagrass among herbicides followed the following trend from least to most injurious: Foramsulfuron = sulfosulfuron = quinclorac = carfentrazone < metsulfuron < rimsulfuron < flazasulfuron = trifloxysulfuron. The most injurious timing was 1 wk after seeding. Foramsulfuron, sulfosulfuron, quinclorac, and carfentrazone did not injure bermudagrass while flazasulfuron and trifloxysulfuron were extremely injurious. Data suggest that foramsulfuron, sulfosulfuron, metsulfuron, quinclorac, and carfentrazone can be used within 3 wk of seeding while rimsulfuron, flazasulfuron, and trifloxysulfuron should not be used within 3 wk of seeding. Establishment rate of 'Riviera' bermudagrass was slow compared to typical establishment of other seeded bermudagrass types. First germination occurred 3 wk after seeding, however, bermudagrass quickly covered the seeded area thereafter. By 6 wk after seeding, noninjured bermudagrass exhibited greater than 80% cover in the absence of weed pressure.

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WEED CONTROL OPTIONS DURING ESTABLISHMENT & GROW-IN OF WARM-SEASON TURF SPECIES

TURFGRASS TOLERANCE AND WEED CONTROL DURING VEGETATIVE ESTABLISHMENT OF WARM-SEASON TURFGRASSES.

J.B. Unruh and B.J. Brecke, University of Florida, IFAS, West Florida Research and Education Center, Jay, FL 32565.

ABSTRACT

Vegetative establishment of warm-season turfgrass is most often accomplished by sprigging, the planting of rhizomes and/or stolons in narrow-spaced furrows. This method is considered the most economical means of vegetative turfgrass establishment, however, sprigged grasses often require 8 to 12 weeks before full groundcover is achieved. During this establishment period, annual grass and broadleaf weeds are serious problems due to the lack of turfgrass competition. Weed competition, in turn, lengthens the time for complete turfgrass ground cover. For this reason, effective herbicides used for weed control during establishment are essential. Scientists have documented various herbicides that can be used for weed control in newly plugged or sprigged turfgrasses, although variation in tolerance among turfgrass species and cultivars to herbicides have been noted. Additionally, some herbicides or combinations of herbicides are known to inhibit rooting of some species while some appear to have little effect on rooting.

Turfgrass tolerance to quinclorac, a herbicide labeled for preemergence and postemergence application in turf to control several weed species including large crabgrass [Digitaria sanguinalis (L.) Scop.], torpedograss (Panicum repens L.), white clover (Trifolium repens L.), and pennywort (Hydrocotyle spp.) was assessed on ‘Tifway' and ‘Tifdwarf' bermudagrass (Cynodon dactylon (L.) Pers. X C. transvaalensis Burtt-Davey) , ‘Salam' seashore paspalum (Paspalum viginatum Swartz), and ‘Meyer' zoysiagrass (Zoysia japonica L.). Across all species, the "at-sprigging" quinclorac application reduced ground cover below the untreated. Quinclorac applied 7 days before sprigging and 7 or 14 days after sprigging had no impact on the growth of the various turf species. Similarly, regardless of turf species, the "at-sprigging" application of quinclorac caused an average of 22% injury, while other timings averaged 8% injury five weeks after sprigging (WAS). At 8 and 13 WAS, the "at-sprigging" application was the only treatment with detectable injury (< 12%).

The utilization of foramsulfuron, a postemergence sulfonylurea herbicide, during establishment is also a viable option. When evaluated 4 WAS, foramsulfuron (0.08 lb ai/a) applied at sprigging or 2WAS and oxadiazon 2G (2 lbs ai/a) applied at sprigging decreased ‘Tifway' bermudagrass ground cover by 14%. When evaluated at six and nine weeks after planting, only foramsulfuron applied 2WAS and oxadiazon 2G applied at sprigging had a negative effect on grow-in. Foramsulfuron applied either 4WAS or 6WAS had no negative impact on bermudagrass establishment. By 11 weeks after planting, no treatment differences were noted.

Some soil fumigants have successfully been used for weed management prior to vegetative establishment of warm-season turfgrass. Methyl bromide (350 lbs/a) and 1,3-dichloropropene at rates >25 gpa provide acceptable control of troublesome weeds when applied preplant. The necessity of laying a plastic tarpaulin over 1,3-dichloropropene treated soil has been demonstrated in several field studies.

SYMPOSIA

WEED CONTROL OPTIONS DURING ESTABLISHMENT & GROW-IN OF WARM-SEASON TURF SPECIES

UTILIZING MESOTRIONE FOR SEEDED ESTABLISHMENT OF TURF-TYPE TALL FESCUE.
J.S. McElroy and G.K. Breeden, University of Tennessee, Knoxville, TN.

ABSTRACT

Mesotrione is currently being evaluated for potential usage in the turfgrass market. Mesotrione is an inhibitor of 4-hydroxyphenylpyruvate dioxygenase (HPPD; EC 1.13.11.27) enzyme activity. In plants, HPPD converts 4-hydroxymethylpyruvate to homogentisate, which is a precursor to plastoquinone and α-tocopherol. Plastoquinone is a cofactor in phytoene desaturase, the precursor to all carotenoids. Depletion of carotenoids yields a bleached white appearance, free radicals accumulate, and plant necrosis ensues. If labeled for use in turfgrass systems, mesotrione will be the first "bleaching," carotenoid production-inhibiting herbicide to be used in turfgrass systems. Introduction of new herbicide chemistry to new agronomic areas often leads to the discovery of unforeseen novel herbicide usage. In the case of mesotrione, researchers have recently demonstrated that it could potentially be safely used during seeded establishment of certain turf species. Further research is needed evaluating specific timings, rates, and multiple applications to assess the safety of mesotrione applied during seeded establishment of turf-type tall fescue.

Research was conducted in Knoxville, TN at Knoxville Experiment Station - Plant Science Unit. For our spring establishment study, 'Kittyhawk' turf-type tall fescue was seeded on March 24, 2004 with a broadcast spreader at a rate of 6 lbs/1000 sq. ft. and cotton germination blanket was applied for two weeks. A complete starter fertilizer (24-6-12) was applied at planting at a rate of 1lb N/1000 sq. ft. No additional fertilization was added during the experiment. Treatments were replicated four times in a randomized complete block design. Herbicides were applied with a CO_2 pressurized sprayer and a 4 ft. boom with a pressure of 26 PSI and 8002XR flat fan nozzles. Mesotrione treatments included were 0.125 and 0.25 lb ai/a applied in a single application at 14 days after emergence (DAE), applied twice at 28 and 42 DAE, and applied three times at 14, 28 and 42 DAE. Quinclorac treatments were 1.5 lb ai/a and 0.75 lb ai/a applied in a single application at 14 DAE. All mesotrione treatments contained 0.25 % v/v NIS and quinclorac treatments had 1.5 pt/a MSO. Experimental units were 5 ft by 5ft. Weed control and turf injury were evaluated visually utilizing a 0% (no weed control or turf injury) to 100% (complete weed control or turf injury) scale. For our fall establishment study, 'Kittyhawk' turf-type tall fescue was seeded on August 30, 2004 at the same rate and fertility applications as the spring study. Spring and fall studies were identical in application methodologies. Nine treatments, including a non-treated, were included in the study. For the eight herbicide treatments, mesotrione was applied at either 0.125 or 0.25 lb ai/a at 0, 7, 14, or 28 DAE. Mesotrione treatments included NIS at 0.25% v/v.

In the spring study, for all single application mesotrione treatments regardless of rate, tall fescue injury peaked at 7 days after treatment (DAT) and injury dissipated by 14 DAT. At 7 DAT, no single application of mesotrione ever exceeded 20% injury. Multiple applications demonstrated similar safety compared to single applications with <20% tall fescue injury observed 7 DAT with two or three biweekly sequential applications and injury dissipation by 14 DAT. Quinclorac applied at 0.75 and 1.5 lb ai/a injured tall fescue 30% 14 DAT. Injury from quinclorac slowly dissipated and was unapparent by 28 DAT. Tall fescue injury from quinclorac produced an epinastic twisting of the leaves, however no plant necrosis was observed. In the fall study, preemergence, 7, and 14 DAT mesotrione applications, regardless of rate, did not injure tall fescue at any rating date. Mesotrione applied at 0.125 and 0.25 lb ai/a 28 DAE, however, injured tall fescue 13 and 23% at 14 DAT. Injury from these applications did not dissipate completely until 28 DAT. It is hypothesized that the decrease in average daily temperature after the 28 DAE applications to $\sim\leq$ 60 F exacerbated the injury from these applications due to decreased physiological activity and thus, decreased herbicide metabolism. Despite injury variation, mesotrione did not reduce tall fescue turf cover compared to the non-treated at any rating date, regardless of application timing or rate. These data indicate that mesotrione is safe for use as preemergence or early postemergence herbicide on newly seeded tall fescue.

TALL IRONWEED (*VERNONIA ALTISSIMA*) CONTROL IN TALL FESCUE (*FESTUCA ARUNDINACEA*) PASTURES. G. K. Breeden, J. S. McElroy, and G. N. Rhodes, Jr., University of Tennessee.

ABSTRACT

Tall ironweed (*Vernonia altissima*) is a troublesome, difficult to control perennial weed in Tennessee pastures, and it can be found anywhere from rolling hills to creek bottoms. Tall ironweed reproduces both from seed and vegetatively from root crowns, making it persistent and giving it the ability to spread across pastures. Clipping can aid in reducing infestations, yet, this alone only slows the spread of tall ironweed. Sometimes re-establishment of the pasture is needed for control of troublesome weeds like tall ironweed. If pasture re-establishment is not an option the use of a timely herbicide application can be useful in reducing infestations of tall ironweed. Surmount (picloram + fluroxypyr) and Pasturegard (triclopyr + fluroxypyr), labeled in 2004 for use in cool-season grass forages, could potentially improve control of many difficult to control weeds. Field research was initiated to evaluate the efficacy of Surmount and Pasturegard on tall ironweed.

Research was conducted at Tellico Plains, TN in 2004. The experiment was replicated 4 times in a randomized complete block design. Experimental units were 10 ft. wide by 30 ft. long. Treatments included in this research were 2,4-D Ester (1 qt/A), Banvel (1 qt/A), Redeem R&P (1 qt/A), Crossbow (1 and 2 qt/A), Grazon P+D (1 and 2 qt/A), Pasturegard (3 pt/A), and Surmount (3 pt/A). Herbicides were applied in a water carrier volume of 15 GPA with a CO_2 pressurized sprayer. Weed control and crop injury were evaluated visually utilizing a 0 (no weed control or crop injury) to 100 (complete control of all weeds or crop) % scale.

Excellent (90% or greater) control of tall ironweed was observed at 4 weeks after application (WAA) with Crossbow at 2 qt/A, Grazon P+D at 2 qt/A, Pasturegard, and Surmount. Tall ironweed control was < 80 % for all other treatments 4 WAA. Good (80-90%) control was observed 8 WAA with Redeem R&P and Crossbow at 1 qt/A. Excellent control was observed with Crossbow at 2 qt/A, Grazon P+D at 1 and 2 qt/A, Pasturegard, and Surmount 8 WAA. Unacceptable (65% or less) control was observed with 2,4-D Ester and Banvel. Excellent control was observed with all treatments except 2,4-D Ester and Banvel. No injury was observed on tall fescue at any of the rating dates. These data indicate that Pasturegard and Surmount are both safe for use on tall fescue. Both herbicides, as well as Crossbow at 2 qt/A and Grazon P+D at 2 qt/A, provided excellent control of tall ironweed throughout the season. Treatments that included triclopyr (Redeem R&P, Crossbow and Pasturegard) provided good to excellent control. This research indicates that there are several options to aid in control of tall ironweed, including the new herbicides Surmount and Pasturegard.

EFFECT OF MOWING AND HEXAZINONE APPLICATION ON GIANT SMUTGRASS (*Sporobolus indicus* var. *pyramidalis*) CONTROL. J. A. Ferrell and J. J. Mullahey; Department of Agronomy, University of Florida, Gainesville, FL and West Florida REC, Milton, FL 32611.

ABSTRACT

Giant smutgrass is a perennial clump-type grassy weed that commonly infests Florida pastures. Experiments were conducted in 1998 and 1999 in Immokalee, FL to determine if multiple mowing treatments, in combination with hexazinone application at 0.56 to 1.7 kg/ha, would improve giant smutgrass control and increase bahiagrass density. It was observed that mowing did not influence smutgrass control in 1998 or 1999. However, hexazinone application did statistically increase giant smutgrass control, relative to the untreated, at all application rates. In 1998, regression analysis determined that hexazinone applied at 0.56 kg/ha provided >90% control 182 days after application (DAT) and >80% 321 DAT. Both 1.1 and 1.7 kg/ha provided greater than 90% control for 365 DAT in 1998. In 1999, due in part to excessive rainfall, 0.56 kg/ha provided >80% control for only 48 DAT. It was also concluded that hexazinone applied 0.83 to 0.98 kg/ha was the lowest application rates that consistently provided between 80 and 90% control over both years. Bahiagrass density after hexazinone application was also observed. From 0 to 30 DAT, bahiagrass density increased by 17% for the 0.56 kg/ha rate and 2% at the 1.7 kg/ha rate. From 30 to 365 DAT, bahiagrass density increased at 0.04% per day as compared to 0.1% per day for 0.56 and 1.7 kg/ha, respectively. Increased bahiagrass injury by the higher application rates of hexazinone was responsible for low levels of bahiagrass growth from 0 to 30 DAT. However, bahiagrass soon recovered from injury and the higher application rates resulted in a more rapid rate of bahiagrass spread, likely due to less competition of smutgrass in areas treated with 1.1 and 1.7 kg/ha rates. From these data it was concluded that mowing prior to hexazinone application is an unwarranted expense and the 1.1 kg/ha rate provided the most effective and consistent smutgrass control with acceptable levels of bahiagrass injury.

CLOVER ESTABLISHMENT IN COOL-SEASON GRASS PASTURES FOLLOWING TREATMENT WITH GRAZON P+D, REDEEM R&P, PASTUREGARD OR SURMOUNT. W.W. Witt, University of Kentucky, Lexington; E.S. Hagood, Virginia Tech, Blacksburg; and P.L. Burch, Dow AgroSciences, Christiansburg VA.

ABSTRACT

Tall fescue (*Festuca arundinacea* Schreb.) is a cool-season grass and is widely used as a pasture for grazing beef animals. It is preferred because it is easy to establish, withstands grazing pressure, and the stand persists for many years. Much of the tall fescue contains a fungal endophyte (*Neotyphodium coenophialum*) that is beneficial to the tall fescue but grazing beef animals frequently experience elevated body temperatures and do not gain as much weight as desired. Clovers (*Trifolium* spp.) are desirable legumes grown in association with tall fescue. The clover-tall fescue pasture improves the overall forage quality and when the clover composition is 30 to 50% of the stand will dilute the toxicity of the endophyte and improve animal weight gain. Broadleaf weeds frequently occur in grazed pastures containing tall fescue and clovers and decrease the overall quality of the forage. This presents a dilemma for pasture managers in that many herbicides used for broadleaf weed control also severely damage, and usually kill the desirable clovers. Also, there was concern about picloram, triclopyr, and clopyralid persistence in soil to prevent clover establishment following the use of products containing these active ingredients. This raised the question "When are herbicide concentrations in soil sufficiently low to allow clover establishment?" Our hypothesis was that clovers could be established the year following herbicide treatments. The objectives of this research were to determine the interval between application of auxin herbicides and successful establishment of clovers interseeded into cool-season pastures and to determine the quality and quantity of clovers and cool-season grass stands.

Experimental sites were near Lexington KY and Blacksburg VA and each site had been in cool-season grass pastures, predominantly tall fescue, for several years before initiation of the trials. The following herbicides were applied at the rates indicated at both sites: Grazon P+D (0.54 lb/gal picloram + 2.0 lb/gal 2,4-D) at 2 and 3 pt/A; Redeem R&P (0.75 lb/gal clopyralid + 2.25 lb/gal triclopyr at 1.5, 2 and 3 pt/A; PastureGard (0.5 lb/gal fluroxypyr + 1.5 lb/gal triclopyr at 2 pt/A; Surmount (0.66 lb/gal picloram + 0.66 lb/gal fluroxypyr at 2 pt/A. A non-treated control was included for comparison. These treatments were made in spring (mid to late May), summer (July), and fall (September). Clovers were seeded in late fall of 2002 or early spring of 2003. Measurements of clover frequency and stand counts were collected.

Clover seeded in February or March was established successfully at both sites with all herbicides and rates when the herbicides were applied no later than October of the preceding year. Grazon P+D at 2 pt/A, Redeem at 1.5, 2 and 3 pt/A, PastureGard at 2 pt/A, and Surmount at 2 pt/A showed no adverse effect on fall seeded clover at either site when applied no later than June of that year. Picloram containing products (Grazon P+D at 2 or 3 pt/A or Surmount at 2 pt/A) applied in July in VA or September in KY reduced the stand of fall seeded clover. The results of this research indicated that clover could be established successfully the year following treatment with these herbicides. Further, many of the treatments allowed for clover establishment in the year of treatment. Also, these herbicides provide excellent control of numerous weeds in cool-season pastures and weed management and clover establishment can be accomplished with proper timing and seeding.

EVALUATION OF NEW HERBICIDES FOR BLACKBERRY (Rubus sp.) CONTROL IN THE SOUTHEAST. J. Tredaway Ducar, Berry College, Mt. Berry, GA 30149 and W.N. Kline, Dow AgroSciences, Duluth, GA.

ABSTRACT

Blackberry (*Rubus* spp.) is a common pasture and rangeland weed. Blackberries are able to regenerate from the crown or rhizomes following mowing, burning, or herbicide treatment making them difficult to control. Therefore, the objectives of our research was to evaluate the efficacy of Surmount (fluroxypyr at 2 pt/A + picloram at 2 pt/A) and PastureGard (triclopyr at 2.25 pt/A + fluroxypyr at 0.75 pt/A) and compare them to the commercial standards for *Rubus* sp. control. Experiments were conducted in Walker County, GA and Madison County, GA in 2003 and 2004, to evaluate Surmount and PastureGard for *Rubus* sp. control in pastures. They were compared against the commercial standards. A randomized complete block design with four replications was utilized with both experiments. Plots measured 12 ft by 40 ft in Walker County and 12 ft by 75 ft at the Madison County site. Treatments were applied using a CO2 pressurized ATV mounted broadcast sprayer delivering 25 and 30 gallons per acre in Walker and Madison counties, respectively. Treatments in the Walker County experiment included PastureGard at 3.0, 4.5, and 6.0 pt/A; Surmount at 4.0 pt/A; Surmount at 2.0 pt/A plus Remedy at 1.0 pt/A; Surmount at 2.0 pt/A plus Ally at 0.3 oz/A; Remedy at 2.0 pt/A, and Crossbow at 8.0 pt/A. Treatments were applied on June 17, 2003 in Walker County. Treatments in the Madison County experiment included PastureGard at 3.0, 4.0, and 5.0 pt/A; Grazon P+D at 2.0 pt/A plus Remedy at 1.0 pt/A; Crossbow at 8.0 pt/A; Surmount at 3.0 and 5.0 pt/A. See Tables 1 and 2 for a complete list of herbicides, formulations, and rates. Treatments for the Madison County experiment were applied on June 2, 2004. Treatments were applied when *Rubus* sp. was actively growing, during flowering. A final assessment for weed control was made 419 DAA (days after application) on the Walker County experiment and an initial assessment was made 147 DAA. Visual evaluations were based on a scale of 0 - 100% with 0 = no weed control and 100 = complete weed control. Data collected included weed control for blackberry (*Rubus cuneifolius*) in Walker County and blackberry and Northern Dewberry (*Rubus flagellaris*) in Madison County. Initial (147 DAA) blackberry control results were similar with all treatments except Crossbow at 8 pt/A. PastureGard, regardless of rate, provided 83-89% control. Grazon P+D (2 pt/A) plus Remedy(1 pt/A) controlled blackberry 81%. Surmount, regardless of rate controlled blackberry at least 97%. Crossbow was the only treatment that was significantly different providing 49% control. Northern dewberry results were much lower than blackberry although there were no differences between any of the treatments. PastureGard at 5 pt/A and at 3 pt/A controlled blackberry 58% and 45%. However, PastureGard at 4 pt/A controlled blackberry 37% which was equivalent with Crossbow (37%) for providing the least amount of control. Grazon P+D plus Remedy provided 50% control while both Surmount treatments (3 and 5 pt/A) controlled Northern dewberry 53 and 55%, respectively.

AMINOPYRALID: GLOBAL OPPORTUNITIES. W.N. Kline, A.A. Chemello, J.L. Troth, and J.M. Breuninger; Dow AgroSciences, Duluth, GA and Indianapolis, IN.

ABSTRACT

Aminopyralid is a new pyridine carboxylic acid herbicide designed and developed for selective broadleaf weed control in rangeland, pastures, rights-of-way, other non-cropland areas natural areas, wheat, barley, sorghum, oil palm and rubber plantations. Aminopyralid provides systemic post-emergence control of herbaceous broadleaf, semi-woody and woody plants. Aminopyralid offers a high level of crop tolerance in a wide range of temperate and tropical forage grasses and cereals. It is effective at rates between 52 and 120 gae/ha in rangeland and non-crop land areas. It will be offered as a stand alone treatment or in premixes with 2,4-D, fluroxypyr and triclopyr. Applied as a stand-alone treatment, aminopyralid controls key weeds in the genera Ambrosia, Acacia, Carduus, Centaurea, Mimosa, and Rumex, in addition to controlling weeds like Cirsium arvense, Acroptilon repens, Senecio jacobaea and Solanum viarum. Mixtures with the herbicides already mentioned, will control a variety of added broadleaf weeds, including Daucus carota, Lantana camara, Lespedeza sp., Ranunculus sp., Senna obtusifolia, Sida sp., Solidago sp., Symphoricarpos occidentalis, Taraxacum officinale, Urtica sp., Vernonia sp. and Vervain sp., In small cereal grains, aminopyralid applied post-emergence will provide excellent activity for control of Fallopia convolvulus, Polygonum aviculare, Silybum marianum, Chrysantemum segetum, Cirsium arvense and Papaver rhoeas, including ALS resistant and 2,4-D tolerant biotypes, with excellent crop safety. Aminopyralid will be offered in cereals with premix partners to control additional weeds including Galium aparine, Kochia scoparia, Stellaria media, Sinapsis arvensis, and Lamium amplexicaule. Product concepts in wheat are being developed in Argentina, Australia, Europe, Central and East Asia and the U.S. Aminopyralid + glyphosate will be positioned in oil palm and rubber plantations as a post-emergence treatment applied around the base of the trees for control of key weeds including Ageratum conyzoides, Asystasia intrusa, Hedyotis verticillata, Mikania cordata, and Paspalum conjugatum. Aminopyralid uses in other crops such as oilseed rape and sugar cane are being evaluated. Registrations are anticipated in more than 45 countries. If you cut and paste your text from another document be sure that you paste it in this document without the formatting codes of your other document.

HORSENETTLE (*SOLANUM CAROLINENSE*) CONTROL WITH PASTUREGUARD AND SURMOUNT.
R.E. Strahan, E.K. Twidwell, S. Dutile, and A. Hogan; Louisiana State University Agricultural Center, Baton Rouge, LA 70803.

ABSTRACT

Horsenettle (*Solanum carolinense*) is a perennial broadleaf plant that is one of the most invasive weeds in bermudagrass (*Cynodon* dactylon) pastures in Louisiana. The weed spreads by rhizomes and seeds and is characterized by globe shaped fruit and prickly spines on the stem and lower leaf veins. All parts of horsenettle are considered to be toxic to most livestock.

Two new herbicides from Dow AgroSciences, Pastureguard (triclopyr + fluroxypyr) and Surmount (fluroxypyr + picloram) are scheduled for release in 2004 for use in pastures. Pastureguard and Surmount do not contain 2,4-D and should be safe in 2,4-D restricted areas of the state. However, the broadleaf weed control spectrum of these herbicides continues to be determined. To date, there is no documented research that has determined the efficacy of Pastureguard and Surmount for horsenettle control in Louisiana pastures.

Field studies were conducted in 2003 in producer pastures in Lafayette and Jeff Davis Parish in south Louisiana to determine postemergence control of horsenettle by single applications of Cimarron (metsulfuron), Weedmaster (2,4-D + dicamba), Cimarron Max (metsulfuron + 2,4-D + dicamba), Crossbow (triclopyr + 2,4-D), Remedy (triclopyr), Grazon P+D (2,4-D + picloram), Redeem (triclopyr + clopyralid), Pastureguard, and Surmount. Herbicides were applied June 10 in Lafayette Parish and August 22 in Jefferson Davis Parish to actively flowering and fruiting horsenettle. Experimental design was a randomized complete block with three replications. Visual horsenettle control and bermudagrass injury were evaluated periodically during the experiment. Data were analyzed using ANOVA and means were separated using Fisher's Protected LSD (P=.05). A treatment by location interaction was observed.

In Lafayette, Cimarron, Weedmaster, Cimarron Max, Grazon P+D, and Surmount provided at least 95% horsenettle control 45 days after treatment (DAT). Surmount provided better horsenettle control than Pastureguard (99% versus 75%) and similar control as the standard Grazon P+D (97%). In Jefferson Davis Parish, Cimarron Max, Grazon P+D, and Surmount gave at least 90% control. Surmount and Grazon P+D controlled horsenettle 90 and 92%, respectively. However, Pastureguard only provided 33% control. Cimarron controlled horsenettle 95% in Lafayette. However, the late season application of Cimarron in Jefferson Davis only controlled horsenettle 68%. Overall, herbicides performed better at the Lafayette location. Improved herbicide performance at Lafayette could be attributed to the earlier timing of the application and the active growing conditions before and after herbicide applications.

Regardless of location and time of application, Cimarron Max, Grazon P+D, and Surmount provided the greatest horsenettle control of the herbicides tested (>90). Surmount consistently controlled horsenettle as well as the standard Grazon P+D in the two studies. However, Pastureguard did not provide satisfactory horsenettle control at either location.

Single early herbicide applications were better than a single late season applications. Although horsenettle had flowers and mature fruit at the time of application in Lafayette, horsenettle was controlled more easily in the late spring (June 10) than in late summer (August 22) in Jefferson Davis. Pastureguard only provided fair control with early season applications and poor control with late season applications. Cimarron Max, Grazon P+D, and Surmount provided the most consistent horsenettle control of the herbicides tested. Results of these studies indicate that Surmount should be an excellent alternative to Grazon P+D for horsenettle control in areas where 2,4-D use is restricted due to sensitive crops.

PREEMERGENCE CONROL OF WEEDY PASTURE GRASSES. M.T. Myers, J.D Byrd, B.K. Burns and R.S. Wright; Mississippi State University, Mississippi State, MS.

ABSTRACT

A greenhouse study was conducted in the fall of 2004 to evaluate the effectiveness of three preemergence herbicides in controlling weedy pasture grasses was conducted. Treatments included 16 oz/A Velpar® 75 DF (hexazinone), 16 oz/A Karmex® 80 DF (diuron), and 8 oz/A Prowl® 3.3 EC (pendimethalin). Grasses were smutgrass (*Sporbolus indicas*), southern crabgrass (*Digitaria ciliaris*), knotroot foxtail (*Setaria geniculata*) and broadleaf signalgrass (*Brachiaria platyphylla*). Twenty pre-germinated seeds were planted immediately prior to treatment in 100% sand at a one-inch depth in 3 by 3 inch plastic pots. Seeds were watered as needed by a hand watering method. Treatments were applied at 20 GPA with a CO_2 pressurized 2-nozzle boom backpack. Visual control based on percent seedling emergence was evaluated at 2, 4, and 6 weeks after treatment (WAT). Control was rated 0 to 100%, 0 indicted all seeds emerged and 100 indicated no emergence.

Results indicated Velpar®, Karmex®, and Prowl®, effectively controlled all grasses 90 to 95% 2 WAT, while control decreased overall to 84 to 86% 4 WAT. No differences were observed 2 and 4 WAT among any factors of herbicides or grasses, but 6 WAT control varied in grasses and herbicides. Overall, Velpar® had the most effective control with 77%, with Karmex® and Prowl® following a close second with 75%. Overall, foxtail was easier to control than the others, with smutgrass being the most difficult to control. Individually Velpar® remained consistent on knotroot foxtail and southern crabgrass with 80% control, while broadleaf signalgrass and smutgrass were controlled 73 to 75%. Karmex® remained consistent on broadleaf signalgrass and knotroot foxtail with 79 to 82% control while southern crabgrass and smutgrass were controlled 72 to 74%. Prowl® controlled knotroot foxtail 79% with 72 to 75% control on the other grasses.

KNOTROOT FOXTAIL (SETARIA GENICULATA) AND SMUTGRASS (SPOROBOLUS INDICUS) CONTROL IN PASTURES USING VELPAR® 75 DF. Burns, B.K., J.D. Byrd Jr., B.S. Peyton and J.M. Taylor. Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Separate tests were conducted in the summer of 2004 with the objectives of evaluating Velpar® 75 DF alone or combined with other herbicides for control of knotroot foxtail and smutgrass in bahiagrass and bermudagrass pastures. Test 1 evaluated knotroot foxtail control. Treatments included: 16 or 24 oz/A Velpar® 75 DF (hexazinone), 16 or 24 oz/A Velpar® 75 DF + 1 oz/A Telar® 75 DF (chlorsulfuron), 16 or 24 oz/A Velpar® 75 DF + 1 oz/A Accent® 75 WG (nicosulfuron), 16 or 24 oz/A Velpar® 75 DF + 0.25 oz/A Cimarron® 60 DF (metsulfuron), 16 or 24 oz/A Velpar® 75 DF + 1 oz/A Cimarron® 60 DF + 1 pt/A Range Star® 3.87 L (1 lb dicamba + 2.87 lb 2,4-D), 2 lb/A Karmex® 80 DF (diuron), 16 or 24 fl oz/A Journey® 2 L (0.75 lb ai imazapic + 1.5 lb ai glyphosate), and 10 or 16 fl oz/A Roundup Pro® 4 L (glyphosate). Treatments other than Roundup Pro® 4 L were applied with 0.25% (V/V) non-ionic surfactant (NIS). All treatments were applied in 20 GPA with a CO_2 pressurized 2-nozzle boom backpack in late August. Plots were 3 feet by 5 feet and knotroot foxtail was approximately 8 inches tall at treatment. Visual control was evaluated at 2, 3, and 4 weeks after treatment (WAT). Test 2 evaluated smutgrass control with treatments of 16 or 24 oz/A Velpar® 75 DF, 16 oz/A Velpar® 75 DF + 0.25 oz/A Cimarron® 60 DF, 16 oz/A Velpar® 75 DF + 1 oz/A Telar® 75 DF, 16 oz/A Velpar® 75 DF + 1 oz/A Accent® 75 WG, 16 oz/A Velpar® + 1.33 oz/A Outrider® 75 DF (sulfosulfuron), 1 oz/A Telar® 75 DF, 1 oz/A Accent® 75 WG, 1.33 oz/A Outrider® 75 DF, 6 fl oz/A Plateau® 2 L (imazapic). All treatments were applied with 0.25% (V/V) NIS and applied in 20 GPA with 2 Boominator® nozzles spraying a 20 feet wide swath. Plots were 40 feet by 65 feet and smutgrass was approximately 24 inches tall at treatment. Visual control was evaluated at 3 and 6 WAT.

Data for test 1 showed that 16 oz/A or 24 oz/A Velpar® effectively controlled knotroot foxtail up to 4 WAT. At 2 WAT, the high rate of Velpar® alone or mixed with 1 oz/A Telar®, 1 oz/A Cimarron® and Range Star®, or 10 fl oz/A Roundup Pro® provided at least 80% control. All other treatments provided similar control, which ranged between 70 and 77%, except Karmex® which provided only 67% control. At 3 WAT, all treatments provided similar control, between 85 to 90%. Similar results were observed 4 WAT.
Data for test 2 showed 16 oz/A or 24 oz/A Velpar® alone was effective for smutgrass control at 3 and 6 WAT. At 3 WAT, Velpar® + Telar® provided the best control at 68%. Both rates of Velpar® alone, or Velpar® + Cimarron®, Accent®, or Outrider® all provided the second highest levels of control at 60%. No other treatment provided more than 40% control. Telar®, Accent®, Outrider®, and Plateau® provided only 40, 20, 10, and 10% control, respectively, at 3 WAT. At 6 WAT, Velpar® + Cimarron® provided the best control at 83%. Smutgrass control with Velpar® + Telar® or Accent®, or either rate of Velpar® alone provided comparable control between 75 and 80%. Velpar® mixed with Outrider® or Accent® provided 40 or 28% control, respectively, while Outrider® or Plateau® alone provided only 10% control.

EVALUATION OF POSTEMERGENT PASTURE HERBICIDES ON PERENNIAL PEANUT YIELD. C.R. Mudge, J.A. Ferrell, and C.A. Smith; University of Florida. P.O. Box 110500, Gainesville, FL 32611.

ASTRACT

Two field studies were conducted in 2004 at the University of Florida Plant Science Research and Education Unit near Citra, Florida to evaluate the effects of six herbicides to an established stand of ‘Arbrook’ and ‘Florigraze’ perennial peanuts (*Arachis glabrata* Benth.). The experimental design was a randomized complete design with a factorial arrangement of treatments replicated 4 times. Factor A consisted of herbicide treatments including 2,4-D (16 oz/A), 2,4-DB (32 oz/A), Plateau (4 oz/A), Raptor (6 oz/A), Velpar (16 and 32 oz/A), and Weedmaster (16 oz/A). Factor B consisted of herbicide application timing at 3 and 21 d after clipping (DAC). Crop injury and harvest yield data were collected. 2,4-D, 2,4-DB, Plateau, and Raptor caused less than 16% injury on Arbrook at 3 and 21 DAC. Less than 3% injury was noted with 2,4-DB and Raptor at all rating dates. Velpar injury at 16 and 32 oz/A was greater when treatments were applied at 21 DAC compared to 3 DAC. Crop injury was 36 to 60% for Weedmaster across all rating dates and application timings. Raptor, Plateau, 2,4-D and 2,4-DB herbicide treatments applied at 3 DAC to Florigraze was injured significantly less than Weedmaster and Velpar treatments. Greater injury was noted when treatments were applied at 21 DAC, though no statistical comparisons were made between application timings. Minimal injury was noted with 2,4-D for both cultivars; however, yields were significantly reduced when 2,4-D was applied at 3 and 21 DAC to Florigraze and Arbrook, respectively. Since visual injury with 2,4-D was not great, the reduction in yield may have been due defoliation of lower leaves. Weedmaster reduced Arbrook yield at both application timings and Florigraze yield at 21 DAC. Velpar applied 21 DAC at 32 oz/A reduced yields by 39 and 41% for Florigraze and Arbrook, respectively. Application of 2,4-DB, Raptor, or Plateau at 21 DAC did not result in yield reduction for either cultivar. Currently, Raptor is not labeled for use in pastures and Plateau, though possessing a label, is only sold to government agencies for use on roadsides. There was no traditional epinasty symptoms with 2,4-D, but yield reductions may be attributed to defoliation of lower leaves. 2,4-DB showed promise as a possible herbicide due to minimal injury and comparable yields; however, this herbicide often provides less than desirable weed control. Velpar, applied immediately after clipping may be beneficial, but delayed application were too injurious. Additionally, Florigraze may possess greater tolerance to herbicides than Arbrook, but additional research is required.

RESPONSE OF SEEDLING LEGUME FORAGES TO SELECTED PASTURE HERBICIDES. D.E. Breeden and W.W. Witt; Department of Agronomy, University of Kentucky, Lexington.

ABSTRACT

Alfalfa (*Medicago sativa* L.), red clover (*Trifolium pratense* L.), and white clover (*Trifolium repens* L.) are cool season forage legumes that improve forage systems in Kentucky. Forage legumes have a symbiotic relationship with rhizobia which fixes atmospheric N into a form that is available for plant uptake. Alfalfa, red clover, and white clover generally have high forage quality. Forage legumes are small seeded species that need special management during the establishment phase. Legumes compete with existing perennial grass sod and weeds for water and solar radiation. Tillage after germination is not an option because seedlings and grass may be injured. The most common method for establishing forage legumes is drill seeding directly into perennial grass sod. To obtain high yielding forage stands, establishment of legumes into existing perennial grass sod can be facilitated with herbicides. Synthetic auxin and ALS inhibiting herbicides have potential for use during the legume establishment phase. Maximum allowable herbicide concentrations in soil for synthetic auxin and ALS inhibiting herbicides have not been evaluated for injury to seedling alfalfa, red clover, and white clover. The objective of this study was to determine the sensitivity of seedling legumes to synthetic auxin and ALS inhibiting 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 injury to seedling legumes. Data were 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} concentration values were calculated from regression equations. Analyses of slopes indicated that seedling legume species' height reductions were significantly different from each other whereas, dry weight reductions were not significantly different from each other with respect to the selected herbicides. I_{50} values could not be calculated for triclopyr, picloram + fluroxypyr, and imazapic height data because 50% inhibition was not reached for the greatest concentrations evaluated. Imazapic, picloram + fluroxypyr, and triclopyr did not inhibit germination or growth of the seedling legumes. Clopyralid prevented germination and growth of alfalfa, red clover, and white clover at 0.2, 0.16, and 0.2 lb AE/acre, respectively. Diflufenzopyr + dicamba prevented germination and growth of all seedling legumes at 0.2 lb AE/acre. Metsulfuron prevented germination of alfalfa and white clover at 0.23 and 0.21 lb AI/acre, respectively. Seedling legume species responded differently to ALS inhibiting herbicides. Metsulfuron caused the most inhibition to alfalfa, red clover, and white clover but imazapic and chlorsulfuron caused the least inhibition to alfalfa, red clover, and white clover. The synthetic auxin herbicides triclopyr and picloram + fluroxypyr did not reduce height or dry weight of the seedling legumes evaluated. These data suggest that clopyralid and diflufenzopyr + dicamba would inhibit germination of these cool season forage legumes in pastures at labeled use rates.

EFFECT OF WEED DENSITY ON SWEETPOTATO YIELD IN MISSISSIPPI FIELD PRODUCTION.
R.S. Taylor, M.W. Shankle, J.L. Main, and J.T. Reed; Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, MS, 38863, and Department of Entomology and Plant Pathology, Mississippi State University, Pontotoc, MS, 39762.

ABSTRACT

Field studies were conducted in 2004 at producer locations near Houlka and Mantee, Mississippi to determine the effect of weed density and insect population on sweetpotato yield. Experimental design was a split-plot with insecticide as the whole-plot factor and weed density as the sub-plot factor. Plot size was eight 1.02 m rows by 15.23 m in length at Houlka, MS and four 1.02 m rows by 15.23 m in length at Mantee, MS. These studies were established in a conventional tilled, dry-land environment. Soil in the study area was disked, hipped, and knocked-down with a do-all prior to planting. 'Beauregard-B63' strain sweetpotato slips were planted at Houlka on May 25, 2004 and 'Beauregard-B73' strain sweetpotato slips were planted at Mantee on June 9, 2004. Planting rate was one plant per 0.31 m of row. Plant canopy coverage was determined by estimating percent groundcover visually. Plant height was based on measurements from soil surface to the uppermost vertical plant structure. Plant density was determined by counting the number of plants in one square meter (plants/m^2). Combinations of mechanical and chemical methods of weed control were utilized to establish treatments of high, medium, and low weed densities. The herbicides used for chemical control were Valor (flumioxazin), Command (clomazone), Select (clethodim), and Sandea (halosulfuron-methyl). Lorsban (chlorpyrifos) was applied pre-plant incorporated (PPI) to evaluate insecticidal effect on insect population and root damage.

The treatment used to establish low weed density was Valor + Command (PRE) fb Sandea + Select (POST) at 0.108, 1.40, 0.026, and 0.560 kg ai/ha, respectively. The treatment used to establish medium weed density was Valor + Command (PRE) fb Sandea + Select (POST) at 0.036, 0.840, 0.013, and 0.280 kg ai/ha, respectively. The treatment used to establish high weed density was Command (PRE) fb Sandea + Select at 0.840, 0.008, and 0.140 kg ai/ha, respectively. A CO_2 tractor mounted sprayer was used to apply herbicide treatments. Solution was applied at 144.21 L/ha. The spray boom was 3.05 m in length, equipped with 11015 FF nozzles spaced 0.38 m apart. The center row of each plot was harvested at Houlka and Mantee on October 5, and September 29, 2004, respectively. Analysis of variance was conducted and means were separated using Fisher's protected LSD at the 0.10 probability level. Only sub-plot factors will be discussed since insecticide had no effect on insect populations, weed density, or yield.

Crop canopy coverage was at least 58 and 86% with low weed density treatments at Houlka and Mantee, MS, respectively. This was greater than crop canopy coverage with medium and high weed density treatments. Pigweed (*Amaranthus* spp.), cocklebur (*Xanthium strumarium*), and nutsedge (*Cyperus* spp.) canopy coverage at Houlka, MS was 16, 4, and 3% with the low weed density treatment and 56, 5, and 4% with the high weed density treatment, respectively. Canopy coverage for pigweed and morningglory (*Ipomea* spp.) at Mantee, MS was 5 and 1.5% with the low weed density treatment and 42 and 1.3% with the high weed density treatment, respectively. Pigweed, cocklebur, and nutsedge height at Houlka was 26.4, 18.8, and 43.2 cm with the low weed density treatment and 32.0, 25.4, and 45.7 cm with the high weed density treatment, respectively. Plant height for pigweed and morningglory at Mantee was 34.1 and 22.6 cm with the low weed density treatment and 42.7 and 22.4 cm with the high weed density treatment, respectively. Plant population at Houlka for pigweed, cocklebur, and nutsedge was 12.1, 0.6, and 1.8 plants/m^2 with the low weed density treatment and 39.6, 2.0, and 4.6 plants/m^2 with the high weed density treatment, respectively. At Mantee, pigweed and morningglory populations were 1.5 and 0.5 plants/m^2 with the low weed density treatment and 13.1 and 1.4 plants/m^2 with the high weed density treatment, respectively.

Sweetpotato roots were graded to determine US No.1, Canners, Culls, and Jumbo yield. Total marketable yield (Totmkt) was recorded as the sum of US No.1, Canners, and Jumbo grade yields. US No. 1 and total marketable yields were combined across locations. US No. 1 yield was highest with low weed density (493 boxes/A), which was greater than 306 and 238 boxes/A with medium and high weed densities, respectively. Total marketable yield was also highest with low weed density (705 boxes/A), which was greater than 465 and 389 boxes/A with medium and high weed densities.

BIOLOGICAL PERSISTENCE OF HERBICIDES USED IN ROTATION WITH VEGETABLES. C. M. Thomas, B.V. Ottis, N. R. Burgos, and R.E. Talbert. Crop, Soil and Environmental Science, University of Arkansas, Fayetteville, AR. 72704

ABSTRACT

Vegetable crops are commonly grown in rotation with other crops including agronomic crops such as field corn (*Zea mays*), soybeans (*Glycine max*), and cereal grains. There is a lack information regarding potential carryover and the risk of injury to vegetable crops. The time from application that a soil active herbicide causes injury to vegetable crops is necessary information to the vegetable grower in developing crop rotation systems.

Separate field studies with warm-season crops, sweet corn (*Zea mays*) 'Merit', cowpea (*Pisum sativum*) 'Early Scarlet', snap bean (*Phaseolus vulgaris*) 'Benton', summer squash (*Cucurbita moschata*) 'Early Prolific', muskmelon (*Cucumis melo*) 'Hales Best', cucumber (*Cucumis sativus*) 'Marketmore', and transplanted processing tomato (*Lycopersicon esculentum)* '7985', and cool-season crops, cabbage *(Brassica oleracea var. capitata)* 'Blue Dynasty', collard (*Brassica oleracea* var. *acephala*) 'Champion', kale (*Brassica oleracea* var. *acephala*) 'Dwarf Siberian, mustard (*Brassica nigra)* 'Savannah', spinach (*Spinacia oleracea)* 'F380', and turnip (*Brassica campestris*) 'Alamo' were conducted at the Arkansas Agricultural Research and Extension Center, Fayetteville, Arkansas in 2004 to evaluate the persistence of 14 herbicides at 0, 1 and 2X rates of application. For warm season crops clopyralid at 0.18 and 0.36, flumioxazin at 0.1 and 0.2, mesotrione at 0.19 and 0.38, flufenacet at 0.3 and 0.6, prosulfuron at 0.027 and 0.054, cloransulam at 0.016 and 0.032, and S-metolachlor at 1.3 and 2.6; for both warm and cool season crops imazamox at 0.03125 and 0.0625, halosulfuron at 0.047 and 0.094, sulfentrazone at 0.375 and 0.75; and for cool season crops, imazethapyr at 0.0625 and 0.125, clomazone at 0.75 and 1.5, fomesafen at 0.375 and 0.75, and rimsulfuron at 0.0625 and 0.125 were included. The experimental design is a randomized complete split-split plot with four replications with herbicide as the main plot, herbicide rate as sub plots, and rows of crops as the sub-sub plots. With the warm-season crops the herbicides were applied on the surface of the soil May 15 and crops planted into a freshly rotary tilled seedbed, starting at the time of herbicide application and at one month intervals through September. With cool–season crops the herbicides were applied on the surface of the soil July 15 and the crops planted August 15, September15 and October 18. Four weeks after planting the crops were visually rated for percentage injury consisting of biomass reduction and chlorosis as compared to the untreated control. The injury scale ranged from 0 for no injury to 100 for plant death.

Herbicide activity on all of the warm season crops had dissipated by one month for S-metolachlor at both rates and activity was very slight at both rates of flufenacet and cloransulam. After two months, activity had totally dissipated for both rates for clopyralid, flumioxazin, imazamox and mesotrione and very slight activity at both rates for halosulfuron. At three months halosulfuron dissipated completely. At four months, sulfentarazone and prosulfuron at both rates still persisted.

All herbicide activity persisted in the cool-season study at one month with the exception of clomazone. All crops tolerated clomazone when planted one month after application. Sulfentrazone was very damaging to spinach, 100% injury at 3 months after application. However, the other fall-planted crucifera greens were more tolerant than spinach to sulfentrazone carryover. At one month, cabbage injury from sulfentrazone carryover was 75%, kale was 50% collards, turnip and mustard was approximately 25%. Fomesafen residues were very injurious to all crops, decreasing form 100% injury at one month after application to 50% or more injury at 3 months after application. Rimsulfuron, halosulfuron and imazethapyr were very injurious to all crops when planted one month after application. By two months injury to all crops was moderate (below 50%) and by three months after application these herbicides had dissipated to below phytotoxic levels on all crops. Imazamox was tolerated by mustard and turnip at one month. Cabbage was injured by imazamox carryover to near 100% at one month with injury dropping to moderate (25%) at two months and dissipating by 3 months. Spinach, kale and collards suffered moderate injury from imazamox at 1 month, with injurious levels dissipating below phytotoxic levels at two months.

SYMPOSIA

PROBLEM WEEDS IN PASTURES & RANGELANDS

PASTURE AND HAY FIELD WEED MANAGEMENT IN THE SOUTHEAST UNITED STATES. T.R. Murphy, J. Everest, J. Norsworthy, J. Green, F. Yelverton, G. Breeden, N. Rhodes, Jr. and S. Hagood. Crop and Soil Sciences, University of Georgia, Griffin, GA 30223; Agronomy and Soils Dept., Auburn University, AL 36849; Dept. of Entomology, Soils and Plant Science, Clemson University, SC 29634; Dept. of Agronomy, University of Kentucky, Lexington, KY 40546; Crop Science Dept., North Carolina State University, Raleigh, NC, 27695; Dept. of Plant Sciences, University of Tennessee, Knoxville, TN 37996; Dept. of Plant Pathology, Physiology and Weed Science, Blacksburg, VA 24061.

ABSTRACT

Weed scientists with forage weed responsibilities in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee and Virginia were surveyed in 2004 as to weed management issues and methods used in grass pastures and hay fields. The survey was designed to distinguish between weed management issues that may only be unique to pastures or hay fields. In this seven state region, 11% and 33% of the pasture and hay field acreage, respectively, was sprayed with herbicides on an annual basis. The top two reasons pastures were sprayed were reduced forage yields and carrying capacity, and concern about poisonous weeds. Hay fields were sprayed because weeds reduce quality and value. The number one reason why weeds were not controlled in both pastures and hay fields was managers considered herbicides too expensive. Relative to row crop producers, the weed control knowledge of pasture managers was considerably lower; for hay producers it was slightly lower. Broadleaf weeds were reported as being the major group of weeds in pastures. In contrast, annual grasses were the major problem weeds in hay fields. Hay producers were more likely than pasture managers to annually purchase a preemergence (PRE) herbicide that would control annual grasses and small-seeded broadleaf weeds. The estimated prices for a PRE herbicide for pasture and hay fields that producers would pay were less than $6.00 and $12.00 per acre, respectively. All states reported that mowing was routinely done in pastures, and if herbicides were not available would be a beneficial weed control method. Burning of warm-season grass hay fields was routinely conducted only in Georgia and South Carolina. Proper use of lime and fertilizer was listed as being the number one method to manage weeds in hay fields if herbicides were not available. Six of seven states agreed that the lack of a selective herbicide for pastures with clover was a major problem. All states agreed or strongly agreed that broadleaf weeds (no species names were included in this question) were relatively easy to control in pastures and hay fields. Pasture and hay field producers would be more likely to purchase lime and fertilizer than herbicides in limited money situations. All states indicated that horse owners were concerned to highly concerned that herbicides may be toxic to their animals. Five of seven states strongly agreed that horse owners were more concerned about poisonous weeds than cattlemen. Additionally, weed scientists in five states indicated they would be willing to develop and annually update a regional weed management publication for pasture and hay field managers. The remaining two states reported that they would possibly participate in the development of this publication. This survey indicated there was strong need for forage weed science education, particularly for pasture managers. Also, there were significant differences between weed management methods that are used or have the potential for use by pasture and hay field managers. Differences in the spectrum of weed species that need to be controlled in grass pastures and hay fields were also documented.

SYMPOSIA

PROBLEM WEEDS IN PASTURE & RANGELANDS

PASTURE AND RANGELAND WEED CONTROL IN FLORIDA. J. A. Ferrell, Department of Agronomy, University of Florida, Gainesville, FL, 32611.

ABSTRACT

The state of Florida spans over 500 miles from north to south and ranges from a temperate climate in the north to tropical in the south. Although Florida is the 4^{th} most populous state in the nation and boasts a thriving tourism industry, traditional agriculture remains a major part of the overall economy. Beef production is a thriving industry with over 1 million head raised annually on approximately 15 million acres of pasture and rangeland. Additionally, there are over 8 commonly used pasture grass species found throughout Florida: bahiagrass (Pensacola, Tifton 9, common, Argentine, Paraguay), hybrid bermudagrass, limpograss, and stargrass. Weeds are a common problem, regardless of grazing species, throughout the state. Although Florida contains many of the commonly occurring species that inhabit other Southeastern United States (blackberry, horsenettle, vaseygrass, etc), there are other species that are somewhat unique to the state. These include tropical soda apple (*Solanum viarum*), lantana (*Lantana camara*), giant smutgrass (*Sporobolus indicus* var *pyramidalis*), and cogongrass (*Imperata cylindrica*). Tropical soda apple currently invests over 1 million acres of Florida grazing lands. The current recommendation for control of this species is mowing in April followed by application of triclopyr (1 lb ai/A) 60 days later when plants reach full bloom. Although this program is highly successful on existing plants, there is currently no means of effectively addressing additional germination and establishment from seed. It is common to achieve >90% tropical soda apple control initially, only to observe a gradual decline to 50% control 6 to 12 months after application. Lantana is an escaped woody ornamental that commonly grows in reverted orange groves and along fence lines. This poisonous plant commonly becomes over 4 feet in height and can form dense hedges when populations are high. There are currently no recommendations for control of this species. However, the use triclopyr and fluroxypyr in combination has shown promise for control of this species. Giant smutgrass is a highly competitive species that grows over 4 feet in height and forms clumps of 18 to 24 inches in diameter. Giant smutgrass is a large-scale problem in South and Central Florida occurring in approximately 75% of all grazing areas. Hexazinone applied at 0.75 to 1 lb ai/A provides excellent control of this species for 1 year after application, but complete re-infestation occurs after 3 years. Cogongrass is an invasive perennial that commonly infests natural areas and pine plantations throughout Florida. However, this weed will also invade grazing lands and fence rows, especially those with low soil fertility and pH. Glyphosate and imazapyr applied at 5 and 1 lb ai/A, respectively, will provide fairly consistent control of cogongrass. However, imazapyr is not labeled for use in grazing areas and the long soil half-life results in difficulty when revegetating the site. The control strategy that has shown the most promise is glyphosate followed by establishment of bahiagrass with proper lime and fertilizer to maximize forage competitiveness.

SYMPOSIA

PROBLEM WEEDS IN PASTURE & RANGELANDS

PASTURE WEED CONTROL PROBLEMS AND CONCERNS IN THE DELTA. D.E. Sanders, J.D. Byrd Jr., and J.W. Boyd, LSU AgCenter, Clinton, LA; Mississippi State University, Mississippi State, MS; and University of Arkansas, Little Rock, AR.

ABSTRACT

The lower Mississippi Delta states of Arkansas, Louisiana, and Mississippi share a commonality of forage production and the weed control problems associated with quality forage production. The combined acreage of improved pasture and forage production fields in the three states exceeds six million acres. The majority of acres produce three forage species: bermudagrass (common and hybrid), fescue and bahiagrass. Unlike current row crop production, in which producers have become fewer in number while individual farms have increased in acreage, pasture and forage production in the Delta is comprised of numerous relatively small farms. The national Farm Census of 2002 reveals that nearly 50% of the total number of farms in the Delta are pasture and forage operations, but occupy only about 16 percent of the acres.

Currently forage production in the three states is divided into two areas: forage for cattle and forage for horses. Cattle forage production is usually a lower input system directly linked to the price received for feeder steers. Prices for feeder steers have fluctuated on an 8-9 year cycle since the end of World War II. When prices are at the top of the cycle producers have been quick to adopt new technology, including new weed control technology. When prices are near the bottom of the cycle producers are usually hesitant to adopt new practices. Success or failure of commercialization of herbicides has been linked by some economists to the timing of the introduction of the herbicide and not necessarily the need for the herbicide. Cattle numbers in the US and in the three states (as well as the associated production acres) have been static for over 20 years and it is expected that the cyclical nature of feeder cattle will continue into the future. Forage acres for horses are on the increase. Prices received for quality bermudagrass hay is based on number of horses. Horse numbers in the three states have increased at about 5% per year for the past 15 years. Fear of contamination of alfalfa with the alfalfa blister beetle has resulted in the rapid decline in market share for alfalfa (historically a premier horse forage) and the subsequent rapid rise in market share for weed free hybrid bermudagrass hay. Quality hay that may bring only \$20-30 per ton in the cattle market may bring as much as \$200 per ton in the horse market. The end result is that horse hay producers are requesting new and better herbicides, especially those that result in selective grass control.

In addition to the forage weeds that have been present for decades, there are continuing influxes of invasive plants that further threaten an industry already deficit in the tools needed to control the existing problems. Cogongrass and tropical soda apple are spreading rapidly throughout Mississippi. Both are a direct threat to forage production. While tropical soda apple is controllable with existing herbicides it is an added expense that may be difficult for a producer to absorb. Currently there are no herbicides that control cogongrass labeled for use in forages.

The basic herbicide manufacturing companies have been unable to provide forage producers with the herbicides needed to produce quality bermudagrass hay. There were more herbicides labeled for selective grass control in bermudagrass forage twenty years ago than there are today. The high costs of obtaining a meat and milk tolerance for any pesticide and the inability to capture enough market share has resulted in companies canceling registrations for herbicides that were effective preemergence grassy weed herbicides and the failure to register new herbicides. The problem with the absence of the proper herbicides does not lie with research and development, but with marketing, registration and federal requirements.

SYMPOSIA

PROBLEM WEEDS IN PASTURE & RANGELANDS

PROBLEM WEEDS AND MANAGEMENT OPTIONS IN TEXAS AND OKLAHOMA PASTURELANDS.

P.A. Baumann and C.R. Medlin, Texas Cooperative Extension, College Station, TX, and Oklahoma State University, Stillwater, OK.

ABSTRACT

Annual and perennial weeds continue to interfere with quality forage production in Texas and Oklahoma. The economics of cattle and hay production have not favored cultural pasture and hay field improvement to help forage grasses out-compete weed growth. In addition, although several highly effective broadleaf weed herbicides have been available for years, their use has been only moderate when one considers the millions of acres of improved pastureland in these two states. The largest void in pasture and hay field weed management remains annual and perennial grass weed control. Imazapic (Plateau) is labeled for use in bermudagrass pastures and is effective on several grass weed species. However, at normal use rates it causes bermudagrass growth suppression in the weeks immediately following application and is currently available for sale only to government agencies. The authors have conducted several field trials evaluating the efficacy of several herbicides for selective weed control in bermudagrass fields. Although most of these products are not currently labeled, once they are evaluated for performance and crop tolerance, label (federal or state) submission could be supported. Nicosulfuron has shown excellent activity for controlling barnyardgrass (Echinochloa crus-galli), dallisgrass (Paspalum dilitatum), yellow foxtail (Setaria faberi), large crabgrass (Digitari sanguinalis), field sandbur (Cenchrus incertus) and johnsongrass (Sorghum halepense), while causing minimal injury to bermudagrass. Sulfosulfuron provides excellent control of johnsongrass with no adverse effects on bermudagrass. Nicosulfuron + rimsulfuron, and chlorsulfuron also show promise for controlling specific weeds in selected forage grasses. Metsulfuron remains the standard for controlling Pensacola bahiagrass (Paspalum notatum).

Problem broadleaf weeds such as Serecia lespedeza (Lespedeza cuneata) and milkweed (Asclepias sp.) often show up where other broadleaves have been controlled. Recent work by Medlin shows that the herbicide combination of triclopyr + fluroxypyr (Pasturegard) provides effective control of serecia lespedeza followed closely by triclopyr used alone. Baumann showed that common milkweed was effectively controlled by picloram + fluroxypyr and picloram used alone. Tropical soda apple has recently shown up in two Texas counties. Preliminary field trials conducted on this specie indicated it can be effectively managed with applications of 2,4-D + picloram, picloram, triclopyr, and triclopyr + fluroxypyr. With the continued prospect of new, invasive weeds entering Texas and Oklahoma will come new management challenges. Research trials need to continually evaluate all feasible options for management of these weeds. Education efforts for forage and beef cattle producers should continue to focus on cultural control that emphasizes producing an aggressive and high quality forage to help keep weed invasions to a minimum.

A NEW GRANULAR HERBICIDE FOR CONTAINER, LANDSCAPE AND FIELD-GROWN ORNAMENTALS. D.W. Lickfeldt, R.L. Smith, D.L. Loughner, M.W. Melichar and J.M. Breuninger; Dow AgroSciences LLC., Indianapolis, IN.

ABSTRACT

In 2003 and 2004, a new herbicide containing three active ingredients was evaluated for efficacy on important weed species and the tolerance of popular ornamental plant species. Currently available ornamental herbicides differ greatly in the weeds they control and tolerance of ornamental plants grown in production nurseries. This new granular product, Showcase®, also known by its experimental number GF-1162, contains 2% trifluralin, 0.25% isoxaben and 0.25% oxyfluorfen. With preemergent applications applied to pots artificially infested with weed seed, Showcase demonstrated exceptional control of many difficult to control species such as spurge, groundsel, bittercress, oxalis, and crabgrass. When applied preemergence at 150 lb/A, Showcase was as efficacious as current standards. At 200 lb/A weed control was exceptional, exceeding all products included in the trials. Ornamental tolerance to Showcase was comparable to that of Snapshot TG® with the exception of whorled plants. On whorled plants such as Daylily and Hosta, where granular products can be retained on leaf surfaces, products containing oxyfluorfen must be applied with special precautions to immediately shake or wash granules from leaf surfaces. Even when whorled plants were injured by Showcase, they did eventually recover. Showcase received a federal registration in 2004 and state registrations may be complete as early as Spring 2005 at which time this new herbicide would be made available to ornamental nurseries and lawn care companies as an alternative to current herbicide options.

EVALUATION OF RIMSULFURON FOR WEED CONTROL IN CITRUS GROVES. Megh Singh and Samunder Singh; University of Florida, Citrus Research and Education Center, Lake Alfred, FL 33850.

ABSTRACT

Weeds compete more vigorously with young citrus trees due to greater availability of space, moisture and nutrients compared to mature trees and severely check their growth. Glyphosate is ubiquitous to POST weed control in citrus groves, however, its continuous use has resulted in the dominance of some broadleaf weeds viz. Brazil pusley (*Richardia brasiliensis* Moq.) in sandy loam soils in Florida. Herbicide rotation and mixture are postulated to lower the risk of shift of weed flora or evolution of resistant biotypes. The present study was conducted to asses the efficacy of tank mix some herbicides against Brazil pusley and Texas panicum (*Panicum taxanum* L.) which were dominant weeds in the fields during 2003 and 2004. Rimsulfuron at 35, 70, 140 and pyrithiobac at 70, 140, 280 g/ha were mixed with glyphosate at 1120 g/ha and compared with glyphosate at 1120 g/ha alone or oryzalin plus glyphosate at 2240+1120 g/ha during the first year. All treatments included Agridex at 1%. During the second year, treatments were modified with repeat applications of rimsulfuron at 35, 70, 140, and 280 g/ha after 30 DAT of rimsulfuron plus glyphosate at 35+1120, 70+1120, 140+1120 and 280+1120 g/ha applications. Other treatments consisted of repeat application of glyphosate after 30 DAT at 1120 g/ha, rimsulfuron plus glyphosate plus diuron at 70+1120+1790 g/ha, rimsulfuron plus pre-mix of Bromacil plus diuron (Krovar 1DF) at 280+3585 g/ha and norflurazon plus diuron at 2690+1790 g/ha. A NIS at 0.25% was added to all treatments except norflurazon plus diuron. Control treatment was maintained during both years and experiments were repeated at two locations. Herbicides were sprayed using a tractor mounted sprayer fitted with 80015 Teejet nozzles and an off center OC-04 flat spray tip, delivering 190 L/ha volume at 152 kPa pressure. Weed mortality data was recorded at fortnight intervals up to 10 WAT. Data were subjected to ANOVA after arcsin transformation. Highest weed control of Brazil pusley was achieved with glyphosate tank mix application with oryzalin up to 8 wks during 2003. Pyrithiobac tank mix with glyphosate provided slightly better weed control compared to rimsulfuron plus glyphosate, but there were no significant differences between the two mixtures. Control of Brazil pusley was reduced after 6 wks in all treatments except glyphosate plus oryzalin. Texas panicum was controlled by all treatments up to 8 wks; control was reduced significantly at 10 wks due to fresh germination of grasses. During 2004 rimsulfuron applied at 280 g/ha with 0.25% NIS and bromacil plus diuron provided highest weed control among the eight treatment combinations. The effect was lowered due to emergence of weeds at later stages, but was still effective up to 14 weeks after treatment (68%). Tank mix of norflurazon) with diuron was not effective after 4 WAT. Rimsulfuron at 140 or 180 g/ha with glyphosate provided statistically similar control of Brazil pusley to that of repeat applications of glyphosate.

EFFICACY OF CARFENTRAZONE TANK MIXED WITH GLYPHOSATE AND PARAQUAT AGAINST CITRUS WEEDS. Samunder Singh and Megh Singh, University of Florida-IFAS, Citrus Research and Education Center, Lake Alfred, FL 33850.

ABSTRACT

Brazil pusley (*Richardia brasiliensis*) is the most problematic weed under 'ridge' soils in Florida citrus. Glyphosate does not provide effective control of Brazil pusley and need repeat applications which may complicate management issues in the future. Carfentrazone has been found effective against some broadleaf weeds, where glyphosate has poor control; however, carfentrazone is not effective against grasses. An effort was made to evaluate efficacy of carfentrazone at 43.7 and 87.5 g ai/ha alone and tank mixed with glyphosate or paraquat at 1120 g/ha against several weeds infesting citrus grove. Glyphosate and paraquat alone were also included along with untreated check for comparisons. All herbicidal treatments included 1% Agridex. Herbicides were sprayed using a tractor mounted sprayer fitted with 80015 Teejet nozzles and an off center OC-04 flat spray tip, delivering 190 L/ha volume at 152 kPa pressure. Spraying was done on 29 and 7 May during 2003 and 2004, respectively in a plot size of 18 by 3 m, with 5 trees per plot of 6-7 yr age and replicated 4 times. The field was infested with several broadleaf and grassy weeds, dominant being Brazil pusley and Texas Panicum (*Panicum texanum*). Weed mortality was recorded at two weeks interval until 8 wk of spraying. Data on visual mortality of broadleaf and grasses was subjected to arcsin transformation for ANOVA. Carfentrazone had only necrotic effect on Brazil pusley as mortality seldom increased 40% when used at highest rate of 87.5 g/ha. There was no difference between the two rates of carfentrazone on Brazil pusley mortality. Treated plants recovered quickly and no more than 10% visible mortality symptoms were observed after 4 wks of spraying. Paraquat provided 90% mortality of Brazil pusley at 2 WAT; the control was significantly decreased at 6 or 8 WAT due to re-growth and fresh germination of Brazil pusley and Texas panicum. Glyphosate was less effective against Brazil pusley compared to paraquat. Addition of carfentrazone to glyphosate or paraquat did not significantly increase mortality of Brazil pusley compared to alone applications of glyphosate or paraquat. Both glyphosate and paraquat treatments provided more than 70% control of Texas panicum until 4 WAT. Grasses were quick to come back in paraquat treated plots and reduced weed control efficacy at 6 WAT. Tank mixing of carfentrazone had no adverse effect on glyphosate efficacy against Texas panicum as 70% or higher control was visible at 8 WAT in all treatments with glyphosate. Carfentrazone alone had no effect on Texas panicum.

HERBICIDE EVALUATION FOR PHYTOTOXICITY AND EFFICACY IN SWEET SORGHUM (SORGHUM BICOLOR). M.A. Thompson, R.E. Talbert, and W.W. Witt; University of Tennessee, Jackson; University of Arkansas, Fayetteville and University of Kentucky, Lexington.

ABSTRACT

Sweet sorghum is a unique minor crop grown on a small number of acres in the southeastern United States which currently has no labeled herbicides for weed control. Herbicides suitable for preemergence (PRE) and postemergence (POST) use in grain sorghum need to be evaluated for crop safety and efficacy in sweet sorghum. Data will be provided to the IR-4 Project to obtain herbicide options suitable for use in the production of sweet sorghum.

In 2004, similar field trials were conducted at each of three locations: Jackson, TN, Fayetteville, AR and Lexington, KY. Seed from the sweet sorghum cultivar 'Dale' was treated with Concep safener and planted at all locations. Herbicide treatments in TN and KY included: Dual II Magnum PRE (1.33 and 2.66 pt/A), Outlook PRE and early POST (14 and 28 oz/A), Aim 1.9 EW POST (0.5 and 1.0 oz/A) + surfactant at 0.25% v/v and Permit 75 WG POST (0.67 and 1.34 oz/A) + surfactant at 0.5% v.v. Atrazine at 1 lb/A was applied PRE before Aim and Permit. Herbicide treatments at AR included: Dual Magnum PRE (1.36 and 2.66 pt/A), Outlook PRE and early POST (14 and 28 oz/A), Aim 1.9 EW POST (0.67, 1.0 and 1.34 oz/A) + surfactant at 0.25% v/v and Sandea 75 WG POST (0.9 and 1.8 oz/A) + surfactant at 0.5% v/v. Dual Magnum at 0.62 pt/A was applied PRE before Aim and Sandea at AR. Sorghum was evaluated for visual injury (all locations) and biomass at maturity (AR), and weed control was evaluated.

Aim caused moderate to severe burning of the sweet sorghum at all locations at 24 to 36 days after application. The Tennessee and Arkansas locations had moderate to severe stunting with Permit/Sandea at 36 and 24 days after application, respectively. Biomass at maturity was reduced with the higher rate of Sandea possibly due to early season injury at Arkansas. Crop safety was generally good with Dual II Magnum and Dual Magnum PRE and Outlook applied PRE or early POST. Dual II Magnum and Dual Magnum PRE appeared to be the best single treatment option with good crop safety at all locations and generally good weed control.

COMPARISON OF NONSYNTHETIC HERBICIDES AND FLAMING FOR USE IN ORGANIC SYSTEMS. C.A. Chase, J.M. Scholberg, and G.E. MacDonald; University of Florida, Gainesville, FL 32611.

ABSTRACT

Organic farmers regard cost-effective weed management as their most important production constraint. There are currently more than 6000 acres of organic citrus in Florida. To assist organic citrus growers with developing effective weed management strategies, work is currently underway at the University of Florida to assess the utility of cover crops for suppression of weeds between tree rows. Cultivation is an option for weed control within the tree rows, but can result in damage to tree trunks and roots. Alternatively, flaming is a permitted practice and nonsynthetic herbicides have become available for use with organic crops. The objectives of this study were to compare the efficacy of four postemergence nonsynthetic herbicides and flaming for weed control and to determine whether multiple, sequential applications were more effective than a single application.

Spring and fall trials were conducted in 2004 on organically certified land at the Plant Science Research and Education Unit, Citra, Florida. Existing vegetation was disked and natural weed populations were allowed to emerge until 2 to 4-in tall. Nonsynthetic herbicides Alldown and Ground Force claim citric acid and garlic extracts as active ingredients; whereas Matran 2 and Xpress have essential oils as active ingredients. Matran 2 contains 45.6 % clove oil and Xpress has 10 % clove oil and 10 % thyme oil. The herbicides were applied at 50 gallons per acre (GPA) in 1, 2 or 3 applications at 2-wk intervals using a CO_2 backpack sprayer. A handheld propane torch was used for flame weeding and a nontreated check was also included. Ground Force was applied at the manufacturer's recommended rate of 7 GPA in spring and was increased to 50 GPA in fall. Alldown and Ground Force were applied undiluted. Matran 2 and Xpress were applied as 15 % v/v solutions in spring and a 20 % rate was added in fall. ThermX 70, a surfactant derived from *Yucca* sp., was added to the Matran 2 and Xpress spray solutions at 0.03 % v/v. The experimental design was a randomized complete block with four replications. Plots were 5 ft wide and 15 ft long. Percent weed canopy control, dry biomass 2 wk after the third application, and weed species sensitivity were assessed.

Flaming was more effective than the nonsynthetic herbicides. In spring, weed canopy decreased from 93 % with the nontreated check to 81 % with Alldown and 76 % with Matran 2. However, weed canopy with flaming was 24 %. There was no difference in biomass among the treatments. In fall, only flaming resulted in significantly lower weed canopy and biomass than the nontreated check. In both spring and fall, as number of applications increased weed canopy decreased in a linear manner. A concomitant linear decline of weed biomass was also observed in fall. However, no significant decrease in biomass occurred in spring. Weed sensitivity of six commonly occurring species are reported for the fall trial. *Cyperus globulosus*, *Paspalum notatum*, *Digitaria ciliaris*, *Commelina benghalensis*, *Richardia scabra*, and *Sida* sp. were all susceptible to flaming; however, sensitivity to the nonsynthetic herbicides varied with species. *C. globulosus* and the grasses were not well controlled by the herbicides. *C. benghalensis* was more sensitive to the citric acid herbicides and broadleaf species were more sensitive to the essential oil herbicides. These herbicides may be useful if integrated with other methods of control and where sensitive species predominate.

FALL VEGETABLE AND STRAWBERRY RESPONSE AND SOIL PERSISTENCE OF HALOSULFURON FOR BARE-SOIL VERSES POLYETHYLENE MULCH CONDITIONS

T.L. Grey, A.S. Culpepper and T.M. Webster; Crop and Soil Department and USDA/ARS, Tifton, Georgia, 31793-0748.

ABSTRACT

Halosulfuron has been proposed as an alternative for nutsedge (*Cyperus* species) management in many vegetable crops due to the elimination of methyl-bromide. Crop tolerance is often the factor limiting its adoption. Different environmental conditions exist under polyethylene mulch, especially temperature and moisture regimes, which affect herbicide dissipation. Thus, herbicides applied to bare-soil (BS) verses under polyethylene mulch (PM) situations could vary with respect to activity and dissipation. Therefore, a series of studies were established to 1) determine the effect of PM and BS application on halosulfuron dissipation; 2) evaluate transplanted cucumber halosulfuron tolerance applied post-emergence and through drip tape irrigation (DRIP) and transplanted eggplant tolerance when DRIP applied; 3) and evaluate strawberry, collards, and seeded mustard tolerance to halosulfuron applied preemergence (PRE) to BS and under PM. Initial halosulfuron concentration was 18.6 and 17.7 ug/kg for the BS and PM, respectively. Twenty four hours after treatment, halosulfuron dissipation was different for the two systems and this continued for the length of the trial. Data indicated that PM decreased the rate of dissipation of halosulfuron verses BS. Vegetable injury and response varied by treatment, planting date, and species. Data indicated that halosulfuron may have a potential use in cucumber and eggplant when applied through drip tape irrigation and for strawberry, collards, and seeded mustard when PRE applied to BG or under PM. This is significant because many growers plant sequential crops on the same polyethylene bed. Additional research on halosulfuron application under PM, to BS, and through DRIP is needed.

EFFECT OF HALOSULFURON-METHYL RATE AND APPLICATION TIME ON SWEETPOTATO FLESH QUALITY. M.W. Shankle, S.T. Kelly, T.F. Garrett, and J.L. Main; Mississippi State University, Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, MS 38863, and LSU AgCenter, Winnsboro, LA 71295.

ABSTRACT

The Mississippi Department of Agriculture and Commerce, Bureau of Plant Industry and the Louisiana Department of Agriculture and Forestry submitted a request to the Environmental Protection Agency for an Emergency Exemption "Section 18" for the use of Sandea 75WG (halosulfuron-methyl) in sweetpotato production for 2004. The EPA granted an Emergency Exemption registration to both states based on the need to control nutsedge (*Cyperus* spp.) and support data from at least two years of university research related to Sandea efficacy in sweetpotato. However, flesh quality issues were reported where Sandea had been applied to fields in Mississippi during the 2004 growing season. This research addressed the effects of Sandea on sweetpotato plant injury, flesh quality, and yield.

Studies were conducted in Pontotoc County, MS at the Ferguson Farm in 2003 and at the Pontotoc Ridge-Flatwoods Branch Experiment Station in 2004 to evaluate the use of Sandea 75WG in sweetpotato. The soil type was a Falkner silt loam (fine-silty, siliceous, thermic Aquic Paleudalfs). The experimental design was a two-factor factorial in a randomized complete block with 4 replications. Plots were three 40 in rows and plants spaced 12-in apart within the row. Study areas were established in conventional tilled, dry-land environments. Granular fertilizer was applied according to soil test recommendations. An insecticide treatment of Capture 2 EC (0.3 lb ai/A bifenthrin) in 2003 and Lorsban 4E (2.0 lb ai/A chlorpyrifos) in 2004 was applied and incorporated prior to planting. Field-grown 'Beauregard B-63' slips were mechanically transplanted on June 25, 2003 and May 26, 2004. Command 3 ME (1.25 lb ai/A clomazone) was applied following planting. All Sandea treatments were applied post-transplant with a CO_2 sprayer, either back-pack or tractor mounted. Sandea was applied at 14, 21, 28, 35, 42, and 49 days after planting (DAP) at 0.012, 0.024, 0.032, and 0.048 lb ai/A. Visual observations of plant injury were made at 10 and 21 days after treatment (DAT). Roots were harvested on October 8, 2003 (105 DAP) and September 15, 2004 (112 DAP). Roots were graded into US No. 1, Canner, Cull, and Jumbo grade yields using the National Sweetpotato Collaborator's standards and weighed. Flesh quality was determined by visual observations on 10 roots/plot and scored as discolored or nondiscolored. Analysis of variance was conducted on weed control, plant injury, and yield using Fisher's protected LSD (α =0.10).

The main effect of Sandea rate was evaluated and a rate effect with regard to plant injury was observed at 10 and 21 DAT in 2003, but not 2004. The two-year average yield of US No. 1 and Total Marketable grade sweetpotato was higher with Sandea at 0.024 lb ai/ac compared to all rates for both years. Flesh injury ranged from 24 to 42% for the different rates. Sprout production of bedded seed was not influenced by Sandea rate.

The main effect of application time on plant injury was evaluated and injury was greater with early compared to late applications for both years. In 2003, plant injury was 26% when applied 14 DAP at 10 DAT, but injury declined to 10% for all application times at 21 DAT. In 2004, plant injury was at least 21% with 14 and 21 DAP applications, which was greater than all other times. Plant injury with 14 and 21 DAP applications declined to less than 12% at 21 DAT, but was still greater than all other application times.

US No. 1 yield was not different among application times except the 42 DAP application, which was greater than all treatments except the 14 DAP timing. Total Marketable yield was also highest with the 42 DAP application, but was not different from the 14, 21, or 35 DAP application timings.

Flesh injury was greater with late compared to early applications. Flesh injury was 14, 68, and 90% for 35, 42, and 49 DAP application times, respectively. Injured flesh was comprised of an internal discoloration and small kernels of unidentified matter. Results from lab analyses of the discolored flesh indicated no halosulfuron residues, but marketing these sweetpotato could be a concern for growers.

Weed control benefits associated with Sandea provide the sweetpotato industry with a much need management tool. This research suggests that Sandea at 0.024 lb ai/A applied at 21 to 28 DAP would be appropriate if suitable weed species are present.

WEED CONTROL IN MISSISSIPPI SWEETPOTATO USING COMMAND AND VALOR. T.F. Garrett, M.W. Shankle, J.L. Main, and S.T. Kelly; Mississippi State University, Pontotoc, MS, and LSU Ag center, Winnsboro, LA

ABSTRACT

A two-year study was conducted in 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. Mississippi currently ranks third in the United States in sweetpotato production. Sweetpotatoes have the highest dollar return per acre of any vegetable crop grown in the state. Weed control is becoming an increasingly important issue for Mississippi sweetpotato producers. There are only a few herbicides labeled for use in sweetpotato, so producers are primarily limited to Command (clomazone) applied pre-transplant followed by a post-emergence application of a graminicide. Although the approval of Command for the use in sweetpotato was a tremendous benefit to sweetpotato producers, additional herbicides are needed for the control of broadleaf weed species. Currently there are no herbicides labeled for effective control of broadleaf weeds. Valor (flumioxazin) may fill this weed control void.

The trial area was prepared by disk cultivation, do-all, and bedding in early spring. Granular fertilizer was applied broadcast according to Mississippi State Soil Testing Laboratory recommendations for both years. Pre-transplant treatments were applied one day prior to planting. Plants were transplanted using a mechanical transplanter on May 30th in 2003 and on June 8th in 2004. Post-transplant treatments were applied immediately after transplanting. 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/ac, Valor at 0, 2, and 3 oz/ac plus 1.66 pt/ac Command 3ME (clomazone), Valor at 0, 2, and 3 oz/ac plus 2 pt/ac Command, and Valor at 0, 2, and 3 oz/ac plus 2.66 pt/ac Command. Post-transplant treatments included Valor at 2 and 3 oz/ac and Valor at 2 and 3 oz/ac plus 1.66 pt/ac Command. Roots were harvested on September 12th for a total of 103 growing days in 2003 and on October 22nd for a total of 136 growing days in 2004. Roots were graded into US No.1, Canner, Jumbo and Cull grades using National Sweetpotato Collaborator's standards and weighed. Analysis of variance was carried out on weed control, plant injury, and yield and means were separated using Fisher's protected LSD (α=0.10).

In 2003, morningglory control was at least 90% at 3 WAT with all treatments that included Valor. However, morningglory control declined over the observation period with all treatments. Morningglory control was higher with Valor at 3 oz/ac compared to the 2 oz/ac rate. Command plus Valor tank-mix improved morningglory control compared to Valor alone. Grass control was at least 80% for all treatments that included Command. This was greater than Valor alone treatments, which had grass control was less than 67%. Plant injury was at least 65% with all post-transplant applications of Valor. Pre-transplant applications injured plants less than 14%. Plant injury was greater at 3 oz/ac rate than the 2 oz/ac rate of Valor. Total marketable yield ranged from 14 to 403 boxes/ac for the untreated and Valor at 3 oz/ac + Command at 2.66 pts/ac, respectively. US No. 1 yield ranged from 0 to 294 boxes/ac for the untreated and Valor at 3 oz/ac + Command at 2.66 pts/ac, respectively. US No. 1 yield was lower with Valor alone compared to the Valor + Command tank-mix.

In 2004, plant injury at 3 WAT was at least 45% for all treatments with a POST application of Valor. This was higher than all PRE applications, which had plant injury of less than 24%. In addition, plant injury was higher with Valor at 3 oz/ac compared to 2 oz/ac for pre-transplant and post-transplant applications. Morningglory control was at least 90% with treatments that included a post-transplant application of Valor. Morningglory control was at least 63% at 3 WAT for all treatments that included Valor. Morningglory control increased in all treatments throughout the observation period. Grass control was at least 87% for all treatments containing an application of Command at 9 WAT. US No. 1 yield ranged from 199 to 465 boxes/ac for the untreated and Valor at 2 oz/ac + Command at 1.66 pts/ac, respectively. Total marketable yield was also highest with Valor at 2 oz/ac + Command at 1.66 pts/ac, which yielded 803 boxes/ac. Yield was improved with the addition of Command as a tank-mix partner compared to Valor alone.

This research indicates that a 2 to 3 oz/ac rate of Valor in a tank mix with Command at 1.66 to 2.66 pts/ac applied pre-transplant will control grasses and morningglory with minimum plant injury and without reducing yields of US No. 1 or total marketable sweetpotato.

CRITICAL PERIOD OF *PARTHENIUM HYSTEROPHORUS* INTERFERENCE WITH CILANTRO. J.P. Morales-Payan and W.M. Stall. Horticultural Sciences Department, University of Florida, Gainesville, FL 32611-0690.

ABSTRACT

The effect of ragweed parthenium (PTNHY) density, time of emergence and time of removal on cilantro yield was determined in a field experiment conducted in San Cristobal, Dominican Republic. 'Long Standing' cilantro was direct-seeded in double bands on raised soil beds. PTNHY (densities of 3 and 6 plants per m^2) grew with the crop after weed-free periods of 15, 25, 35, and 45 days after emergence (DAE), or emerged with the crop and was removed at 15, 25, 35, and 45 DAE. Other weeds were removed by hand throughout the season. When PTNHY emerged with the crop, cilantro yield decreased drastically as the duration of PTNHY interference increased. Crop yield loss was 60-70% when PTNHY competed with the crop the entire season at the densities of 3 and 6 plants per m^2, respectively. If a 10% yield loss threshold were tolerable, the critical PTNHY-free period in cilantro was 15-27 days after emergence at the PTNHY density of 3 plants per m^2, and 15-32 days after emergence at the density of 6 plants per m^2.

***BOERHAVIA ERECTA* INTERFERENCE THRESHOLD WITH EGGPLANT.** J.P. Morales-Payan and W.M. Stall. Horticultural Sciences Department, University of Florida, Gainesville, FL 32611-0690.

ABSTRACT

A field experiment was conducted in San Cristobal, Dominican Republic, to quantify the effect of season-long interference of erect spiderling (*Boerhavia erecta*) (BOEER) densities on eggplant yield. 'Jira' eggplant was transplanted in single rows and managed according to local recommendations. Natural BOEER populations were thinned to desired densities (0, 3, 6, 9, 12, 15, 18, and 21 plants per m^2) 10 days after weed emergence and allowed to grow with the crop the remainder of the season. Other weeds were hand-removed throughout the season. Eggplant yield decreased sharply (approximately 11%) as BOEER density increased from 0 to 9 plants per m^2. Maximum yield loss (approximately 15%) occurred at the densities of 15-21 plants per m^2. Eggplant yield loss due to increasing BOEER density was directly correlated with reduced nitrogen in nitrate in eggplant sap at flowering and harvesting. For 5 and 10% eggplant yield loss thresholds, season-long interference from 3 and 7 BOEER plants per m^2, respectively, would be tolerable.

KILLED COVER CROP MULCHES FOR SWEETPOTATO PRODUCTION. H.F. Harrison and D.M. Jackson. U.S. Vegetable Laboratory, USDA-ARS, 2700 Savannah Highway, Charleston, SC.

ABSTRACT

A no-till cultural practice where an oat and crimson clover cover crop mixture was left on the soil surface to serve as mulch for the following sweetpotato crop was evaluated in 2002. The experiment was arranged in a split plot design where the four main plot treatments were (1) cover crop mulch that was hand-weeded, (2) cover crop mulch with no weed control, (3) conventional tillage, hand-weeded, and (4) conventional tillage, weedy. Subplots were three sweetpotato varieties, Ruddy, SC 1149-19 and Beauregard. Ruddy is a recently released insect resistant variety; SC 1149-19 and Beauregard are insect susceptible. The objectives were to (1) assess weed suppression by the mulch (2) determine the effectiveness of insect resistant sweetpotato varieties in no-till (3) determine the effect of cover crop mulch on sweetpotato yield and quality. Annual grass seedling counts were ten times higher in conventional tillage plots and broadleaf weed seedling counts were three times higher in the conventional tillage plots at three weeks after planting. Weed suppression by the cover crop mulch was also reflected in the yields. Yields averaged over varieties of the weedy, mulched cover crop treatment were higher than those of the weedy, conventional tillage plots. Yields of hand-weeded conventional tillage and hand-weeded cover crop mulched plots were not different. SC1149-19 produced significantly more storage roots and more total yield than did the other two varieties. The insect resistance of Ruddy held up well under the killed-cover crop conditions, and this cultivar had significantly higher percent clean roots and lower infestations by WDS (Wireworm-*Diabrotica-Systena* complex), sweetpotato flea beetles, grubs, and sweetpotato weevils than the two susceptible genotypes. In general, injury to sweetpotato roots by soil insect pests was lower in the cover crop mulch plots than in the conventional tillage plots. This was somewhat surprising because the conventional wisdom suggests that insect populations should be higher in the cover crop mulch plots due to the presence of crop litter. The results of this experiment indicate that the cover crop mulch production system may be useful in sweetpotato production. Potential benefits of the cover crop mulch include weed suppression and reduced insect injury. Obstacles include the difficulty in planting sweetpotato vine cuttings through the cover crop litter and the inability to cultivate for weed control through the mulch.

BIOLOGY AND MANAGEMENT OF EASTERN BLACK NIGHTSHADE IN PLASTICULTURE TOMATO. J.K. Buckelew, D.W. Monks, and K.M. Jennings; North Carolina State University, Raleigh, NC 27695

ABSTRACT

Field studies were conducted in 2003 and 2004 to determine the effects of eastern black nightshade (*Solanum ptycanthum*) at 0, 1, 2, 3, 4, and 5 weeds per crop hole on tomato fruit quality and yield. Nightshade and tomato were established within the same planting hole. A separate study determined effects on removal and establishment of eastern black nightshade on this weeds' seed viability and production, and tomato yield. Eastern black nightshade seedlings were established at 0, 1, 2, 3, 4, 5, and 11 WAP, and removed at 0, 1, 2, 3, 4, 6, and 11 WAP. Establishment at 0 WAP and removal at 0 WAP were the weed-free, and weedy treatments, respectively.

A nonlinear model fit the percent yield loss of jumbo tomato grade, the premium grade, on eastern black nightshade density. The predicted asymptotic yield loss was 84%, and the percent yield loss below 1 weed per crop hole, as density approaches 0, was 116.

Percent viability of eastern black nightshade seeds from large berries, medium berries, small berries, and extra small berries, was 100, 46, 7, 0.2%, respectively (LSD = 0.098.) Medium and large berries were produced by those nightshade seedlings established at or before 2 WAP, or removed at or after 4 WAP, therefore, delay of weed growth until after 2 WAP, or control of weeds by 4 WAP would need to be achieved, to prevent eastern black nightshade from making highly viable seed (medium and large grade seeds) contributions to the seedbank.

Tomato yields across years for the timing study differed, so data were not combined. At Fletcher, treatment yield means differed for weight of threes, but regression analyses revealed no significant trends. At Clinton, treatment yield means differed for the sum weight of jumbo and extra large grades. Regression analyses for this yield component revealed Y=32,806 kg - 983 WAP for removal treatments, but no significant trend for establishment treatments. Thus, for every week that eastern black nightshade is not removed after planting, tomato fruit yield (sum of jumbo and extra large) is reduced by an additional 983 kg per ha.

SYMPOSIA

COMPONENTS & COMPLETE SYSTEM ALTERNATIVES FOR METHYL BROMIDE

HERBICIDE COMPONENTS FOR METHYL BROMIDE ALTERNATIVES SYSTEMS IN STRAWBERRIES. D.W. Monks, K.M. Jennings, and W.E. Mitchem; North Carolina State University, Raleigh, NC. (279)

ABSTRACT

The phase out of methyl bromide will likely result in reduced weed control in strawberries. Studies have been conducted since 1996 to evaluate the alternative fumigants chloropicrin, Telone-C35 and metam sodium in strawberries. Estimated yields and income from strawberry treated with these fumigants in these studies are at least as high as strawberry treated with methyl bromide. However, weed control in strawberry treated with alternative fumigants is often lacking. Thus, with the phase out of methyl bromide, annual winter weed problems are likely to increase. Studies were conducted at the Horticultural Crops Research Station, Clinton, North Carolina in 2004 to evaluate herbicide components that will supplement fumigants in strawberry production. Three options exist for supplementing fumigants in strawberry. These options are: 1. hand removal, 2. preemergence herbicide application prior to laying plastic mulch or 3. preemergence and/or postemergence herbicide application over strawberry and plastic mulch. Hand removal is effective on certain weeds but not other weeds such as yellow and purple nutsedge. Terbacil (1.6 and 3.2 ounces ai per acre), oxyflourfen (0.25 and 0.5 pound ai per acre), and aciflourfen (0.5 pound ai per acre) were applied on October 8, 2004 prior to laying black plastic. Chandler strawberry plants (rooted plug plants) were transplanted on October 12, 2004. Aciflourfen did not injure strawberry. Terbacil and oxyflourfen caused 8 to 13% injury at 4 weeks after treatment. By 8 weeks, injury was reduced to 3 to 8% injury and by 12 weeks injury was 3 to 10%. SINAR (wild radish) control was 100% at approximately 8 weeks after application. In another study, Chandler strawberry plants (rooted plug plants) were transplanted on October 12, 2004. DCPA (6 and 7.5 pounds ai per acre), napropamide (2 and 4 pounds ai per acre), metolachlor (1 and 1.5 pounds ai per acre), and terbacil (1.6 and 3.2 ounces ai per acre) were applied 2 days after transplanting. No injury was observed 5 days after application. However, by approximately 30 days after application injury from DCPA, napropamide and terbacil was less 7% or less, 10% or less, 12% or less, and 38% or less, respectively. By approximately 90 days after application, strawberry treated with DCPA exhibited no injury, napropamide exhibited 0 to 7%, metolachlor exhibited 10 to 15% and terbacil exhibited 16 to 17 %. It appears from these trials that terbacil and oxyflourfen have potential for use under plastic mulch. DCPA, napropamide, and metolachlor have potential to be used as preemergence herbicides applied over strawberry for weed control.

SYMPOSIA

COMPONENTS & COMPLETE SYSTEM ALTERNATIVES FOR METHYL BROMIDE

ALTERNATIVE METHYL BROMIDE SYSTEMS FOR MANAGING PURPLE NUTSEDGE IN GEORGIA PEPPER AND EGGPLANT. A.S. Culpepper and D.B. Langston, University of Georgia, Tifton, GA 31793.

ABSTRACT

The value of developing alternatives to methyl bromide is increasing as the expected removal of methyl bromide from the market place nears as well as its cost continues to increase. Experiments were conducted in spring eggplant and fall pepper near TyTy, Georgia to determine which alternatives should be tested by growers during 2005.

Treatments for both experiments were arranged factorially with two levels of mulch (low density polyethylene [LDPE] or virtually impermeable [VIF]) and seven levels of fumigants (Table 1). In the fall pepper trial, there was an additional factor with two herbicide levels (Command 3 EC at 1 qt/A plus Devrinol 50 WDG at 3 lb/A plus Dual Magnum 7.62 EC at 1.0 pt/A or no herbicide system). Each study was conducted as a randomized complete block design with three replications. Data were analyzed using analysis of variance and treatment means were separated using Fisher's Protected LSD at P = 0.05. Reported nutsedge control was calculated by dividing the number of nutsedge plants emerged through the film in a given treated plot by the number of nutsedge emerged through the LDPE film of the non-treated control.

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.
2. Telone II (12 gal/A broadcast) injected 10-12 inches deep followed with chloropicrin (150 lb/A broadcast) injected 6-8 inches in the bed.
3. Telone C35 (35 gal/A broadcast) injected 10-12 inches deep followed with chloropicrin (150 lb/A broadcast) injected 6-8 inches in the bed.
4. Telone II (12 gal/A broadcast) injected 10-12 inches deep followed with K-Pam (60 gal/A broadcast on six foot centers) incorporated 3-4 inches deep and then pulled into a 32 inch bed.
5. Iodomethane plus chloropicrin 50:50 (400 lb/A broadcast) injected in the bed to a depth of 6-8 inches.
6. An experimental fumigant in combination with chloropicrin injected in the bed to a depth of 6-8 inches.
7. No fumigant.

Spring Eggplant Trial Results (fumigant by mulch interaction significant):
At 8 weeks after treatment (WAT), only Telone II or Telone C35 followed by chloropicrin provided less than 92% purple nutsedge control (89-91%) when applied under LDPE film. Under VIF film, all fumigants provided complete control. By 15 WAT, purple nutsedge control was still greater than 97% with methyl bromide, Telone II followed by K-Pam, and iodomethane when applied under LDPE film. Statistically the experimental (87% control) was as effective as the aforementioned fumigant options; however, Telone II or Telone C35 followed by chloropicrin were less effective (75-80%). All treatments provided at least 98% control when applied under VIF film.

Eggplant were transplanted while poking holes through the mulch at 28 days after fumigating. No visual injury was noted with any fumigant applied under LDPE film. However under VIF film, Telone II followed by chloropicrin (81%), Telone C35 followed by chloropicrin (55%), Telone II followed by K-Pam (92%), and the experimental mixture (35%) caused severe injury at 4 days after transplanting. Because of severe injury with fumigants under VIF film, eggplant was replanted 7 days after the initial planting for all VIF treatments. Eggplant were harvested four times with no statistical differences in yield number or weight of eggplant harvested was noted among fumigants when using LDPE film. Because of replanting, yields when using VIF film were less than when using LDPE film.

Fall Pepper Trial Results (fumigant by mulch interaction significant; herbicide main effect also significant):
At 3 WAT, methyl bromide (97%) was the only fumigant controlling nutsedge greater than 86% when using LDPE film. Telone II followed by chloropicrin provided only 15% control while other fumigants provided 70 to 86% control. Telone II followed by chloropicrin, Telone C35 followed by chloropicrin, and the experimental mixture were 75, 29, and 19%, respectively, more effective under VIF film as compared to LDPE film. By 14 WAT, methyl

bromide on LDPE film provided 63% control; however, control was at least 29% more effective than any alternative. When using VIF mulch, Telone C35 followed by chloropicrin, iodomethane, and the experimental mixture were as effective as methyl bromide applied under LDPE film.

Holes were poked in plastic 10 days after fumigating and pepper was planted the following day. Injury from fumigants was less than 7% when using LDPE film at 16 days after transplanting. Injury was 12, 15, 17, and 73% with Telone II followed by chloropicrin, Telone C35 followed by chloropicrin, the experimental mixture, and iodomethane applied under VIF film, respectively. Pepper was harvested and graded three times. Yields from individual harvest dates were similar to cumulative yields. Pepper fruit number and weights with Telone C35 followed by chloropicrin were similar to methyl bromide on LDPE film; pepper weights when using other fumigants were 75 to 85% of those with methyl bromide. Under VIF film, yields from alternative treated plots were similar to yields from plots treated methyl bromide under LDPE film with the one exception being iodomethane. Yields from iodomethane treated plots using VIF film were less than other treatments because of crop injury.

The herbicide system did not impact pepper growth and only improved purple nutsedge control 23% compared to the no herbicide option, when pooled over fumigant and mulch options. This level of control did not improve yields.

SYMPOSIA

COMPONENTS & COMPLETE SYSTEM ALTERNATIVES FOR METHYL BROMIDE

SHOULD I STAY OR SHOULD I GROW: THE NUTSEDGE DILEMMA IN POLYETHYLENE MULCH SYSTEMS. T.M. Webster, Crop Protection and Management Research Unit, USDA-ARS, Tifton, GA 31794.

ABSTRACT

Polyethylene mulches are an effective physical barrier for weeds in vegetable production and will be a critical component of weed management systems in the absence of methyl bromide. However, purple nutsedge and yellow nutsedge are two weed species that are capable of piercing the physical barrier of the polyethylene mulch. Studies were conducted to evaluate the following hypotheses: 1) polyethylene mulch will hinder nutsedge shoot growth, tuber production, and patch expansion; 2) purple nutsedge and yellow nutsedge will be affected by mulches in a similar manner; and 3) purple nutsedge and yellow nutsedge will have similar growth habits in the absence of mulch. In a greenhouse study, pre-sprouted tubers of purple nutsedge and yellow nutsedge were planted in the center of a 59 cm diameter and 23 cm deep pot filled with sifted field soil, a single tuber per experimental unit. There were three treatments, including a non-mulched control, 1.25 mil black low density polyethylene mulch, and 1.25 mil clear mulch. The study included three replications, was repeated over time and the duration of the study was 16 weeks. The numbers of emerged nutsedge shoots, numbers of shoots trapped beneath the mulches, and tuber numbers were quantified. Treatments in the field study were similar to those in the greenhouse; single pre-sprouted nutsedge tubers of each species were transplanted in plots covered with black mulch, clear mulch, and non-mulched control. However, the objective of the field study was to evaluate spatial growth patterns of purple nutsedge and yellow nutsedge over time. Plots were 5.4 m wide and 9 m long with 3 replications and the study was repeated over time. Plots were divided into quadrats that were 12.7 cm long and 12.7 cm wide. At 8, 16, 24, 32, and 60 weeks after planting (WAP), emerged nutsedge shoots were characterized in each patch.

In the non-mulched control of the greenhouse study, yellow nutsedge produced 9-times more shoots (146 yellow nutsedge shoots vs. 15 purple nutsedge shoots) and 7-times more tubers than purple nutsedge (366 yellow nutsedge tubers vs. 47 purple nutsedge tubers). Yellow nutsedge was sensitive to the physical barrier of both black and clear mulches, reducing shoot numbers (that pierced the mulch) by 96% and tuber numbers by 50%, relative to the non-mulched control. Yellow nutsedge shoots trapped beneath the black and clear mulches represented at least 92% of the total number of shoots (sum of those that pierced the mulch barrier and those trapped under the mulch). Differences in purple nutsedge shoot and tuber numbers could not detected among the treatments.

In the field study, polyethylene mulch affected growth patterns of both purple nutsedge and yellow nutsedge. Black mulch promoted purple nutsedge growth relative to the non-mulched control. At 32 and 60 WAP, the black mulch plots had nearly twice as many purple nutsedge shoots (at 32 WAP: 1548 shoots for black mulch vs. 794 shoots for non-mulched; at 60 WAP: 3439 shoots in black mulch vs. 1858 shoots in non-mulched) and the purple nutsedge patches covered twice the area relative to the non-mulched control (at 32 WAP: 16.1 m^2 for black mulch vs. 8.1 m^2 for non-mulch; at 60 WAP: 22.1 m^2 for black mulch vs. 11.6 m^2 for non-mulched). The promotion of purple nutsedge growth by black mulch is in direct contrast to the growth of yellow nutsedge. Yellow nutsedge shoots in the black mulch produced three-times less shoots compared to yellow nutsedge in the non-mulched control at 16 WAP (137 shoot in the non-mulched vs. 36 in the black mulch) and 24 WAP (208 shoots in the non-mulched vs. 73 in the black mulch). Due to the limited movement of yellow nutsedge (and few quadrats occupied), kriged estimates were not the most accurate means of evaluating patch size. Instead, the number of quadrats occupied by yellow nutsedge shoots estimated patch size. Yellow nutsedge in the non-mulched control occupied twice as many quadrats (11 quadrats) compared to yellow nutsedge in the black mulch plots (5.3 quadrats). Due to the sensitivity of yellow nutsedge to the cool autumn temperatures and extreme variability in winter survival, data were not collected at 32 WAP or 60 WAP. Comparison of purple nutsedge and yellow nutsedge in the field in the non-mulched control indicated that the patterns of growth were vastly different. At 24 WAP in the non-mulched control, yellow nutsedge patches were estimated at 0.18 m^2, whereas purple nutsedge patches were estimated at 5.5 m^2, a 31-fold difference in patch size.

In summary, these data indicate that purple nutsedge and yellow nutsedge have dissimilar growth habits and responses to the physical barrier of polyethylene mulch. Yellow nutsedge does not distribute itself far from the mother tuber and it appears likely that human disturbance is a key factor in dispersing this species throughout fields. In contrast, purple nutsedge is capable of distributing itself throughout its environment, but likely also benefits from

human disturbance, in terms of dispersal. Agricultural systems that use polyethylene mulch will suppress yellow nutsedge growth, however black mulch promotes growth and lateral spread of purple nutsedge.

SYMPOSIA

COMPONENTS & COMPLETE SYSTEM ALTERNATIVES FOR METHYL BROMIDE

POST-DIRECTED HERBICIDES FOR PLASTICULTURE TOMATO. K.M. Jennings, J.K. Buckelew, and D.W. Monks; North Carolina State University, Raleigh, NC 27695-7609. (284)

ABSTRACT

Plasticulture tomato growers have focused their weed control efforts on row middles since methyl bromide provided excellent weed control in the row. Preemergence (PRE) and postemergence (POST) herbicides such as metribuzin and paraquat are used to control weeds in the row middles. With the phase out of methyl bromide it is anticipated that more weed pressure will develop in the holes where the tomato is planted through the plastic. Weeds such as Palmer amaranth (*Amaranthus palmerii*) and nutsedge (*Cyperus*) species will probably become more troublesome in the row and there will likely be weed escapes and weed shifts towards broadleaf weeds that will be difficult to control. Therefore, it is necessary to not only have weed control methods available for row middles but for beds as well. Four methyl bromide alternatives are hand weeding around the hole, applying herbicides under the plastic, applying herbicides directed to the weeds growing in the holes near the crop, and the combination of an alternative fumigant plus a herbicide treatment applied PRE or POST-directed.

In 2004 three studies were conducted evaluating various fumigant/herbicide alternatives to methyl bromide for weed control in plasticulture tomatoes. Amelia tomato plants were transplanted into black plastic mulch at the Mountain Horticultural Crops Research Station, Fletcher, NC in June. All trials included a nontreated check for comparison and treatments were replicated at least 3 times. All plots were rated visually for crop injury and weed control. Tomato fruit yield and quality were determined.

In the first trial, herbicide treatments included postemergence applications of Sandea (0.5 oz pr/A), Envoke (0.15 oz/A), and Matrix (1.5 oz/A) alone and in combination with each other, and with and without Dual Magnum (1.0 pt/A). Three weeks prior to the application weeds were planted in individual holes in the plastic. On the day of application the same weeds were planted in separate holes thus allowing evaluation of PRE and POST weed control. Treatments were directed to the tomatoes and sprayed over-the-top of the weeds on July 15. Plots consisted of 3 tomato plants and 2 rows of weeds. Eastern black nightshade (*Solanum ptycanthum*), sicklepod (*Senna obtusifolia)*, redroot pigweed (*Amaranthus retroflexus*), apple of Peru (*Nicondra physalodes*), velvetleaf (*Abutilon theophrasti*), hairy galinsoga (*Galinsoga ciliata*), pitted (*Ipomoea lacunosa*) and ivyleaf/entire (*Ipomoea hederacea*) morningglories, and jimsonweed (*Datura stramonium*) were evaluated. Total marketable yield ranged from 4.7 to 7.6 lb/plot. No differences in total marketable yield were observed across treatments. All herbicide treatments increased marketable yield over the nontreated check. All weeds were controlled less than 70% with the PRE treatments with the exception of Dual on redroot pigweed, eastern black nightshade, and hairy galinsoga; Matrix and Sandea on hairy galinsoga and redroot pigweed. Envoke, Matrix, and Sandea applied POST controlled redroot pigweed, apple of Peru, and hairy galinsoga 80% or greater. Sicklepod and velvetleaf were controlled 80 to 100% by Matrix or Sandea. Envoke or Sandea controlled jimsonweed 90 to 100%.

Another trial was conducted in 2003 and 2004 to evaluate eastern black nightshade control in plasticulture tomato. Herbicide treatments included Envoke (0.1, 0.14, 0.15, 0.2, 0.28, 0.3, 0.56, and 0.6 oz pr /A), Valor (2 and 3 oz/A), Raptor (4 and 6 oz/A), Sencor (5.3 oz/A), Harmony GT (0.03, 0.05, 0.07, 0.09, and 0.11 oz/A), Firstrate (0.3 oz/A), and Sandea (0.5 and 0.75 oz/A) applied POST-directed to the tomato plants and POST over-the-top of weeds. Nine weeds (see above) were planted in individual holes. At the time of application, tomato plants were 12-inches tall, and weeds had one true leaf and were no greater than 3-inches tall. Valor, Raptor, and Firstrate were injurious to the tomato plants. No differences were observed in crop visual injury, crop height, or crop yield among Envoke, Harmony GT, Sencor, and Sandea, and the nontreated check. From weed control ratings predicted rates for weed control of at least 85% were generated. Envoke at a predicted rate of 0.5 oz/A will control apple of Peru, eastern black nightshade, and jimsonweed. Results predicted that Harmony GT at 0.08 oz/A will control redroot pigweed, velvetleaf, hairy galinsoga, and jimsonweed.

In the fumigant/herbicide trial treatments included methyl bromide (400 lb/A), chloropicrin (150 lb/A), chloropicrin and Dual Magnum PRE (1.33 pt/A) or Goal PRE (0.5 pt/A) or Kapam (75 gal/A), and Telone C35 (35 gal/A). Palmer amaranth seed was spread on top of the bed prior to applying the treatments and laying of the plastic. Palmer amaranth counts in the tomato hole were recorded 7, 9, and 12 weeks after treatment. The number of Palmer

amaranth plants that emerged in the plots treated with chloropicrin alone were similar to those that emerged from the nontreated plots. The number of plants was reduced to 0, 5, and 0 when Dual Magnum, Goal, or Kapam were applied in combination with chloropicrin, respectively. Methyl bromide prevented the emergence of Palmer amaranth and only 2 emerged from those plots treated with Telone C35.

SYMPOSIA

NEW & POTENTIAL HERBICIDES FOR VEGETABLE & FRUIT CROPS

FLUMIOXAZIN AND TERBACIL – CHANGES FOR WEED CONTROL IN TREE FRUIT.

W.E. Mitchem, W.G. Henderson, D.W. Monks, A.W. MacRae, K.M. Jennings, North Carolina State University, Fletcher, NC; Clemson University, Edgefield, SC; and North Carolina State University, Raleigh, NC. (285)

ABSTRACT

Trials were conducted at various locations in NC and SC since 2001 to determine the potential for flumioxazin use in apple and peach trees. Additional trials were conducted in SC during 2003 and 2004 to evaluate terbacil for use in newly planted and non-bearing peach trees at rates less than currently registered in established peach orchards. Visual estimates were used to evaluate treatment efficacy and herbicide injury. All treatments were applied in combination with either glyphosate or paraquat for non-selective POST weed control. No apple or peach tree injury was observed with any treatment.

In 2001 flumioxazin applied at 4, 6, 8, and 12 oz ai/A as a single application on May 15 and as a sequential application at 6 oz ai/A applied March 14 and June 29 provided 98% or better control of common ragweed through August 9. Flumioxazin at 4 oz ai/A applied May 15 provided 76% control of large crabgrass through August 9 which was less than the control provided by the remaining herbicide treatments. Treatments providing the best overall control through August 9 included flumioxazin at 8 and 12 oz ai/A applied May 15 and the sequential flumioxazin application at 6 oz ai/A applied March 14 and again on June 29.

A study conducted in 2002 compared sequential flumioxazin treatments to a simazine plus norflurazon tank mix at 2 lb ai/A each. Flumioxazin was applied March 14 followed by (fb) an application on June 3 at 4 fb 4, 6 fb 4, and 6 fb 6 oz ai/A. Spotted spurge control through July 30 ranged from 90 to 93% in areas treated with flumioxazin while the simazine plus norflurazon tank mix provided 73% control which was similar. Large crabgrass control through July 30 ranged from 91 to 94% with flumioxazin, while the simazine plus norflurazon tank mix provided less control at 71%.

Flumioxazin was evaluated in 2004 in SC at lower rates than had previously been tested. Fall applications (October 29, 2003) of flumioxazin applied at 2, 3, and 4 oz ai/A were compared to a fall application of simazine at 2 lb ai/A. All treatments provided 96% or better control of cutleaf eveningprimrose through April 28. Carolina geranium control with flumioxazin, regardless of rate, was 100% through April 28 which was better than the 90% control achieved with simazine. Common vetch control through April 28 with flumioxazin ranged from 92 to 98% which was also better than 82% control provided by simazine. In another study flumioxazin was applied in the fall (October 29, 2003) or in the winter (March 2, 2004) at 2, 3, or 4 oz ai/A followed by a late spring (May 19, 2004) application at the same rate. A fall application of simazine at 1.5 lb ai/A followed by a late spring application of terbacil plus diuron at 1.2 lb ai/A each was included as a comparison treatment. All fall flumioxazin treatments provided better cutleaf eveningprimrose control than winter flumioxazin treatments through April 28, 2004. Cutleaf eveningprimrose control with flumioxazin or simazine applied in the fall ranged from 95 to 98% while control with winter applications ranged from 68 to 74%. All flumioxazin treatments, regardless of application time provided 100% control of Carolina geranium which was better than the 93% control attained with simazine at 1.5 lb ai/A. July 15 observations found that all treatments provided 97% or better control of Florida pusley and large crabgrass.

Terbacil was evaluated in 2003 at 0.2 fb 0.4, and 0.4 fb 0.4 lb ai/A. A standard comparison treatment of oryzalin at 2 fb 2 lb ai/A was included. The initial applications were made March 3 followed by the second application on May 16. July 1 observations indicated that terbacil at 0.2 fb 0.4 and 0.4 fb 0.4 lb ai/A provided 94 and 97% control of goosegrass, respectively. Goosegrass control with the oryzalin treatment was less at 79%. In 2004 terbacil was applied March 17 at 0.8 lb ai/A fb paraquat on June 11. Terbacil applied March 17 and June 11 at 0.4 lb ai/A each time and flumioxazin at 3 oz ai/A applied March 17 fb June11 were also included. Through July 15 large crabgrass control was 99% or better among all treatments. Terbacil at 0.8 lb ai/A in March fb paraquat in June provided 91% control of broadleaf signalgrass which was less than the 99% or better control provided by the sequential applications of terbacil at 0.4 lb ai/A or flumioxazin at 3 oz ai/A.

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NEW & POTENTIAL HERBICIDES FOR VEGETABLES & FRUIT CROPS

FMC AGPRODUCTS: CURRENT AND PENDING HERBICIDES FOR VEGETABLES. H.G. Hancock, FMC Corporation, AgProducts Group, Hamilton, GA 31811.

ABSTRACT

FMC AgProducts Group currently has three proprietary herbicides: clomazone, sulfentrazone and carfentrazone-ethyl. These herbicides, individually and collectively, represent significant agronomic utility for a broad and diverse range of crop and non-crop uses, broadleaf and grass weeds, and use patterns, which fit most cultural practices.

Over the five-year period, 1999 to 2003, for which there are statistical data, herbicide treated acreage has increased in six of the nine market segments of the ‘specialty’ crops. Treated acres increased significantly in tomato (36%), vines / grapes (25%), tree nut (13%), and ‘vegetables’ (11%). Smaller increases in acreage of ~4% were recorded for pome / stone fruit and potato. Declines in acreage (<10%) were noted for citrus, ‘other fruits’ and pea/bean. Over the same period, herbicide volume decreased 15 to 62% in all segments except vines/ grape, which exhibited a modest 4% increase. This overall trend, generally increasing acreage and decreasing herbicide volume suggests several potential operational causes. Among the likely factors producing these results are the use of more active or selective herbicides with reduced application rates, reliance on fewer herbicides and changing weed management practices. These changes have occurred against a backdrop of changing weed spectra. In the last SWSS Weed Survey (2002) among specialty crops, sedges (*Cyperus* spp.), morningglories (*Ipomoea* spp. and *Jacquemontia tamnifolia*), pigweeds and amaranths (*Amaranthus* spp.) have emerged as widespread and troublesome weeds. Numerous weeds, such as false daisy (*Eclipta prostrata)*, sicklepod (*Senna obtusifolia*), wild poinsettia (*Euphorbia heterophylla*) and nightshades (*Solanum* spp.) among others, have become regional problems. Grass weeds alike represent significant management challenges.

FMC herbicides readily fit into current and evolving weed management practices in the specialty crops. Clomazone, an isoxazolidinone, was first registered in 1985. Marketed as Command®, clomazone has been used in numerous vegetable crops under 24(c) labels in many states for broadleaf and grass weed control. In 2001, these 24(c) registrations were unified or incorporated in the Command® §3 label. IR4 is currently completing work to add rhubarb and broccoli. Sulfentrazone, a soil-applied triazolinone, was first registered in 1997 and is marketed as Spartan® in numerous crops. In a manner similar to Command®, specialty crops were initially added to Spartan® uses as §18 emergency exemptions. With progressive research and IR4 effort, potato, pea and bean (dry), horseradish, cabbage and asparagus were added to the §3 Spartan® label in 2003. Strawberry, pea and bean (succulent, except lima bean) and flax remain §18 exemptions. IR4 currently has efforts underway for establishing tolerances in fruiting vegetables, strawberry, mustard greens, kale, turnip, pea (succulent), cucurbit melon group, and blueberry. Carfentrazone-ethyl, a post-applied triazolinone, first registered in 1998 as Aim® (Shark® in California) has experienced continued expansion in novel use patterns in a multitude of crop and non-crop sites. More recently (2003), the culmination of IR4 and FMC efforts on a ‘super crop group’ (EPA Reduced Data Set) initiative resulted in an extensive number of crops and crop groups being added to carfentrazone-ethyl labels. Among these additions are root / tuber vegetables, bulb vegetables, leafy vegetables, legume vegetables, fruiting vegetables, caneberries, bushberries, and herbs and spices. A significant number of uses were added among the tropical fruits including banana, date, persimmon, cacao, coffee, tea, coconut, kiwifruit, and guayule among others. The addition of the ‘super crop group’ uses, along with many others developed by FMC, makes carfentrazone-ethyl one of the most expansive products for post-emergent weed control and harvest-aid. FMC continues to focus on herbicide development in the specialty crops and appreciates the efforts of IR4 and its stakeholders.

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NEW & POTENTIAL HERBICIDES FOR VEGETABLES & FRUIT CROPS

CRITICAL WEED-FREE PERIODS FOR TOMATO, PEPPER, WATERMELON, AND CUCUMBER.
W.M. Stall and J.P. Morales-Payan; Horticultural Sciences Department, University of Florida, Gainesville, FL 32611-0690.

ABSTRACT

The critical period of interference (CPI) is the specific time interval during crop growth that a crop must be maintained weed-free to prevent interference from reducing yields. CPI with vegetables reported in the literature depended mainly on weed species, weed mixtures, weed density, and crop species and crop planting method (direct-seeded or transplanted). Direct-seeded crops generally had longer CPI than transplanted crops.

In direct-seeded tomato competing with multiple weeds, the CPI for a 10% yield loss was 6-9 weeks after transplanting (WAT), coinciding with the crop flowering and fruit set stages. In transplanted tomato competing either with multiple weeds or with troublesome individual weeds (pigweeds, nightshades, yellow nutsedge), the end of the CPI was usually at the early fruit set stage crop (5-6 WAT), although with purple nutsedge the end of the CPI was up to 9 WAT. In contrast, the beginning of the CPI seemed to be more weed-related, and it was approximately 2 WAT for smooth pigweed, 3 WAT for nutsedges and nightshades, 4 WAT for prostrate pigweed, and 4 WAT for multiple weeds. In all cases, the CPI started the re-initiation of transplant growth and the initiation of crop flowering.

In peppers competing with monospecific weed stands, the CPI generally started very early in the season: 1 WAT with yellow nutsedge (in fall), 1.5 WAT with livid and smooth amaranths, 2 WAT with American black nightshade, and 3 WAT with yellow nutsedge (in spring) and purple nutsedge. This may be partially attributed to the slower growth rate and more reduced canopy of peppers (as compared to tomato). As in tomato, the CPI with pepper generally ended during the flowering and early fruiting stages: 2.5 WAT with American black nightshade, 4 WAT with amaranths, 5 WAT with yellow nutsedge in spring, 6 WAT with purple nutsedge, and 7 WAT with yellow nutsedge in fall. In transplanted bell peppers competing with multiple weeds, the initial weed-free period needed to prevent yield loss was at least 3 WAT, and weeds emerging later than 9 WAT did not cause yield loss. In transplanted chilli peppers, the CPI with multiple weeds was 2-10 WAT and 2-6 WAT with large crabgrass.

In cucumber competing with either pure purple nutsedge stands or with multiple weeds, the minimum weed-free period was 3-4 WACE, which generally coincided with the initiation of crop flowering. However, when competing with amaranths, removal by 2 WACE was needed to prevent 10% yield loss. For purple nutsedge, the end of the CPI was 7 WACE.

Little documented information is available on weed interference with watermelon. In seedless watermelon competing with large crabgrass, the minimum weed-free period was 6 WAT. In seeded watermelon, the minimum weed-free periods were 0.5 weeks after crop emergence (WACE) for smooth amaranth and 5 WACE for yellow nutsedge.

The bottom line is that the extent of weed interference with crops is influenced by (among other factors) weed species, weed population composition (mixed or pure stands), time of emergence and time of removal. For a given yield loss threshold (commonly set arbitrarily at 5 or 10%) in a particular vegetable crop, the minimum weed-free period and maximum weedy period may be shorter or longer, depending on the weed(s) involved, which has clear practical implications.

SYMPOSIA

NEW & POTENTIAL HERBICIDES FOR VEGETABLES & FRUIT CROPS

DEVELOPMENT OF VALOR IN SWEETPOTATO. S.T. Kelly and M.W. Shankle. LSU AgCenter, Winnsboro, LA and Pontotoc Ridge-Flatwoods Branch Experiment Station, Mississippi State University, Pontotoc, MS.

ABSTRACT

Sweetpotato producers in Louisiana and Mississippi face a variety of weedy pests. Prior to the labeling of Command, the primary weeds producers faced were annual grasses, morningglories (*Ipomoea*) and prickly sida (*Sida spinosa*). However, with widespread use of Command in sweetpotato, producers have seen the weed spectrum shift to problem weeds such as pigweeds (*Amaranthus* spp.), copperleaf (*Acalypha ostryifolia*), smellmelon (*Cucumis melo*), and sedges (*Cyperus* spp.).

Research trials in 2003 in Louisiana indicated that sweetpotato tolerated up to 3 oz/A Valor applied pre-transplant, and yields were increased over the non-treated. Although Valor did not reduce yields when applied post-transplant to sweetpotato, injury was excessive in some cases and was not acceptable. Valor applied post-transplant with 0.25% surfactant caused stand loss at 3 oz/A, and subsequent yield loss.

Additional experiments in Louisiana were conducted to determine if injury with post-transplant applications of Valor could be reduced by tank-mixing with Command. Valor (0, 2, or 3 oz/A) was tank-mixed with Command (0, 1.8 or 2.3 pt/A) and applied post-transplant. No consistent safening effect was observed at any of three locations. An interaction between Valor and Command was not observed for any of the yield parameters measured. This would indicate that although early injury was observed, it 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 a function of grass control, since a postemergence grass herbicide was not used to control emerging annual grasses in the Valor-treated plots.

A similar experiment conducted at Pontotoc, MS evaluated Valor plus Command tank-mixes. Command (2 pt/A) was tank mixed with Valor (1, 2, or 3 oz/A) and applied pre- or post-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 (*Brachiaria platyphylla*) was controlled at least 80% with Valor + Command treatments post-transplant. Redroot pigweed (*Amaranthus retroflexus*) was controlled 100% with any treatment including Valor at 18 and 25 DAT. Pitted morningglory (*Ipomoea lacunosa*) control was at least 80% for all Valor + Command treatments.

While Valor appears to fill a void in sweetpotato weed control, further development is necessary. Many growers are not receptive to the idea of planting through a herbicide and would prefer to tank-mix with Command for a post-transplant application in order to minimize weed escapes. Many growers are also reluctant not to cultivate sweetpotato because of a fear of mis-shapen roots. Current weed control recommendations for Louisiana and Mississippi suggest that growers apply Valor (2 oz/A) to a weed-free seed bed, apply Command post-transplant, and use a graminicide to control grass escapes.

SITE PREPARATION IN COMBINATION WITH HERBACEOUS WEED CONTROL. R.A. Williams, C.L. Ramsey, and S. Jose, West Florida Research and Education Center – IFAS, University of Florida, Milton, FL.

ABSTRACT

Many studies have shown the benefits of controlling herbaceous competition in newly planted pine stands (Yeiser and Ezell, 2001). Some new products and combinations of existing products are showing promise as a one pass operation in preparing a site for planting and to remain to eliminate or reduce the herbaceous vegetation component. This study is located in Baldwin County, Alabama with the purpose of testing these products as to their effectiveness in controlling unwanted vegetation and in providing for pine growth and survival. Six herbicide treatments were tested that included imazapyr and glyphosate in combination with and without sulfometuron methyl and metsulfuron methyl. All hardwood trees in the treated areas are dead. The hardwood species included Turkey oak, Black Jack oak, Southern Red Oak, persimmon, and sweetgum trees. Major shrubs and grasses were sparkleberry, gallberry and broomsedge. After one year since the herbicide application, very little grass species have re-established on the site. All longleaf pine seedlings planted in the area treated with herbicide are still free to grow. Ground line diameter measurements were significantly greater on pine seedlings planted in herbicide treated areas. The same pattern of growth was measured on pine seedling height. This study has demonstrated that a one pass herbicide operation can be effectively used to control not only herbaceous competition, but tough hardwood species as well.

EVALUATION OF CLOPYRALID, FLUROXYPYR, METSULFURON METHYL, AND TRICLOPYR FOR SCOTCHBROOM CONTROL. M.P. Blair; Department of Agronomy, University of Kentucky, Lexington, KY and S.M. Zedaker; Department of Forestry, Virginia Tech, Blacksburg, VA.

ABSTRACT

Scotchbroom (*Cytisus scoparius* L.) is a perennial woody shrub that is present in 25 of the 50 United States. This federally listed invasive species is native to Europe and was introduced in California in the late 1800's as an ornamental plant and soil stabilizer. The continued ornamental use of this leguminous plant has contributed to its spread across the continental United States and Hawaii. Scotchbroom can establish itself on a variety of sites, including dry upland sites. Scotchbroom readily establishes in open environments during early succession. Individual plants may produce up to 60 seed pods by the second year of growth with each pod containing 5-8 seeds. This fecundity and rapid growth rate have contributed to failures in Douglas-fir plantations in the Pacific Northwest. Dense stands of scotchbroom may also interfere with right-of-way access and maintenance. This troublesome species is beginning to invade the Piedmont and Coastal Plain physiographic regions of the southeastern United States.

A study was initiated in August, 2003 to evaluate chemical control options for scotchbroom. Seven chemical treatments and one untreated control treatment were evaluated in a completely randomized design study with four replications in the Coastal Plain region of Virginia. Plots were installed along a forest road and were 25' X 15'. Treatments included Garlon 4 (triclopyr ester) at 0.5, 0.75, and 1 lb a.i. per acre, Escort (metsulfuron methyl), at 2.4 oz a.i. per acre, Escort plus Garlon 4 at 1.2 oz a.i. and 0.5 lb a.i. per acre, respectively, Garlon 3A (triclopyr amine) plus Vista (fluroxypyr) at 1 lb a.i. and 0.5 lb a.i. per acre, respectively, and Transline (clopyralid) plus Vista at 0.5 lb a.i. and 0.5 lb a.i. per acre. All treatments included a nonionic surfactant at 0.25% v/v and were applied as a roadside foliar spray using a CO2 powered sprayer equipped with Boombuster™ tips mounted on an ATV. Application volume was 20 GPA.

Data were collected at pre-application, 7 weeks after treatment (WAT), and 40 WAT. Green scotchbroom and brown (dead) scotchbroom horizontal line intercept counts were made at one foot intervals. This data was then transformed into percent cover by plot and analyzed using analysis of covariance (preapplication data as the covariate) in SAS®. Least squared treatment means were compared using Tukey-Kramer HSD at p = 0.05.

All treatments reduced percent cover of live scotchbroom to less than 10% 7 WAT and maintained this reduction in cover 40 WAT. Garlon 4 alone reduced scotchbroom cover to less than 5% 7 WAT and maintained a reduction the following growing season regardless of rate used. Escort provided a reduction in cover to 9% 7 WAT and further decreased cover to 0% 40 WAT. The Escort / Garlon 4 tank mix increased cover between 7 and 40 WAT, yet still had satisfactory control. The Transline / Vista tank mix was the only treatment to reduce percent cover to 0% at 7 WAT and maintain the 0% cover level the following growing season.

Growth regulator herbicides (Garlon, Vista, and Transline) are effective control options for scotchbroom. This is consistent with past studies. Escort, a sulfonylurea herbicide in the ALS inhibitor class of herbicides, is an effective control option. Imazapyr, an imidazolinone herbicide also belonging to the ALS family, has been shown to be ineffective in controlling scotchbroom. This comparison shows that two compounds with the same mode of action but different chemical structures may have different control results. Further rate titrations of the growth regulator herbicides should be examined for cost efficacy, control options, and crop sensitivity (i.e. southern yellow pine). Additional studies are needed to determine if retreatment can eradicate scotchbroom in southern yellow pine plantations.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

LONG-TERM GROWTH RESPONSES TO DIVERSE CHEMICAL SITE PREPARATION METHODS AND LOBLOLLY PINE SEED TYPE ON A WELL-DRAINED SITE IN NORTH LOUISIANA. Blazier, M.A., and Clason, T.R.; Louisiana State University Ag Center Homer, LA; and Natural Resources Conservation Service, Alexandria, LA.

ABSTRACT

Southern pine plantations constitute Louisiana's top agricultural commodity, contributing $3.7 billion to its economy in 2003. However, many of these forests grow on soils that poorly hold water and nutrients. On such soils, seedling mortality is often high and tree growth rates are relatively low. The economic viability of forest management on such soils is improved through management practices that better allocate water and nutrients to crop trees. On a sandy, gravelly soil in northwest Louisiana, pine survival and growth were observed for 10 years in response to (1) planting containerized seedlings, (2) using various herbicides to suppress competing vegetation at planting, and (3) planting seedlings at densities lower than conventional guidelines suggest. Planting containerized seedlings, which have healthier root systems at planting than commonly planted bareroot seedlings, has had the greatest influence on pine growth and survival on this droughty soil. Survival rates and wood yields of trees grown from containerized seedlings have been 15% and 35% higher, respectively, than that of bareroot seedlings. All herbicides tested were equally effective in promoting crop tree survival. However, blends of herbicides applied after planting promoted better tree growth than either single-chemical herbicides or pre-planting applications. The herbicide mixtures that produced the best wood yields after 10 years were hexazinone+sulfometuron (Velpar+Oust) and imazapyr+metsulfuron (Arsenal+Escort) applied in the summer following planting. Planting of trees at densities approximately half that currently planted on such soils has resulted in better survival rates and wood volume per tree than in areas planted with current guidelines. Thus, on sandy, gravelly soils it is essential to plant trees with the best available root systems and minimize the seedlings' competition for water and nutrients by planting at low densities and using herbicide mixtures to provide a broad spectrum of competition control.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

INTEGRATION OF SITE PREPARATION AND HERBACEOUS WEED CONTROL ON UPPER COASTAL PLAIN SITES: SECOND YEAR RESULTS. D.K. Lauer, Silvics Analytic, Richmond, VA, and H.E. Quicke, BASF Corporation, Auburn, AL.

ABSTRACT

Three study locations were established in the Upper Coastal Plain to examine post-plant herbaceous weed control (HWC) strategies following two timings (July vs. October) and three rates (32, 48, and 64 oz ac^{-1}) of Chopper herbicide site preparation. Site conditions consisted of a one pass rip and bed with machine plant on a moderately well to well drained clay soil, no tillage with machine plant on a moderately well to well drained clay soil, and a bed with hand planting on a somewhat poorly drained silt loam that is saturated to within 6 inches over half the year. Chopper site prep treatments were applied to large plots ten pine rows in width. Loblolly pines were planted the winter following site prep. Chopper site prep treatments included 2 qt ac^{-1} Gly-Flo on two sites and 1 qt ac^{-1} Garlon 4 on the site with waxy leafed shrub competition. All treatments included 0.5% non-ionic surfactant in a total spray volume of 10 gal ac^{-1}. Treatments were replicated three times at each location in a split-plot design with Chopper site prep as main plot treatments and HWC as sub-plot treatments.

HWC treatments were assigned at random to the inner pine rows of each site prep treatment plot. Arsenal AC + Oust (4 + 2 oz ac^{-1}) treatments included no HWC and first year applications in March and June. These first year treatments were included with and without Arsenal AC + Oust applied in March of the second year.

Chopper site prep treatments differed by site prep date and rate. Vegetation control and pine growth was always similar or better for the early (July) application date and the higher (48 or 64 oz) Chopper rates. There were no interactions between Chopper site prep treatments and HWC for year 2 pine volume. The few interactions for total vegetation cover development through the first two years occurred at the rip and bed clay soil location due to differences in vegetation development without HWC. Chopper site prep without HWC performed better than HWC without Chopper site prep at the one location where this comparison was available.

The largest year 2 pine volume response was from first-year HWC at all locations even with this wide range of soil conditions. First-year treatments were effective for the March or June application dates at the two bedded locations but only for the March application date at the location that was not bedded. Pine response to first-year HWC at the location without tillage was limited by less effective weed control following the June application.

Pine response from second-year HWC varied and was related to efficacy and early pine growth. Pines responded well to Chopper site prep and first year HWC on the rip and bed clay soil with little additional response from second-year HWC. Pines responded to second-year HWC when combined with first-year March HWC at the location that was not bedded because this combination improved duration of weed control. Pines responded to second-year HWC with or without first-year HWC on the somewhat poorly drained silt loam because second-year treatments were effective and first-year pine growth was limited by saturated soil conditions.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

HERBACEOUS WEED CONTROL IN FIRST-YEAR LOBLOLLY PINE USING OUST XP, OUST EXTRA, OUSTAR, MATRIX, AND STEADFAST. A.W. Ezell, J.L. Yeiser and L.R. Nelson; Mississippi State University, Starkville; Stephen F. Austin State University, Nacagdoches, TX; and Clemson University, Clemson, SC.

ABSTRACT

A total of 16 treatments were evaluated in first-year loblolly plantations at three locations across the South. Treatments were applied in mid-April, 2004 and included different rates of Oust Extra, Matrix, Steadfast applied alone and in tank mixes with Arsenal AC. Arsenal AC and Oustar were also applied alone and Oust XP was tank mixed with Arsenal AC in one treatment. Plots were evaluated at 30, 60, 90, and 120 days after treatment (DAT) for both pine vigor and ground cover by grasses, forbs, and percent clear ground. None of the treatments resulted in any damage to the pine seedlings. Overall, the tank mixes of Oust Extra and Arsenal AC provided the best control of forbs and grasses. Oustar and Oust XP + Arsenal AC also provided very good control of competing species.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

OUST EXTRA COMBINATIONS FOR HERBACEOUS WEED CONTROL AND LOBLOLLY PINE SEEDLING PERFORMANCE. J.L. Yeiser, Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University, Nacogdoches, TX 75962 and A.W. Ezell, Department of Forestry, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Oust Extra is a new, pre-mix blend of Oust XP and Escort XP for use on forestry sites. The objective of this study was to compare weed control, crop tolerance, and pine growth resulting from treatments of Oust XP+Escort XP (Oust Extra) alone, in combination with common tank partners, with Arsenal AC alone, and with untreated checks. In Texas, when compared to Arsenal AC alone, the addition of 2.25+.75 oz of Oust XP+Escort XP (3 oz Oust Extra) enhanced age two ground line diameter while the 3+1 oz rate of Oust XP+Escort XP (4 oz Oust Extra) enhanced both total height and ground line diameter. In both Texas and Mississippi, three-way Arsenal AC+Oust XP+Escort XP mixtures provided numerically more and Arsenal AC alone treatments numerically less weed control and seedling growth than other treatments. In Texas, Oust XP+Escort XP performed better than Velpar DF+Oust XP; in Mississippi the reverse was true. Differences in rank at the two sites may be attributed to common ragweed, wooly croton, horseweed, and Rubus control. Arsenal AC did not control Rubus and common ragweed. Velpar DF+Oust XP did not control wooly croton and Rubus. Escort XP controlled horseweed and Rubus. Oust Extra mixed easily and stayed in suspension. No herbicide damage was observed on pines.

INTRODUCTION

The impact of herbaceous competition on loblolly pine (Pinus taeda L.) seedlings performance is well documented. As a result, herbaceous weed control is a standard part of loblolly pine plantation establishment and justifies the continued refinement of product rates and combinations. The objective of this study was to compare Oust XP+Escort XP alone (Oust Extra) and in combination with common tank partners, Arsenal AC alone, and industry checks (Oustar) for weed control, and newly planted loblolly pine seedling tolerance and performance. The Oust XP+Escort XP mixtures tested here are now commercially available as a pre-mixed blend called Oust Extra.

METHODS

Two sites were tested--one near Sturgis, MS and one near Nacogdoches, TX. Table 1 summarizes site conditions, major competitors, herbicide applications, and plot layout. At both sites, plots were visually evaluated for efficacy at 30-120 days after treatment (DAT). In Mississippi, an additional evaluation was conducted 150 DAT and in Texas 180 DAT. Seedlings were assessed for survival (%) and measured for total height (H-ft) and ground line diameter (D-in) after one and two growing seasons.

Treatments were assigned to a randomized complete block design with 12 treatments per block. Each test site had four blocks. Analyses of variance were conducted on weed control and seedling parameters after one and two growing seasons. In Texas, a factorial analysis of Arsenal AC (4, 6oz) without and with Oust XP+Escort XP (3+1; 2.25+.75oz) was also conducted. Duncan’s New Multiple Range test (DNMRT α=0.05) was used to separate treatment means. Because of space limits, only selected analyses are presented.

RESULTS

Weed Control
Weed control in Texas was excellent (Table 2). All herbicide treatments provided more weed free space 30 and 60 DAT than checks. Statistical differences between treatments were difficult to interpret. Numerically, 30 DAT, Velpar DF+Oust XP and Arsenal AC+Oust XP+Escort XP (6+3+1oz) treatments provided 74-81% bare ground. This was followed by Arsenal AC+Oust XP+Escort XP (6+2.25+.75, 4+3+1oz) and Arsenal AC (6oz) at 60-69%, Oust XP+Escort XP and Arsenal AC+Oust XP+Escort XP (4+2.25+.75oz) with 54-56%, then Arsenal AC (4oz) with 46% and last checks with 26% bare ground. When weed control at 30 DAT was compared to 60 DAT, differences were observed. Changes in treatment rank resulted from differences in forb (common ragweed, wooly

croton) and Rubus control. For example, Arsenal AC+Oust XP+Escort XP provided best forb and Rubus control. Velpar DF+Oust XP mixtures provided early forb control but failed to provide wooly croton and Rubus control. Oust XP+Escort XP mixtures provided excellent Rubus and moderate forb control. Arsenal AC treatments controlled neither common ragweed nor Rubus. Patterns in weed control first observed 60 DAT were still present 180 DAT.

The factorial analysis of Arsenal AC alone and mixed with Oust XP+Escort XP revealed no statistical differences in bare ground, and grass, forb, and Rubus cover for rate of Arsenal AC (4, 6oz) at 30-180 DAT (data not presented). The addition of Oust XP+Escort XP to the Arsenal AC tank did not enhance grass control over that of Arsenal AC alone (data not presented). Forb cover 30 and 60 DAT was less with Arsenal AC+Oust XP+Escort XP mixtures than for Arsenal AC alone (data not presented). After 60 DAT, forb cover on Arsenal AC plots > Arsenal AC+Oust XP+Escort XP (2.25+.75oz) > Arsenal AC+ Oust XP+Escort XP (3+1oz). Rubus cover 30 DAT for Arsenal AC alone=Arsenal AC+Oust XP+Escort XP (2.25+.75oz) > Arsenal AC+Oust XP+Escort XP (3+1oz) (data not presented). Thereafter, Rubus cover on Arsenal AC plots was greater than when either rate of Oust XP+Escort XP was mixed with Arsenal AC.

In Mississippi, weed control was excellent and statistical differences were detected (Table 3). For bare ground 30 DAT, tank mixtures provided 93% > Arsenal AC 80% > checks 18%. At 60 DAT, bare ground for tank mixtures was 95% > Arsenal AC 49% > checks 5%. By 90 DAT, bare ground for Arsenal AC+ Oust XP+Escort XP mixtures was 97%, Oust XP+Escort XP mixtures 88%, and Velpar DF+Oust XP (21.33+2oz) > Velpar DF+Oust XP mixtures (56%) > Arsenal AC (18%) > checks (1%). At 150 DAT, Arsenal AC+ Oust XP+Escort XP mixtures provided 67% bare ground > Oust XP+Escort XP mixtures 47% > Velpar DF+Oust XP mixtures 26% > Arsenal AC 4% > checks 0%. Arsenal AC did not control common ragweed. Escort XP containing mixtures were very efficacious on horseweed. Grasses were readily controlled by all herbicide treatments.

Seedling Performance

Texas seedling survival was excellent (Table 4). After two growing seasons, all treatments exhibited more than 92% survival. Minor differences in survival were detected and considered not treatment related. Generally, age one total H and D were numerically largest for mixtures of Arsenal AC+Oust XP+Escort XP (4+3+1, 6+2.25+.75, 6+3+1oz) and Velpar DF+Oust XP (Oustar 13; 10.67+1, 21.33+2oz). Nine of twelve treatments produced tallest age two seedlings. The same nine treatments producing the tallest also produced the largest seedlings in D. More treatments produced seedling of comparable size at age two than age one. Increased similarity in age-two growth may be weather related as 9 of 10 months of recorded rainfall in 2004 were above the 30-year mean.

From the factorial analysis of Texas data, rate of Arsenal AC did not influence age one seedling performance (S1, S2, H1, D1) (data not presented). For age two, mixing Arsenal AC with Oust XP+Escort XP enhanced seedling growth. For example, for D Arsenal alone < Oust XP+Escort XP 2.25+.75oz < Oust XP+Escort XP 3+1oz; for total H Arsenal AC alone < Oust XP+Escort XP (3+1; 2.25+.75oz) and Oust XP+Escort XP 2.25+.75oz= Oust XP+Escort XP 3+1oz (data not presented).

In Mississippi, minor treatment differences in S1 and S2 were detected and considered not related to treatments (Table 4). Much of the seedling mortality was thought to be due to excessive soil moisture. Statistically, many age-one treatments produced seedlings similar in total H. Largest D occurred on 3-of-4 Arsenal AC+Oust XP+Escort XP mixtures. Numerically, Arsenal AC+Oust XP+Escort XP mixtures produced tallest and largest seedlings at ages one and two. At age two, check seedlings were statistically the shortest and smallest and Arsenal AC+Oust XP+Escort XP seedlings were tallest and largest.

In summary, in Texas the most numerical weed control and numerical seedling growth was achieved with Arsenal AC+Oust XP+Escort XP mixtures, followed by Velpar DF+Oust treatments followed by Oust XP+Escort XP, Arsenal AC, and last, checks. In Mississippi, the most numerical weed control and numerical seedling growth resulted from Arsenal AC+Oust XP+Escort XP, followed by Oust XP+Escort XP, followed by Velpar DF+Oust treatments and last checks. Differences in rank (Oust XP+Escort XP better than Velpar DF+Oust XP in Mississippi; in Texas the reverse) may be attributed to product control of common ragweed, wooly croton, horseweed, and Rubus at respective sites.

Table 1. Description of study sites, major competitors, application dates and equipment, and plot layout.

Location	Sturgis, MS	Nacogdoches, TX
Physiography	Hilly Upper Coastal Plain	Hilly Upper Coastal Plain

Soil	Ruston Fine Sandy Loam pH 5.3	Sandy Clay Loam (1st 6”) pH 5.0
Harvest	Natural pine hardwood; Clearcut 2001	Pine plantation; Clearcut Dec-2000
Site Prep #1	April 2002 ULW rate 4.67lb	May 2002; Single Chop
Site Prep #2	September 2002 burned	June 2002; Arsenal+Accord+ Rebound 16+64+32oz @ 10 GPA
Planted	January 2003; Hand; Bare root	December 2002; Machine; Bare root
Bare Ground	<50%	60%
Forbs+Grasses	35% Common ragweed, horseweed, late boneset; panicgrasses, broomsedge	15%+8% Common ragweed, wooly croton, late boneset; panicgrasses
Major trees	15% sweetgum and oaks	<1% sweetgum and oaks
Shrubs	American beautyberry	0%
Brambles	<1% Rubus	15% Rubus
Application day	April, 13, 2003	April 8, 2003
Equipment	CO_2 backpack; a single KLC 9 nozzle; 10 GPA	CO_2 backpack; T-boom with 4, 8002 nozzles; 10 GPA
Treatment Plot	30-ft x 100-ft	5-ft x 130-ft; 16 seedlings per row
Measurement Plot	Middle 10-ft of the plot; >10 seedlings	Middle 12 seedlings

Table 2. Bare ground (%) and vegetation cover (%) for early post-emergence treatments applied near Nacogdoches, TX on April 8, 2003 for herbaceous release of newly planted loblolly pine seedlings.

	Rate[1]	Days After Treatment							
Herbicide	oz/ac	30	60	90	180	30	60	90	180
		Bare ground[2]				Grass cover[2]			
Check	none	26f	24g	4d	2e	28a	28a	31a	39a
Oustar	13	83a	74bcdef	28c	24bcd	3c	4b	5cd	8d
V+O	21.33+2	76ab	76bcde	31bc	23bcd	7bc	6b	10cd	14cd
V+O	10.67+1	74abc	61f	26c	18bcde	5bc	7b	16bc	20bcd
Ar	6	60cde	66ef	18cd	10de	8bc	5b	7cd	10cd
Ar	4	46e	70cdef	18cd	13cde	6bc	3b	4cd	9d
O+E	3+1	54de	74bcdef	23c	19bcde	15b	10b	23ab	30ab
O+E	2.25+.75	56de	69def	21c	19bcde	10bc	7b	15bc	24bc
Ar+O+E	6+3+1	81a	94a	66a	44a	7bc	2b	2d	6d
Ar+O+E	6+2.25+.75	69bcd	83ab	45b	32abc	9bc	4b	6cd	13cd
Ar+O+E	4+3+1	65bcd	86abc	45b	36ab	10bc	6b	8cd	16cd
Ar+O+E	4+2.25+.75	56de	80bcd	28c	19bcde	6bc	3b	8cd	16cd
		Forb cover[2]				Rubus cover[2]			
Check	none	36a	40a	58a	51ab	11abc	11b	13a	15abc
Oustar	13	7bc	13bc	54a	48ab	9c	11bc	13a	23a
V+O	21.33+2	8bc	10bc	39ab	35b	8c	8bcd	16a	24a
V+O	10.67+1	14bc	20b	44ab	44ab	9c	10bcd	13a	18ab
Ar	6	14bc	19b	59a	60a	11bc	11b	14a	20a
Ar	4	19b	18bc	59a	51ab	21a	21a	19a	25a
O+E	3+1	16bc	16bc	51a	45ab	12abc	1e	3b	6c
O+E	2.25+.75	15bc	20b	61a	50ab	12abc	3de	3b	5c
Ar+O+E	6+3+1	7bc	4c	26b	34b	7c	1e	2b	5c
Ar+O+E	6+2.25+.75	7bc	5c	39ab	41ab	12abc	3cde	4b	7bc
Ar+O+E	4+3+1	7bc	10bc	43ab	39b	12abc	3de	3b	6bc
Ar+O+E	4+2.25+.75	12bc	9bc	54a	50ab	20ab	4bcde	4b	8bc

[1] Ar=Arsenal AC; O=Oust XP; E=Escort XP; V=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).

Table 3. Bare ground (%) and vegetation cover (%) for early post-emergence treatments applied near Sturgis, MS on April 13, 2003 over the top of newly planted loblolly pine seedlings.

Herbicide[1]	Rate[1] oz/ac	30	60	90	150	30	60	90	150
		Days After Treatment							
		Bare ground				Grass			
Check	none	18c	5c	1d	0e	21b	15b	12ab	13ab
Oustar	13	91a	93a	58b	23d	4a	1a	1a	9a
V+O	21.33+2	92a	96a	83a	30d	5a	2a	2ab	10ab
V+O	10.67+1	90a	90a	54b	26d	5a	2a	2ab	9ab
A	6	84b	49b	19c	2e	5a	1a	1b	9b
A	4	76b	49b	17c	6e	3a	2a	2b	7b
O+E	3+1	94a	95a	87a	44c	3a	2a	2ab	19b
O+E	2.25+.75	94a	96a	89a	49c	4a	1a	1ab	20a
A+O+E	6+3+1	90a	97a	93a	82a	6a	1a	1ab	9a
A+O+E	6+2.25+.75	94a	96a	92a	51bc	4a	1a	1ab	8a
A+O+E	4+3+1	92a	97a	93a	67b	3a	1a	1a	15a
A+O+E	4+2.25+.75	94a	97a	92a	69b	3a	1a	1a	11a
		Forbs							
Check	none	53c	85c	90c	94d				
Oustar	13	7a	6a	36b	69c				
V+O	21.33+2	5a	2a	14a	60c				
V+O	10.67+1	6a	8a	41b	65c				
A	6	13b	50b	78c	90d				
A	4	21b	49b	80c	88d				
O+E	3+1	4a	4a	8a	38b				
O+E	2.25+.75	3a	3a	3a	31b				
A+O+E	6+3+1	4a	2a	5a	10a				
A+O+E	6+2.25+.75	4a	4a	6a	35b				
A+O+E	4+3+1	4a	2a	2a	18ab				
A+O+E	4+2.25+.75	4a	3a	5a	20ab				

[1] Ar=Arsenal AC; O=Oust XP; E=Escort XP; V=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).

Table 4. Seedling performance after one and two growing seasons for survival (S1 %; S2 %), total height (H1 ft; H2 ft) and ground line diameter (D1 in; D2 in).

Herbicide	Rate	S1	S2	H1	H2	D1	D2
Texas							
Ar[1]+O+E	4+3+1	100a	100a	1.84ab	5.32ab	.41ab	1.36a
Ar+O+E	6+2.25+.75	98ab	98a	1.75abc	4.86abc	.40abc	1.24abc
Ar+O+E	6+3+1	100a	100a	1.75abc	5.03abc	.42a	1.31ab
Ar+O+E	4+2.25+.75	96ab	94a	1.60cde	4.70abcd	.35ef	1.09abcd
Oustar	13	98ab	98a	1.93a	5.32a	.41abc	1.36a
V+O	10.67+1	98ab	96a	1.77abc	5.08abc	.37bcd	1.19abc
V+O	21.33+2	96ab	96a	1.72bc	4.95abc	.38abcd	1.24abc
O+E	3+1	92b	92a	1.44e	4.30bcd	.33ef	1.01bcd
O+E	2.25+.75	100a	94a	1.63cde	4.57abcd	.36cde	1.14abc
Ar	6	96ab	96a	1.66bcd	4.48abcd	.35de	1.06abcd
Ar	4	100a	100a	1.47de	4.07cd	.29f	0.96cd
Check	none	100a	100a	1.43e	3.72d	.29f	0.80d

Table 4. Seedling performance after one and two growing seasons for survival (S1 %; S2 %), total height (H1 ft; H2 ft) and ground line diameter (D1 in; D2 in).—continued.

Herbicide	Rate	S1	S2	H1	H2	D1	D2

Mississippi							
Ar[1]+O+E	4+3+1	78b	78b	1.84a	5.30a	.53a	1.34a
Ar+O+E	6+2.25+.75	83b	83b	1.73ab	4.90ab	.37c	1.22a
Ar+O+E	6+3+1	95a	93a	1.75ab	5.05a	.51a	1.32a
Ar+O+E	4+2.25+.75	83b	83b	1.73ab	5.13a	.52a	1.24a
Oustar	13	95a	90a	1.84a	4.76b	.43b	1.12b
V+O	10.67+1	83b	83b	1.70ab	4.78b	.38c	1.06b
V+O	21.33+2	80b	80b	1.52b	4.33c	.36c	1.03b
O+E	3+1	93a	93a	1.60b	4.57bc	.42b	1.11b
O+E	2.25+.75	85b	85ab	1.69ab	4.78b	.43b	1.09b
Ar	6	80b	80b	1.61b	4.21c	.36c	.91b
Ar	4	75b	75b	1.63b	4.51bc	.41b	.99b
Check	none	83b	80b	1.55b	3.97c	.32d	.75c

[1] Ar=Arsenal AC; O=Oust XP; E=Escort XP; V=Velpar DF. All rates are in ounces of product per acre.
[2] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test, α=0.05).

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

WEED SUPPRESSION TREATMENTS FOR FORESTED WETLAND RESTORATION IN LOUISIANA.

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ABSTRACT

Wetlands Reserve Program provides financial and technical assistance for restoring agriculturally converted wetlands to their functional state. The restoration process addresses soil, water, wildlife and other related natural resource concerns in an environmentally beneficial and cost-effective manner. Ceasing agricultural production has an immediate positive impact on soil erosion and water quality, while initiating the natural wildlife habitat successional process. Although artificial reforestation methods are used to accelerate woody species diversity and vertical structure development, tree establishment practices failed to provide the vertical structure and hard mast production in a time frame necessary for sustaining avian and deer populations. Field trials in Georgia and Arkansas have shown that planting large caliper one-year-old potted seedlings enhances oak performance. Height growth is significantly improved and mast production begins during the fourth growing season. A field trial was designed to determine the impact of potted and containerized Nuttall oak, with and without vegetation management, on wildlife habitat development during wetland restoration in the alluvial plains of Louisiana. The objectives of the trial were to (1) Evaluate the potential use of potted and containerized oak seedling on WRP sites for accelerated growth, (2) Evaluate the cost effectiveness of potted and containerized oak seedlings, (3) Determine impact of site preparation on seedling survival rates including bare root seedlings, and (4) Determine impact of site preparation on wildlife habitat development of WRP sites.

Tree establishment practices included three site preparation treatments, three types of Nuttall oak planting stock and two post plant weed suppression treatments. Site preparation treatments were broadcast mowing, broadcast mowing with a pre-plant herbicide and subsoiling with pre-plant herbicide. Pre-plant herbicide treatment was a tank mix of glyphosate and sulfometuron at 32 and 3 oz per acre. It was applied at 20 gallons per acre in September 2003 following mowing but prior to subsoiling. Nuttall oak planting stock, potted, containerized and bare root seedlings, were randomly assigned within each site preparation treatment and planted in December 2003 on a 12 foot by 12 foot spacing. Post plant suppression were split-plot treatments, which included no suppression and sulfometuron at 2 oz per acre applied as a 5-foot band in March 2003. All site preparation treatments were replicated three times.

Subsoiling with pre-plant vegetation management treatment increased survival rates during the first growing season. Seedling survival averaged 87 percent exceeding broadcast mowing, and broadcast mowing and pre-plant weed suppression by 48 and 36 percent. Potted and containerized planting stock survival averaged 90 and 70 percent, respectively, while bare root survival rate was 56 percent. Combining post plant weed suppression with pre-plant site preparation treatments had no impact on seedling survival.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

MATRIX OR STEADFAST BLENDS WITH COMMONLY USED HERBICIDES FOR HERBACEOUS WEED CONTROL IN NEWLY PLANTED SOUTHERN PINES. J.L. Yeiser, Stephen F. Austin State University, Arthur Temple College of Forestry and Agriculture, Nacogdoches, TX 75962.

ABSTRACT

DuPont's Steadfast and Matrix herbicides were mixed with commonly used products and screened for herbaceous release and pine tolerance in newly planted southern pines. One site for loblolly, slash, and longleaf pines were tested. Weed control from Steadfast and Matrix and their blends was significantly less than achieved with industry standards. Significant gain in weed control from Steadfast or Matrix blends with commonly used products seems unlikely. Pine survival was excellent at all three sites. All three southern pines exhibited excellent tolerance of Matrix and Steadfast. Damage of slash pine seedlings by Oust Extra+Arsenal AC (3+4oz) was observed.

INTRODUCTION

Since the mid-1980's, researchers have screened a variety of herbicides for herbaceous competitor control and resultant southern pine herbicide tolerance and performance. Although precursors of today's products were actually tested, names of products screened for use are: Velpar and Oust since the mid-1980's; Arsenal since the late 1980's; Pendulum, Milestone, StrongArm, Plateau, Pursuit, and Scepter in the late 1990's; and Steadfast and Matrix in 2004.

DuPont's Steadfast herbicide (a.i.=50% nicosulfuron+25% rimsulfuron by weight) is a water-dispersible granule containing 75% active ingredient by weight and used in field corn. DuPont's Matrix herbicide (a.i.=75% rimsulfuron by weight) is a dry flowable herbicide used in potatoes. Both products rely on root and leaf uptake to provide selective forb and grass control. The potential of Steadfast and Matrix in herbicide blends for herbaceous release and enhanced performance of southern pines is unknown. The objective of this study was to screen Steadfast and Matrix with commonly used forest herbicides for herbaceous weed control in newly planted southern pine seedlings.

METHODS

Three sites were tested--one near Many, LA, one near Fields, LA and one near Warren, TX. Table 1 summarizes site conditions, major competitors, and herbicide application dates. Herbicides were applied with a CO_2, backpack attached to a "T-boom" supporting 4, 8002 nozzles. Herbicides were applied at a total volume of 10 GPA in a 5-ft band center over seedlings.

Treatment plots were 5-ft x 130-ft and contained 16 seedlings. Measurement plots were internal to treatment plots. The center 12 seedlings in treatment plots were monitored for herbicide tolerance, leaving the two seedlings on each end as buffers. Visual evaluation of plots was conducted at 30-day intervals, 30-120 days after treatment (DAT).

At each site, plots were established in a randomized complete block with four blocks. At Many, Fields, and Warren there were 16, 16, and 10 treatments per block, respectively. Analyses of variance were conducted on weed control and seedling tolerance 30-120 DAT. Tolerance codes for herbicide tolerance were: 1=excellent quality; all green; vigorous growth; 2=good quality; no brown out; moderate growth; 3=fair quality; likely to live, 25% brown; little growth; 4= poor quality; may or may not live; 50% brown, and 5=dead. Duncan's New Multiple Range test (α=0.05) was used to separate treatment means.

RESULTS

Weed Control

Weed control is presented for loblolly (Table 2), slash (Table 3), and longleaf (Table 4) pines. Mixing Steadfast or Matrix with commonly used herbicides provided little additional bare ground than the name brand and less than industry checks for loblolly, slash, and longleaf pine seedlings. For example, for loblolly and slash seedlings, Matrix (2oz) or Steadfast (1oz) mixed with Oust Extra (2oz), provided bare ground above that of Oust Extra (2oz) 30 DAT of 4%, 6%; 1%, 21%; 60 DAT 20%, 8%; 14%, 29% 90 DAT 20%, 8%; 13%, 16% and 120 DAT 0%, -3%; 8%, 14%, respectively. In all cases, bare ground was well below that of Oustar (13oz) and Arsenal AC+Oust XP (4+2oz). Furthermore, for loblolly and slash pine seedlings, Matrix (2oz) or Steadfast (1oz) mixed with Arsenal AC (4oz) provided additional control 30 DAT of -1%, -3%; 1%, 21%; 60 DAT -8%, -8%; 14%, 29%; 90 DAT -8%, -8%; 13%, 16%, and 120 DAT 3%, 0%; 8%, 14%, respectively. However, bare ground was below that achieved with Arsenal AC+Oust XP (4+2oz). For longleaf pine, mixing Steadfast (1oz) or Matrix (2oz) with Oust XP (2oz) provided more bare ground than Oust XP (2oz) at 30 DAT 1%, -6%; 60 DAT 1%, -4%; 90 DAT –16%, -9%; 120 DAT –25%, -20% bare ground, respectively. For all evaluations, bare ground for Steadfast or Matrix mixtures with Oust XP was significantly less than for Oustar 10oz.

Matrix (4oz) controlled Helianthus, topic croton, panicum, and provided partial control of spiderwort. Matrix (4oz) did not control common ragweed, Rubus, late boneset, and dogfennel. Steadfast (2oz) controlled Helianthus, tropic cotton, common ragweed, panicum and spiderwort but did not control Rubus, late boneset or dogfennel.

Seedling Survival

Seedling survival and herbicide tolerance is presented for loblolly (Table 5), slash (Table 6), and longleaf (Table 7) pines. Treated and untreated loblolly survival was 95%, 100% at 30 DAT; 90%, 100% at 60 DAT; 90%, 100% at 90 DAT; and 83%, 96% at 120 DAT, respectively. Survival ranged 30 DAT from a high of 100% to a low of 92%. At 120 DAT, survival remained excellent with a high of 96% to a low of 77%. Statistical differences in loblolly pine survival were not considered meaningful. For treated and untreated slash pine, survival was 99.7%, 100% at 30 DAT; 99.7%, 100% at 60 DAT; 99.4%, 100% at 90 DAT; and 99%, 98% at 120 DAT, respectively. Slash pine survival for treated and untreated treatments was excellent 30 DAT ranging from 100% to 97.9% and had not changed at 120 DAT. Longleaf survival was excellent. For treated and untreated plots survival 30 DAT was 99.8%, 100%; 60 DAT 99.3%, 100%; 90 DAT 99.1, 100%; and 120 DAT 99%, and 98%, respectively.

A herbicide tolerance code of 1 is most and 5 least desirable. Treated and untreated loblolly pine seedlings exhibited similar herbicide tolerance at all evaluations (Tables 5-7). Minor differences in slash pine tolerance was detected 30 DAT. Thereafter, all herbicide tolerance was statistically similar. For longleaf pine, herbicide tolerance for check and treated seedlings were similar. No herbicide damage was observed for loblolly and longleaf seedlings. Slash pine seedlings did exhibit damage from Oust Extra+Arsenal AC+ (3+4oz).

Table 1. Description of study locations, site preparation, major competitors, and application dates.

Location	Many (Sabine Parish), LA—Forest Capital Partners-loblolly pine	Fields (Beauregard Parish), LA—Forest Capital Partners-slash pine	Warren (Tyler County), TX—Temple-Inland Forest-longleaf pine
Physiography	Hilly upper coastal plain	Lower coastal plain	Lower coastal plain
Soil	Eastwood fine sandy loam	Loam over silt loam	Sandy loam
Harvest	Clearcut Oct 2002	Clearcut Jun 2003	Clearcut Sept 2002
Site Prep #1	Shear & leave July 2003	Burned Jul 2003	Chopped Apr-May 2003
Site Prep #2	Burned Aug 2003	Bedded Jul 2003	Jun-03; Arsenal AC+Garlon 4+Rebound 14+64+16oz
Planted	Jan 2004; Machine; Bare root	Jan 2004; Hand; Bare root	Dec 2003; Hand; Container
Bare Ground	30%	30%	50%
Forbs+Grasses	20+50% (approx 50% 4-8" tall)	20%+20% (approx 50% >4" tall)	20%+30% (approx 60% > 4" tall)
Forbs	Late boneset, common ragweed, dogfennel, purple cudweed	Plantain, purple cudweed, dogfennel	Swamp sunflower, tropic croton, dogfennel, three-seeded mercury
Grasses	Panicgrasses, Chasmanthium,	Panicgrasses,	panicgrasses, rushes/sedges

	Paspalum, Andropogon	Chasmanthium, Paspalum, Andropogon	
Major trees	<3% Sweetgum and oaks	5% oak, yaupon	<3% oak, yaupon
Shrubs	<1% American beautyberry	3% American beautyberry	<1% American beautyberry
Brambles	<1% Rubus	20% Rubus	<1% Rubus
Application day	Apr, 5, 2004	Apr 8, 2004	May 20, 2004

Table 2. Bare ground, and forb and grass cover (%) resulting from over the top, herbaceous release of loblolly pine seedlings with Matrix or Steadfast combinations applied 17-Apr-04 near Many, LA.

Herbicide[1]	Rate (oz/ac)	Bare-ground	Forb	Grass	Bare-ground	Forb	Grass
		30 DAT (17-May-04)			60 DAT (17-Jun-04)		
Oustar	13	76.8 a	10.3 g	8.5 e	79.3 a	8.5 e	6.0 f
Oust Extra+Arsenal AC	3+4	76.3 a	11.3 g	9.5 e	80.0 a	10.0 e	8.3 ef
Oust Extra+Arsenal AC	2+4	68.8 ab	11.3 fg	11.3 e	77.5 a	10.0 e	7.5 f
OustXP+Arsenal AC	2+4	68.8 ab	11.3 g	12.5 de	75.0 a	8.5 e	7.8 f
Oust Extra	3	68.8 ab	21.3 def	7.5 e	37.5 cd	41.3 bc	17.5 cde
Arsenal AC	4	61.3 bc	20.0 ef	15.0 cde	62.5 b	20.0 d	13.8 def
Matrix+Arsenal AC	2+4	60.0 bc	21.3 def	13.8 cde	55.0 b	21.3 d	15.0 def
Steadfast+Arsenal AC	1+4	58.8 bc	21.3 def	15.0 cde	55.0 b	22.5 d	17.5 cde
Steadfast+Oust Extra	1+2	57.5 bc	27.5 cde	10.0 e	28.8 de	42.5 bc	21.3 bcd
Matrix+Oust Extra	2+2	55.0 c	30.0 cd	10.0 e	41.3 c	42.5 bc	11.3 ef
Oust Extra	2	51.3 c	30.0 cd	15.0 cde	21.3 ef	47.5 ab	26.3 abc
Matrix	4	38.8 d	28.8 cde	21.3 bcd	18.8 fg	38.8 c	27.5 ab
Matrix	2	31.3 de	35.0 bc	27.5 ab	11.3 fg	42.5 bc	30.0 ab
Steadfast	2	30.0 de	42.5 ab	22.5 abc	16.3 gh	45.0 abc	30.0 ab
Steadfast	1	21.3 ef	41.3 ab	27.5 ab	10.0 gh	45.0 abc	33.8 a
Check	none	18.3 f	46.3 a	31.3 a	6.0 h	50.0 a	35.0 a
		90 DAT (17-Jul-04)			120 DAT (17-Aug-04)		
Oustar	13	79.3 a	8.5 e	6.0 f	35.0 b	23.8 d	26.3 cd
Oust Extra+Arsenal AC	3+4	80.0 a	10.0 e	8.3 ef	42.5 a	28.8 d	27.5 bcd
Oust Extra+Arsenal AC	2+4	77.5 a	10.0 e	7.5 f	32.5 b	23.8 d	40.0 ab
OustXP+Arsenal AC	2+4	75.0 a	7.8 e	7.8 f	22.5 c	27.5 d	31.3 abcd
Oust Extra	3	37.5 cd	41.3 bc	17.5 cde	30.0 b	42.5 abc	20.0 d
Arsenal AC	4	62.5 b	20.0 d	13.8 def	15.0 de	32.5 cd	42.5 a
Matrix+Arsenal AC	2+4	55.0 b	21.3 d	15.0 def	17.5 cd	32.5 cd	23.8 cd
Steadfast+Arsenal AC	1+4	55.0 b	22.5 d	17.5 cde	15.0 de	35.0 bcd	40.0 ab
Steadfast+Oust Extra	1+2	28.8 de	42.5 bc	21.3 bcd	10.0 ef	47.5 a	36.3 abc
Matrix+Oust Extra	2+2	41.3 c	42.5 bc	11.3 ef	12.5 de	48.8 a	32.5 abcd
Oust Extra	2	21.3 ef	47.5 ab	26.3 abc	12.5 de	50.0 a	27.5 bcd
Matrix	4	18.8 fg	38.8 c	27.5 ab	4.8 f	41.3 abc	27.5 bcd
Matrix	2	11.3 gh	42.5 bc	33.0 ab	3.0 f	43.8 abc	33.8 abc
Steadfast	2	16.3 fg	45.0 abc	30.0 ab	3.0 f	45.0 ab	31.3 abcd
Steadfast	1	10.0 gh	45.0 abc	33.8 a	3.0 f	45.0 ab	32.5 abcd
Check	none	6.0 h	50.0 a	35.0 a	3.0 f	50.0 a	35.0 abc

[1] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

Table 3. Bare ground and grass, Rubus and forb cover (%) following an 8-Apr-04 application of Matrix or Steadfast combinations for herbaceous release of newly planted slash pine seedlings near Fields, LA.

Herbicide[1]	Rate (oz/ac)	Bare-ground	Grass	Rubus	Forb	Bare-ground	Grass	Rubus	Forb
		30 DAT (7-May-04)				60 DAT (7-Jun-04)			
O[2]	13	85.0 a	2.5 f	4.0 b	5.5 d	81.3 a	5.3 e	5.3 d	3.0 f
OE+Ar	3+4	50.0 bc	11.5 def	21.3 ab	16.3 bcd	76.3 ab	6.0 de	8.8 cd	6.0 ef
OE+Ar	2+4	46.3 bcd	10.0 def	20.0 ab	22.5 abc	65.0 abc	11.5 cde	16.3 bcd	6.5 ef
O_XP+Ar	2+4	57.5 b	9.5 def	18.8 ab	10.0 cd	60.0 abc	13.0 cde	21.3 abc	6.5 ef
OE	3	50.0 bc	12.5 cdef	23.8 a	10.5 cd	63.8 abc	15.0 cde	12.0 bcd	6.5 ef
Ar	4	42.5 bcd	21.3 abcd	16.3 ab	17.5 bcd	50.0 cd	10.3 cde	18.8 bcd	19.0cde
M+Ar	2+4	43.8 bcd	15.8 bcde	22.5 a	15.0 bcd	48.8 cd	11.5 cde	22.0 abc	12.8 ef
S+Ar	1+4	57.5 b	11.3 def	15.0 ab	12.0 cd	53.8 bcd	16.3 cde	15.0 bcd	11.3 ef
S+OE	1+2	62.5 ab	6.5 ef	20.0 ab	9.5 cd	61.3 abc	15.0 cde	16.3 bcd	7.0 ef
M+OE	2+2	42.5 bcd	11.3 def	28.8 a	15.0 bcd	46.3 cd	18.8 cd	17.5 bcd	14.5 def
OE	2	41.3 bcd	13.8 bcdef	28.8 a	16.3 bcd	32.5 de	22.5 bc	25.0 ab	17.5 cde
M	4	25.0 cd	22.5 abcd	22.5 a	21.3 abc	10.0 ef	33.8 ab	21.3 abc	27.5 abcd
M	2	20.0 d	30.0 a	25.0 a	21.3 abc	3.5 f	40.0 a	33.8 a	18.3 bcde
S	2	40.0 bcd	20.0 abcd	12.5 ab	23.8 abc	20.0 ef	33.8 ab	13.8 bcd	30.0 abc
S	1	21.3 d	25.0 abc	16.3 ab	31.3 a	7.0 f	37.5 a	17.5 bcd	31.3 ab
Check	none	22.5 d	26.3 ab	18.3 ab	27.5 ab	10.3 ef	31.3 ab	17.0 bcd	38.8 a
		90 DAT (7-Jul-04)				120 DAT (7-Aug-04)			
OE+Ar	3+4	72.5 a	9.5 fg	4.8 e	11.5 defg	56.3 a	12.5 b	2.5 d	23.8 abcd
OE+Ar	2+4	60.0 abc	12.8 efg	10.8 cde	11.3 defg	51.3 a	15.3 b	14.5 cd	16.3 d
O_XP+Ar	2+4	55.0 abcd	13.0 efg	25.0 abc	7.8 fg	27.5 bc	18.8 b	35.0 ab	20.0 cd
OE	3	62.5 ab	21.3 def	5.3 e	9.0 efg	35.0 b	36.3 a	5.3 d	25.0 abcd
Ar	4	23.3 fg	16.3 defg	33.8 a	22.5 cd	11.5 de	20.0 b	40.0 a	27.5 abcd
M+Ar	2+4	23.8 fg	20.0 def	30.0 ab	23.8 cd	9.3 de	20.0 b	38.8 a	26.3 abcd
S+Ar	1+4	40.0 def	17.5 defg	22.5 abcd	17.5 cdef	16.3 cde	18.8 b	28.8 abc	31.3 abcd
S+OE	1+2	46.3 bcde	26.3 bcd	10.3 cde	16.3 cdef	31.3 b	38.8 a	5.5 d	22.5 bcd
M+OE	2+2	42.5 cde	23.8 cde	7.8 de	21.3 cde	25.0 bc	37.5 a	7.8 d	26.3 abcd
OE	2	30.0 efg	33.8 abc	6.5 e	27.5 bc	17.0 cd	41.3 a	6.5 d	32.5 abcd
O	13	60.0 abc	6.3 g	12.5 cde	3.5 g	37.5 b	12.5 b	20.0 bcd	18.3 cd
M	4	2.0 h	36.3 ab	28.8 ab	28.8 bc	2.5 e	36.3 a	28.8 abc	28.8 abcd
M	2	2.5 h	41.3 a	35.0 a	22.0 cd	2.0 e	41.3 a	35.0 ab	22.0 bcd
S	2	12.5 gh	36.3 ab	13.8 ced	36.3 ab	8.3 de	36.3 a	15.0 cd	38.8 ab
S	1	2.0 h	40.0 a	18.8 bcde	36.3 ab	2.0 e	40.0 a	18.8 bcd	36.3 abc
Check	none	1.5 h	38.8 a	17.0 bcde	41.3 a	2.0 e	38.8 a	17.0 cd	41.3 a

[1] Herbicide means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).
[2] O=Oustar; OE=Oust Extra; Ar=Arsenal AC; O_XP=Oust XP; M=Matrix; S=Steadfast.

Table 4. Bare ground, forb and grass cover (%) for over-the-top, herbaceous release of longleaf pine seedlings with Matrix or Steadfast combinations applied on 21-May-04 near Warren, TX.

Herbicide[1]	Rate (oz/ac)	Bare-ground	Forb	Grass	Bare-ground	Forb	Grass
		30 DAT (20-Jun-04)			60 DAT (20-Jul-04)		
Oustar	10	87.5 c	4.8 e	3.0 d	93.5 e	1.5 c	0.8 c
Oust XP	3	57.5 b	16.3 cd	21.3 c	65.0 d	20.0 b	10.0 b
Steadfast+Oust XP	1+2	56.3 b	21.3 abc	21.3 c	58.8 d	22.5 b	17.5 b
Oust XP	2	55.0 b	25.0 abc	19.5 c	57.5 d	27.5 b	15.0 b
Steadfast	1	52.5 b	20.0 bcd	25.0 bc	30.0 b	28.8 b	38.8 a
Steadfast	2	51.3 b	20.0 bcd	27.5 abc	42.5 c	21.3 b	35.0 a
Matrix	4	51.3 b	11.3 de	31.3 ab	35.0 bc	22.5 b	37.5 a
Matrix	2	51.3 b	21.3 abc	26.3 abc	26.3 ab	31.3 ab	41.3 a
Matrix+Oust XP	2+2	48.8 b	27.5 ab	22.5 bc	53.8 d	31.3 b	13.8 b
Check	none	31.3 a	30.0 a	35.0 a	16.3 a	41.3 a	38.8 a
		90 DAT (20-Aug-04)			120 DAT (20-Sep-04)		
Oustar	10	96.3 d	1.0 e	0.8 d	93.5 c	1.5 f	1.5 d
Oust	3	50.0 bc	20.0 d	25.0 c	38.8 b	27.5 e	27.5 bc
Steadfast+Oust XP	1+2	38.8 b	27.5 cd	31.3 bc	32.5 b	38.8 bcd	25.0 c
Oust XP	2	55.0 c	21.3 d	24.5 c	32.5 b	32.5 de	33.8 bc
Steadfast	1	13.8 a	46.3 ab	37.5 abc	9.5 a	45.0 ab	42.5 ab
Steadfast	2	15.0 a	36.3 bc	46.3 ab	10.0 a	47.5 ab	38.8 abc
Matrix	4	18.8 a	28.8 cd	46.3 ab	10.8 a	30.0 de	52.5 a
Matrix	2	170.8 a	53.8 a	32.5 bc	10.8 a	53.8 a	32.5 bc
Matrix+Oust XP	2+2	46.3 bc	30.0 cd	23.3 c	37.5 b	33.8 cde	27.5 bc
Check	none	2.5 a	42.5 b	50.0 a	2.5 a	42.5 bc	50.0 a

[1] Herbicide means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

Table 5. Herbicide tolerance and survival following herbaceous release of loblolly pine seedlings with over-the-top Matrix or Steadfast combinations applied 17-Apr-04 near Many, LA.

Herbicide[1]	Rate (oz/ac)	Toler-ance	Survi-val	Toler-ance	Survi-ival	Toler-ance	Survi-val	Toler-ance	Survi-val
		30 DAT 17-May-04		60 DAT 17-Jun-04		90 DAT 17-Jul-04		120 DAT 17-Aug-04	
Oustar	13	2.3 a	96 a	2.3 a	90 ab	2.3 a	90 ab	1.8 a	85 a
Oust Extra+Arsenal AC	3+4	2.4 a	94 a	2.4 a	90 ab	2.4 a	90 ab	2.2 a	81 a
Oust Extra+Arsenal AC	2+4	2.5 a	94 a	2.5 a	94 ab	2.5 a	94 ab	1.8 a	85 a
OustXP+Arsenal AC	2+4	2.4 a	90 a	2.4 a	90 ab	2.4 a	90 ab	1.9 a	88 a
Oust Extra	3	2.6 a	92 a	2.7 a	90 ab	2.7 a	90 ab	2.2 a	81 a
Arsenal AC	4	2.4 a	90 a	2.4 a	90 ab	2.4 a	90 ab	2.1 a	81 a
Matrix+Arsenal AC	2+4	2.3 a	96 a	2.3 a	96 ab	2.3 a	96 ab	1.9 a	88 a
Steadfast+Arsenal AC	1+4	2.3 a	94 a	2.4 a	88 ab	2.4 a	88 ab	1.8 a	85 a
Steadfast+Oust Extra	1+2	2.5 a	98 a	2.6 a	92 ab	2.6 a	92 ab	2.3 a	81 a
Matrix+Oust Extra	2+2	2.6 a	92 a	2.8 a	81 b	2.8 a	81 b	2.6 a	81 a
Oust Extra	2	2.6 a	92 a	2.7 a	92 ab	2.7 a	92 ab	2.1 a	85 a
Matrix	4	2.2 a	98 a	2.3 a	90 ab	2.3 a	90 ab	2.0 a	85 a
Matrix	2	2.3 a	96 a	2.4 a	96 ab	2.3 a	96 ab	2.1 a	88 a
Steadfast	2	2.5 a	100 a	2.6 a	81 b	2.6 a	81 b	2.4 a	77 a
Steadfast	1	2.5 a	98 a	2.5 a	83 ab	2.5 a	83 ab	2.4 a	77 a
Check	none	2.0 a	100 a	2.0 a	100 a	2.0 a	100 a	1.7 a	96 a

[1] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

Table 6. Herbicide tolerance and survival (%) 30-120 days after treatment (DAT) on 8-Apr-04 of slash pine seedlings with Matrix or Steadfast combinations for over the top, herbaceous release near Fields, LA.

Herbicide[1]	Rate (oz/ac)	Toler-ance	Survi-val	Toler-ance	Survi-ival	Toler-ance	Survi-val	Toler-ance	Survi-val
		30 DAT 17-May-04		60 DAT 17-Jun-04		90 DAT 17-Jul-04		120 DAT 17-Aug-04	
Oustar[2]	13	1.31 bc	100 a	1.5 a	100 a	1.7 b	98 a	1.10 abc	98 a
Oust Extra+Arsenal AC	3+4	1.54 abc	100 a	1.6 a	100 a	2.3 a	100 a	1.54 a	98 a
Oust Extra+Arsenal AC	2+4	1.46 abc	100 a	1.7 a	100 a	1.8 ab	100 a	1.08 abc	98 a
Oust XP+Arsenal AC	2+4	1.56 abc	100 a	1.5 a	100 a	1.6 b	100 a	1.19 abc	100 a
Oust Extra	3	1.79 abc	100 a	1.6 a	100 a	1.8 ab	100 a	1.02 c	100 a
Arsenal AC	4	1.58 abc	100 a	1.8 a	100 a	1.6 b	100 a	1.50 ab	98 a
Matric+Arsenal AC	2+4	1.44 abc	100 a	1.7 a	100 a	1.7 b	100 a	1.08 abc	100 a
Steadfast+Arsenal AC	1+4	1.79 abc	100 a	1.5 a	100 a	1.6 b	100 a	1.19 abc	100 a
Steadfast+Oust Extra	1+2	1.47 abc	100 a	1.5 a	100 a	1.3 b	100 a	1.13 abc	98 a
Matrix+Oust Extra	2+2	1.54 abc	100 a	1.7 a	100 a	1.6 b	100 a	1.25 abc	100 a
Oust Extra	2	1.94 a	100 a	1.8 a	98 a	1.6 b	98 a	1.08 abc	98 a
Matrix	4	1.92 ab	100 a	1.5 a	100 a	1.6 b	100 a	1.06 bc	100 a
Matrix	2	1.73 abc	100 a	1.4 a	98 a	1.5 b	98 a	1.23 abc	98 a
Steadfast	2	1.40 abc	100 a	1.4 a	100 a	1.4 b	100 a	1.21 abc	100 a
Steadfast	1	1.50 abc	100 a	1.6 a	100 a	1.6 b	100 a	1.27 abc	100 a
Check	none	1.27 c	100 a	1.4 a	100 a	1.4 b	100 a	1.21 abc	98 a

[1] Herbicide means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).
[2] O=Oustar; OE=Oust Extra; Ar=Arsenal AC; O_XP=Oust XP; M=Matrix; S=Steadfast.

Table 7. Herbicide tolerance and survival (%) following over the top, herbaceous release of longleaf pine seedlings with Matrix or Steadfast combinations applied on 8-Apr-04 near Warren, TX.

Herbicide[1]	Rate (oz/ac)	Toler-ance	Survi-val	Toler-ance	Survi-ival	Toler-ance	Survi-val	Toler-ance	Survi-val
		30 DAT 20-Jun-04		60 DAT 20-Jul-04		90 DAT 20-AUG-04		120 DAT 20-SEP-04	
Oust XP	2	1.2 a	100 a	1.2 b	100 a	1.1 a	100 a	1.1 b	100 a
Matrix	2	1.4 a	100 a	1.6 ab	100 a	1.0 a	100 a	1.2 ab	100 a
Oust XP	3	1.4 a	100 a	1.4 b	100 a	1.2 a	98 a	1.2 ab	98 a
Steadfast	2	1.5 a	100 a	1.3 b	100 a	1.1 a	100 a	1.2 ab	100 a
Steadfast	1	1.5 a	100 a	1.1 b	100 a	1.1 a	100 a	1.2 ab	100 a
Oustar	10	1.5 a	100 a	1.9 a	98 a	1.2 a	98 a	1.2 ab	98 a
Steadfast+Oust XP	1+2	1.5 a	100 a	1.6 ab	100 a	1.2 a	100 a	1.3 ab	100 a
Check	none	1.6 a	100 a	1.3 b	98 a	1.1 a	98 a	1.2 ab	98 a
Matrix+Oust XP	2+2	1.6 a	98 a	1.4 b	98 a	1.2 a	98 a	1.3 ab	98 a
Matrix	4	1.7 a	100 a	1.5 ab	98 a	1.4 a	98 a	1.4 a	96 a

[1] Herbicide means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

BAREROOT AND CONTAINERIZED LONGLEAF PINE RESPONSES TO HERBACEOUS WEED CONTROL AND STIMUPRO ROOT TREATMENTS. C.L. Ramsey and S. Jose; USDA-APHIS-PPQ-CPHST, Fort Collins, CO. 80526 and UFL/IFAS, University of Florida, Milton campus, Milton FL. 32583.

ABSTRACT

Two field studies were conducted on longleaf and loblolly pine seedlings in 2004 at the University of Florida WFREC research station in Jay, FL. The main objective was to determine the effects of a seaweed extract, Stimupro, on pine growth and survival. One study involved root applications (RA) of Stimupro (0, 2, 4, and 6% v/v) applied during planting in February to container longleaf and bareroot loblolly pines. The second study involved foliar applications (FA) of Stimupro (0, 1, 2, and 4% v/v) applied in July to container longleaf and bareroot loblolly pines. Three additional treatments in the root applied study included a soil moisture enhancement polymer (Hydretain). The containerized longleaf were soaked in a water solution containing Hydretain about 4 hours before they were planted. Herbaceous weed control consisted of a split application of hexazinone (Velpar DF) at 0.56 kg ai ha^{-1} each time, in April and July 2004. Both studies were a randomized, complete block design with four replications. Pines were planted on 1.2 x 2.4 m spacing, with 60 seedlings per treatment. Linear relationships were analyzed between root collar diameter (RCD), stem volume index (SVI) or survival, and Stimupro rates for each study. Stimupro negatively effected loblolly pine survival in the RA study, but had no effect on RCD or SVI. When applied to longleaf pines in the RA study, Stimupro had no effect on RCD or survival, but had a positive effect on SVI. As the Stimupro rate increased from 0 to 6% (v/v) SVI increased linearly from 4.7 to 7.2 cm^3, respectively, for the longleaf seedlings ($p = 0.0088$). In the FA study Stimupro had no effect on loblolly pine RCD, SVI, or survival. However, Stimupro had a positive effect on SVI (0.0708), no effect on RCD or survival for the FA longleaf pines. In this study SVI increased from 5.1 to 9.3 cm^3 as Stimupro increased from 0 to 4% (v/v). The additional Hydretain treatments had no effect on longleaf growth or survival. However, the average survival was 45 and 27% for the pines treated with and without Hydretain, which indicates the potential to increase pine survival by about 18% if rainfall was not a factor in these studies. The pines were planted on Feb. 13, 2004, which was followed by only 22 mm of rain in March and 37 mm of rain in May. Thus all the pines suffered under a major, early spring drought, which had a confounding effect on pine growth and survival. Despite the drought effects it appears that Stimupro does increase longleaf growth, but not survival. Foliar applications are easier to apply, but may have the shortest time period to benefit pine growth. This study should be repeated another year, to determine the results under less stressful rainfall events.

SYMPOSIA

FORESTRY IN THE NEW MILLENIA

1st YEAR RESULTS FOR MULTIPLE SPECIES PLANTINGS IN THE FLORIDA PANHANDLE. R.A. Williams, West Florida Research and Education Center – IFAS, University of Florida, Milton, FL.

ABSTRACT

Statistics from Florida's Forest – 1995 showed 4.9 million acres of planted pines. The acres of planted pines are projected to increase to 6 million acres by 2025. Hardwood volumes are projected to decrease as net annual removals increase and a decrease in net annual growth. Hardwood pulpwood and sawtimber is increasingly difficult to find close to the mills that use hardwood fiber in their wood production. With such demands on the remaining hardwood resources, these conditions led me to the conclusion that the panhandle of Florida needs to increase its supply of hardwood timber. 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. Another advantage of growing various species of trees is that other resources values can be introduced to a property to enhance wildlife habitat or to improve water quality, etc. 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.

SYMPOSIA

FORESTRY IN THE NEW MILLENIA

EFFECTIVE CONTROL OF KUDZU USING SULFOMETURON, METSULFURON, CHLORSULFURON, CLOPYRALID, AND PICLORAM.

A.W. Ezell, Department of Forestry, Mississippi State University, Starkville, MS.

ABSTRACT

Six herbicide treatments were applied to a well-established kudzu patch in August, 2003. Treatments included Escort XP (4 oz/A), Oust Extra (8 oz/A), Tordon K (1 gal/A), Escort XP (4 oz/A) + Telar (2 oz/A), Transline (21 oz/A), and Escort XP (2 oz/A) + Telar (4 oz/A). Plots were evaluated at 10, 30, and 60 DAT for brownout and the following June, July, August, and September for percent ground cover by kudzu. Tordon K provided the fastest brownout. By June, 2004 all treatments except Transline had reduced kudzu coverage by greater than 90%. At that time, origin of the sprouting vines were identified and flagged. Kudzu coverage increased throughout the growing season due to growth of the original vines noted in June evaluations. No new sprouts were found in any treatment plots except in all replications of the Transline treatments. This evaluation was facilitated by treatment of the outside perimeter of all plots at the time of plot installation. Overall, five of the six treatments provided comparable control, and if follow-up applications had been made in June or July of 2004, total control of the vine would have been expected in those treatment plots.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

EFFECTS OF SULFOMETURON FORMULATIONS ON WEED CONTROL AND LONGLEAF PINE TOLERANCE. L.R. Nelson, Clemson University, Clemson, SC.

ABSTRACT

Herbicide treatments were applied over first-year longleaf pine, (*Pinus palustris*Mill.,) seedlings to compare effects of sulfometuron formulations and hexazinone tank mixture ratios on weed control and pine tolerance. PRE Treatments included: sulfometuron methyl @ 3 oz prod/ac in both the commercial (Oust) formulation and with altered inerts (sulfometuron alt); hexazinone + sulfometuron (prepackaged mix of 63.2% and 11.8%, respectively) @ 10 and 13 oz prod/ac; 2 oz prod/ac sulfometuron alt + 16 oz prod/ac of hexazinone DF; 3 oz sulfometuron alt + 8 oz hexazinone DF; 10.67 oz prod/ac of hexazinone and the same rate followed by either POST 2 oz prod/ac of sulfometuron or sulfometuron alt.

Primary weed species included buckhorn plantain, goosegrass and field sandbur. All treatments provided good to excellent weed control through 16 WAT. None of the treatments caused significant pine seedling mortality or phototoxicity.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

THIRD-YEAR PINE GROWTH RESPONSE TO WOODY RELEASE TREATMENTS INCLUDING OUST XP. A.W. Ezell, J.L. Yeiser, and L.R. Nelson; Mississippi State University, Starkville, MS; Stephen F. Austin State University, Nacagdoches, TX; and Clemson University, Clemson, SC.

ABSTRACT

A total of six or eight herbicide treatments were applied to loblolly pine plantations in September of the second growing season after planting. Six treatments were applied in Texas and South Carolina and eight were applied in Mississippi. The treatments including Oust XP provided excellent weed control the growing season following applications except those plots in Texas which contained wooly croton. Both height and diameter growth were enhanced by the treatments, during the second year after treatment, especially in Mississippi where better herbaceous weed control resulted due to a lack of wooly croton in the plots. Third-year growth measurements were recorded in Mississippi and the trends observed in the second year continued in year three following treatment. Overall, treatments containing Oust XP resulted in better height and diameter growth. Only the highest rate (16 oz/A) of Arsenal AC alone provided growth as good as the treatments which contained Oust XP and a lower rate of Arsenal AC.

SYMPOSIA

FORESTRY IN THE NEW MILLENIUM

ONE- AND TWO-PASS CHEMICAL SITE PREPARATION TREATMENTS FOR YAUPON CONTROL AND INTEGRATED SAME-YEAR CONTAINERIZED SOUTHERN PINE PLANTINGS.

J.L. Yeiser, Stephen F. Austin State University, Arthur Temple College of Forestry and Agriculture, Nacogdoches, TX 75962.

ABSTRACT

One-pass (ULW treatment) and two-pass (ULW treatment followed in 8 weeks by foliar sprays) herbicide site preparation treatments were applied to investigate yaupon control and the integration of site preparation with same year containerized plantings. One site near Elizabeth, LA was tested. Two-pass treatments provided more brownout than one pass treatments 30 days after treatment (DAT). At 60 DAT, brownout on most treatments was similar. Two-pass treatments containing Oust XP had less herbaceous cover 180 DAT than single-pass ULW treatments. Loblolly and slash seedlings were taller on treated than untreated plots. Loblolly, slash, and longleaf seedlings were larger in ground line diameter on treated than untreated plots. Numerically, seedlings on two-pass plots were larger than one-pass plots. Each year more longleaf seedlings flushed on two-pass than one-pass than check plots. One- and two-pass treatments provided similar yaupon control. Two- and one-pass chemical site preparation can be integrated with planting of containerized southern pines for reduced regeneration lag.

INTRODUCTION

Weather and harvesting date may delay the preparation of harvested acres planned for preparation. These acres are carried forward for subsequent preparation and planting. Managers need flexibility in site preparation methods that avoid regeneration lag and favor prompt reforestation.

Yaupon is a common evergreen shrub found along the coast of Virginia southward to Florida. It extends across Florida into Texas. Yaupon has a thicket forming habit characterized by an aggressive rootstock supporting one stem 10 to 20 ft. in height or many shorter stems beneath a low, dense crown. It is a common competitor on southern pine sites in Louisiana and Texas.

The objective of this study was to investigate one- and two-pass chemical site preparation alternatives for the control of yaupon and the reduction of regeneration lag on harvested sites.

METHODS

One site near Elizabeth, LA on land owned by Forest Capital Partners was tested. Table 1 summarizes site conditions, major competitors, and herbicide application dates. Liquid herbicides were applied at a total volume of 10 GPA.

Fifteen seedlings of loblolly, slash, and longleaf pine were planted on 3-ft x 3-ft spacing in the middle 10-ft of treatment plots. Seedlings were assessed for survival and measured for total height (H) and ground line diameter (D) after one, two and three growing seasons. Volume Index was computed as VI=H*(D*D). Visual evaluation of plots was conducted at 30 and 60 days after treatment (DAT) of plots with a foliar spray of herbicide (Table 2). Herbaceous cover was assessed 180 DAT.

Plots were established in a randomized complete block with four blocks. Analyses of variance were conducted on weed control and seedling survival and growth. Duncan's New Multiple Range test (α=0.05) was used to separate treatment means.

RESULTS

Weed Control
Thirty DAT, total vegetation brownout was greatest with three, two-pass treatments (4lb ULW followed by VMF and Garlon 4 mixes) and a single-pass treatment of 5.33 lb ULW (Table 2). A two-pass WeedMaster mix was

intermediate and single-pass treatments of 4.67 or 4 lb of ULW provided least brownout. Woody plant brownout, as well as wax myrtle and yaupon specifically, was best for three, two-pass treatments (4 lb ULW followed by VMF or Garlon 4 mixes) > a single pass of 5.33lb ULW or two-pass WeedMaster mix > single-pass treatments of 4.67 lb or 4 lb ULW alone. Sixty DAT, total vegetation brownout was significantly higher for two-pass treatments and 5.33lb ULW than 4 lb ULW alone. Woody plant brownout was similar for all treatments. Three, two-pass treatments (4lb ULW followed by VMF and Garlon 4 mixes) provided more brownout of wax myrtle than 4lb of ULW alone. All four two-pass treatments and 5.33lb ULW browned yaupon better than a single-pass of 4.0 lb ULW. At 180 DAT, herbaceous cover (data not presented) was less (30%) for three, two-pass treatments (4lb ULW followed by VMF and Garlon 4 mixes) and a single-pass treatment of 5.33 lb ULW than (60%) for the two-pass WeedMaster mix and 4 or 4.67lb of ULW. Other treatments were (45%) intermediate and similar to treatments with higher and lower levels of herbaceous cover. Herbaceous colonizers of plots were common broomsedge, Florida paspalum, rushes and sedges. Yaupon levels three years after treatment were similar for two-pass and one-pass treatments.

Seedling Survival
After three growing seasons, survival exceeded 73% for all species and treatments. Untreated checks were intermediate in rank for loblolly, slash, and longleaf pines. Some single-pass and two-pass treatments ranked above and below checks.

Seedling Performance
Much similarity was observed for age two and three loblolly pine growth for two-pass and single-pass treatments. Differences mostly commonly occurred between extremes in performance. For example, after two growing seasons, loblolly pine H was less on checks than on plots prepared for planting with two-pass treatments and single-pass ULW high rates (4.67, 5.33lb) (Table 3). For D, ULW (4lb) and check plots had smaller trees than VMF Glyphosate+Oust XP+Optima (64+2+32) plots. VI was significantly less on checks than plots prepared with three, two-pass treatments (ULW 4lb followed by Garlon 4+Oust XP+Optima (64+2+32), VMF Glyphosate+Oust XP+Optima (64+2+32), VMF Glyphosate+Garlon 4+Optima (64+64+32)). At age three, H was similar for two- and single-pass treatments but larger than for checks. D was least on checks and similar for most single- and two-pass treatments. Age three VI was greater on three, two-pass treatments (ULW 4lb followed by Garlon 4+Oust XP+Optima (64+2+32), VMF Glyphosate+Oust XP+Optima (64+2+32), VMF Glyphosate+Garlon 4+Optima (64+64+32) and one single-pass ULW treatment (5.33lb) than on checks.

Age two and three slash pine H and D was greater for treated than untreated plots (Table 3). Numerically, age two and three H and D were larger for two-pass than one-pass treatments.

Age two H reflects the grass stage of longleaf seedlings (Table 3). Seedling D on treated plots was larger than on checks. Age three H shows early evidence of seedlings coming out of the grass stage. That is, the check at age 1, 2, and 3 had 0, 0, and 2 seedlings, respectively, that had flushed and all of these had a D > 1.0”. Single-pass ULW treatments at age 1, 2, and 3 averaged 3, 14, 21 flushed seedlings, respectively, all with a D > 1.0”. Two-pass treatments at age 1, 2, and 3 had 9, 91, and 119 flushed seedlings, respectively, all with D > 1.0. Clearly, more seedlings in two-pass plots than in one-pass plots than in checks flushed from the grass stage each year.

Table 1. Description of study location, herbicide application dates, major competitors, and planting stock and date.

Location	Elizabeth, (Allen Parish), LA; Forest Capital Partners; Loblolly pine
Physiography	Upper Coast Plain transition into the Lower Coastal Plain
Soil	Loam over Silty Clay
Harvest	Jan 2001
Site Prep #1	ULW on 22-Mar-02
Site Prep #2	Foliar Spray on 22-May-02
Major Arborescents	Sweetgum, Maple, Ash, Sassafras, Persimmon
Shrubs	Yaupon, Southern Bayberry, Vaccinium,
Semi-Woody	American Beautyberry
Brambles	Rubus
Major Grasses	Purple lovegrass (Eragrostis), panic grasses (Panicum, Dichanthelium), Sedges

	(Cyperus), Common broomsedge (Andropogon), Florida Paspalum (Paspalum)
Planted	Hand; Containerized; 6-Jun-02
Herbicide Plots	Treatment 30-ft x 100-ft; Assessment 10-ft x 80-ft
Equipment	SOLO backpack blower modified for ULW application CO_2 backpack; a single KLC-9 nozzle; 7-ft straight boom

Table 2. One- and two-pass herbicide treatments for site preparation and resultant brownout (%) 30 and 60 days after treatment (DAT) with the foliar spray.

ULW (lb/ac)	Herbicide[1] Rate (product oz/ac)	Total	Woody	Wax Myrtle	Yaupon
30 DAT---22-Jun-02					
4	VMF Glyphoste+Oust XP+Optima (64+2+32)	88a	88a	88a	88a
4	VMF Glyphosate+Garlon 4+Optima (64+64+32)	88a	88a	88a	88a
4	Garlon 4+Oust XP+Optima (64+2+32)	88a	88a	88a	88a
5.33	none	85a	68b	70b	75b
4	WeedMaster+Escort XP+Optima (64+1+32)	78b	68b	68b	75b
4.67	none	68c	58c	58c	58c
4	none	68c	58c	58c	58c
60 DAT---22-Jul-02					
4	VMF Glyphosate+Oust XP+Optima (64+2+32)	92a	92a	99a	97a
4	VMF Glyphosate+Garlon 4+Optima (64+64+32)	98a	95a	99a	98a
4	Garlon 4+Oust XP+Optima (64+2+32)	92a	86a	99a	95a
5.33	none	93a	88a	94ab	95a
4	WeedMaster+Escort XP+Optima (64+1+32)	90a	91a	92ab	92a
4.67	none	83ab	80a	90ab	87ab
4	none	73b	73a	70b	73b

[1] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

Table 3. One- and two-pass herbicide treatments for site preparation and resultant seedling total height (H-ft), ground line diameter (D-in), and volume index (VI-ft^3) at ages 2 and 3.

ULW (lb/ac)	Herbicide[1] Rate (product oz/ac)	H2	D2	VI2	H3	D3	VI3
Loblolly Pine							
4	Garlon 4+Oust XP+Optima (64+2+32)	3.16a	.80ab	.0164a	6.73a	1.72a	.1613a
4	VMF Glyphosate+Oust XP+Optima (64+2+32)	3.79a	.86a	.0227a	7.39a	1.64ab	.1546a
4	VMF Glyphosate+Garlon 4+Optima (64+64+32)	3.25a	.72ab	.0166a	6.62a	1.39ab	.1365a
5.33	none	3.32a	.67ab	.0144ab	7.10a	1.48ab	.1352a
4	WeedMaster+Escort XP+Optima (64+1+32)	3.27a	.70ab	.0143ab	6.47a	1.37ab	.1069ab
4.67	none	3.30a	.62ab	.0106ab	6.60a	1.19ab	.0795ab
4	none	2.73ab	.54b	.0078ab	5.86a	1.08b	.0700ab
None	none	1.84b	.27c	.0011b	3.46b	0.50c	.0078b
Slash Pine							
4	Garlon 4+Oust XP+Optima (64+2+32)	3.51a	.87ab	.0237a	7.28a	1.89a	.2068a
4	VMF Glyphosate+Garlon 4+Optima (64+64+32)	3.74a	.89a	.0230a	7.35a	1.89a	.2012a

4	WeedMaster+Escort XP+Optima (64+1+32)	3.28a	.71ab	.0143ab	6.73a	1.59ab	.1473ab
4	VMF Glyphosate+Oust XP+Optima (64+2+32)	3.52a	.76ab	.0186a	6.91a	1.55ab	.1462ab
5.33	none	3.49a	.73ab	.0173a	6.74a	1.50ab	.1261ab
4	none	3.36a	.68ab	.0126ab	6.65a	1.41ab	.1064abc
4.67	none	3.17a	.64b	.0120ab	6.13a	1.20b	.0801bc
None	none	2.44b	.37c	.0027b	4.58b	0.72c	.0212c

Table 3. One- and two-pass herbicide treatments for site preparation and resultant seedling total height (H-ft), ground line diameter (D-in), and volume index (VI-ft^3) at ages 2 and 3---continued.

ULW (lb/ac)	Herbicide[1] Rate (product oz/ac)	H2	D2	VI2	H3	D3	VI3
Longleaf Pine							
4	Garlon 4+Oust XP+Optima (64+2+32)	.37a	1.17a	.0044a	1.71a	1.46a	.0328a
4	VMF Glyphosate+Oust XP+Optima (64+2+32)	.36ab	1.18a	.0040a	1.18ab	1.34ab	.0185ab
5.33	none	.31abc	1.01a	.0027abc	0.96abc	1.16bc	.0130ab
4	WeedMaster+Escort XP+Optima (64+1+32)	.26bcd	1.06a	.0024bcd	0.84abc	1.25abc	.0114b
4	VMF Glyphosate+Garlon 4+Optima (64+64+32)	.27abc	1.10a	.0029abc	0.77bc	0.21abc	.0108b
4.67	none	.25cd	0.99a	.0020bcd	0.60bc	1.11bc	.0065b
4	none	.22cd	0.97a	.0017cd	0.54bc	1.00c	.0047b
None	none	.16d	0.67b	.0006d	0.19c	0.69d	.0008b

[1] Treatment means within a column sharing the same letter are not significantly different (Duncan's New Multiple Range Test α=0.05).

BROADLEAF WEED CONTROL USING OVERDRIVE TANK MIXTURES. D.P. Montgomery, C.C. Evans, and D.L. Martin; Horticulture and Landscape Architecture Department, Oklahoma State University, Stillwater, OK 74078.

ABSTRACT

A roadside weed control study was conducted during the summer of 2004 to evaluate Overdrive tank mixes for effectiveness in controlling summer broadleaf weeds. Overdrive was evaluated at 4, 6, & 8 oz. prod. /A alone with the 4 oz. prod. /A rate being used for all tank mix treatments. Herbicides used for tank mixes were Escort at 0.25 & 0.5 oz. prod. /A, Telar at 0.25 & 0.5 oz. prod. /A, 2,4-D amine 8 & 16 oz. prod. /A, MicroFlo triclopyr 3A at 8 & 16 oz. prod. /A, and Vanquish at 8 & 16 oz. prod. /A. All treatments included Surf King non-ionic surfactant at 0.25 % V/V. Treatments were applied on 26 May to broadleaf weeds ranging in height from 0.5 inches to 6 inches. 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 a randomized complete block design. Visual weed control ratings were taken for marestail (*Conyza canadensis*) and palmer amaranth (*Amaranthus palmeri*) at 13, 27, 56, and 84 days-after-treatment (DAT). Ratings were also collected on common bermudagrass injury.

Before summarizing the weed control results from this study it needs to be pointed out that at the day-of-treatment all vegetation was actively growing but soil moisture conditions were dry. Soon after initial treatment untreated weeds began to show drought symptoms (13 DAT) with the drought persisting for another week to ten days before rainfall. Evaluations made at 55 and 84 DAT were made with ideal growing conditions as evidenced by increased weed control and subsequent rainfall. The early drought conditions during the first several weeks of this study were likely responsible for the slow weed control responses.

Evaluations made on marestail control at 13 DAT showed moderate levels of growth suppression from all treatments. Complete vertical growth suppression and a small amount of chlorosis at terminal growing point but no necrosis was evident from all treatments. At 27 DAT growth suppression increased from all treatments with increasing levels of chlorosis but still very little necrosis or actual control was being achieved. At 55 DAT ratings large crabgrass had grown to about 14 inches in most plots and the small marestail plants were no longer visible and evaluations were not taken. However marestail plants did not outgrow the suppression as none were noticed above the canopy of crabgrass or bermudagrass for the duration of the study. Palmer amaranth was the most predominant broadleaf weed in the study. At 13 DAT evaluations palmer amaranth control ranged from 35-58% with control increasing to 35-73% at 27 DAT. At 27 DAT all treatments, despite the slow activity from the dry conditions, were producing moderate (48%) to good control (73%) except treatments including Telar. At 55 DAT, after good rainfall, palmer amaranth control increased for all treatments. While Telar treatments were not producing acceptable control most other treatments were producing good (72%) to excellent control (93%) of palmer amaranth. The combinations of 2,4-D/Overdrive were producing 88 to 90% control of palmer amaranth. By the final 84 DAT evaluations, control for all treatments had increased again as mid summer rains promoted palmer amaranth growth in untreated plots. All treatments, excluding Telar, were producing at least 80% control with treatments of Overdrive 6 & 8 oz. alone, 2,4-D, triclopyr 3A, and Vanquish producing excellent control. Very little to no common bermudagrass injury was noticed due to any of the treatments throughout the duration of this study. Many of the herbicides and rates used in this study would likely produce moderate levels of broadleaf weed control when used alone. However tank-mixing some of these products at the lower rates may have potential to produce acceptable broadleaf weed control while helping to minimize treatment costs.

JOHNSONGRASS CONTROL WITH GLYPHOSATE FORMULATIONS IN OKLAHOMA. C.C. Evans, D.P. Montgomery, and D.L. Martin; Horticulture and Landscape Architecture Department, Oklahoma State University, Stillwater, OK 74078.

ABSTRACT

A roadside weed control study was conducted during the summer of 2004 to evaluate johnsongrass (*Sorghum halepense (*L.*) Pres.*) control with six glyphosate formulations tank mixed at two rates with Outrider. Each glyphosate formulation and rate was tank mixed with Outrider at 1.33 oz prod. / A. Glyphosate formulations were MON 78754, 10 & 13 oz / A, MON 79688, 8.25 & 10.7 oz / A, MON 79730, 8.25 & 10.7 oz / A, MON 78503, 7.4 & 9.6 oz / A, MON 79527, 8.25 & 10.7 oz / A, and MON 79528, 8.25 & 10.7 oz / A. Treatments were applied 18 May to johnsongrass ranging in height from 12 inches to 18 inches. Treatments were applied to 5 by 15 foot plots using a CO_2 powered boom sprayer calibrated to deliver 30 gallons of spray solution per acre. Treatments were replicated 3 times in a randomized complete block design. Visual weed control ratings were taken for johnsongrass at 7, 14, 28, 56 and 84 days-after-treatment (DAT). Ratings were also collected on common bermudagrass (*Cynodon dactylon* var. *dactylon*) injury at 7, 14 and 28 DAT.

Most treatments were producing moderate amounts of johnsongrass control (51-75%) at 7 DAT. MON 79528 and 79503 were producing the best control at the higher rate. At 14 DAT all treatments were providing increased levels of johnsongrass control. The higher rates of MON 79528, 79688, 79503, and 79527 were all producing good (81 – 88%) control of johnsongrass with other rates and formulations producing moderate control levels. At 28 DAT all treatments were showing slight decreases in johnsongrass control which was possibly due to abundant rainfall during June. MON 79527, 79528, and 79688 formulations were still maintaining good johnsongrass control (80-81%) at 28 DAT. At 56 DAT the high rate of MON 79527 was the only treatment maintaining an 80% or greater level of johnsongrass control (84%). MON 79688 and 79503 were producing johnsongrass control levels of 78 and 79%. At the final 84 DAT evaluations only the MON 97527 was maintaining johnsongrass control levels above 80% (83%). The formulations MON 79688 and 79503 were maintaining johnsongrass control levels of 78 and 76%. Any treatment able to maintain $\geq$ 80% or better johnsongrass control at 84 DAT during wet summer should yield positive results in a roadside weed control program. Common bermudagrass injury ranged from 2-10% through the 28 DAT evaluations. This level of injury is acceptable for roadsides. This study was conducted using a blind format where we did not know the chemical identity of the MON glyphosate formulations. Many of the formulations that performed well in the test were experimental formulations that may be commercialized in the near future.

TALL FESCUE (*FESTUCA ARUNDINACEA*) UTILITY TURF MANAGEMENT WITH JOURNEY AND PLATEAU. J.S. McElroy and G.K. Breeden, University of Tennessee, Knoxville, TN.

ABSTRACT

Journey is a new herbicide for tall fescue seedhead suppression in utility turfgrass and highway right-of-way areas. Journey is a pre-package mixture of imazapic and glyphosate that was introduced as a replacement of Plateau, a herbicide containing imazapic alone, in the utility turfgrass market. Glyphosate is only contained in minor amounts in Journey and provides little to no weed control at recommended rates for tall fescue seed suppression. The addition of glyphosate to imazapic, albeit at low concentrations compared to glyphosate non-selective herbicide formulations such as Roundup, still leaves end-users hesitant about using the product. Many utility turfgrass managers in Tennessee, such as airports, municipalities, and Department of Transportation officials have voiced concern about potential injury from glyphosate in the Journey product compared to the standard Plateau formulation. Research was conducted in 2004, therefore to evaluate the use of Journey for tall fescue seedhead suppression compared to Plateau.

Research was conducted in 2004 at the University of Tennessee, Knoxville Experiment Station- Plant Sciences Unit, Knoxville, TN. The experiment was conducted on a tall fescue pasture area managed as a right-of-way, with approximately four to six yearly mowings and no fertility added over the past 3 years. Soil was an Etowah silt loam with a pH of 5.4. Eight treatments, plus a non-treated check, where included in the experiment. Plateau treatments contained 0.031, 0.047, 0.063, 0.125 lb ae/a of imazapic. Journey treatments contained the same amount of imazapic, with the addition of 0.063, 0.094, 0.125, and 0.250 lb ae/a of glyphosate, respectively. Equivalent Plateau product rates were 2.0, 3.0, 4.0, and 8.0 fl oz/a. Equivalent Journey product rates were 5.3, 8.0, 10.7, and 21.3 fl oz/a. All treatments included 0.25% v/v NIS. The experiment was conducted in a randomized complete block design with four replicates. Ratings of tall fescue injury and seedhead number was rated at 2 and 7 weeks after treatment (WAT). Tall fescue injury was rated on a scale of 0 (no visible phytotoxicity) to 100 (complete plant necrosis)%. Seedheads suppression was rated on a similar scale were 0% was equal to similar seedhead number compared to the non-treated and 100% was equal to no observed seedheads in the treated area. Data were subjected to analysis of variance ($p = 0.05$). Journey and Plateau treatments were plotted with increasing imazapic concentrations and the model equations fit to describe the observed trend.

Increasing rates of Journey resulted in a linear increase in tall fescue injury 2 weeks after treatment (WAT). Journey at 21.3 fl oz/a injured tall fescue approximately 28%, while no other Journey treatment exceeded 20% injury. No Plateau treatment exceeded 20% injury 2 WAT. Increasing rates of Journey injured tall fescue exponentially 7 WAT. Journey applied at 21.3 fl oz/a exceeded 80% tall fescue injury, a large increase from approximately 28% injury from a 10.7 fl oz/a application. An equivalent imazapic rate applied as Plateau, however, did not exceed 30% tall fescue injury. Little difference was observed between Journey and Plateau when applied in equivalent amounts of imazapic at 0.031 or 0.047 lb ae/a. These data indicate that the additional glyphosate contained within Journey causes no additional tall fescue phytotoxicity when applied at up to 8 fl oz/a of Journey. However, rates above 8 fl oz/a should not be applied due to the potential injury.

All Journey and Plateau treatments reduced tall fescue seedheads 100% compared to the non-treated at both 2 and 7 WAT, indicating the effectiveness of both herbicides for tall fescue seedhead suppression. While further ratings were warranted to assess the longevity of tall fescue seedhead suppression, the emergence of dallisgrass and dallisgrass seedheads around mid-June greatly confounded such a task. In fact, by early July little tall fescue was observed at all in any of the plots as the experiment area was dominated throughout by dallisgrass. By late September/early October, however, the stand was again dominated by tall fescue, with the dallisgrass subsiding in growth. Such a coexistence seems common in tall fescue roadsides of Tennessee and due to this fact, the predominant grass mowed during June, July, and August is dallisgrass, not tall fescue. Further research is needed to assess potential growth and seedhead suppression options for dallisgrass in mixed tall fescue/dallisgrass utility turfgrass stands.

EVALUATION OF TURF GROWTH REGULATORS FOR TALL FESCUE (*Festuca arundinacea* Schreb.) SEEDHEAD SUPPRESSION. M.P. Blair; Department of Agronomy, University of Kentucky, Lexington, KY 40546.

ABSTRACT

Herbicides marketed specifically for tall fescue seedhead suppression and broadleaf weed herbicides labeled for tall fescue seedhead suppression are commonly used by landowners to reduce mowing frequencies. The Kentucky Transportation Cabinet (KTC) specifically uses these compounds to suppress tall fescue seedheads in areas where it is cost prohibitive to mow. The standard treatment for the KTC is Stronghold at 12 fluid ounces per acre. A study was designed to examine rate titrations and tank mixtures of labeled seedhead suppressants for efficacy in tall fescue seedhead suppression and discoloration to tall fescue foliage.

The trial was installed in two locations; one located at Princeton, KY in western Kentucky and one located at Lexington, KY in central Kentucky. A randomized complete block design with three replications (blocks serving as replicates) was installed at each site and 25 treatments were applied at 20 GPA using a CO_2 powered sprayer. The Princeton trial was installed on April 5th, 2004 and the Lexington trial was installed on April 27th, 2004. Plots were 7' X 25' and all treatments included a nonionic surfactant at 0.25% v/v. Treatments included Stronghold (a.i. mefluidide, imazethapyr, and imazapyr) at 8, 12, and 16 fl oz / ac, Stronghold at 2, 3, and 4 fl oz / ac with each being tank mixed with Escort (a.i. metsulfuron methyl) at 0.25 and 0.5 oz / ac, Plateau (a.i. imazapic) at 1, 2, 3, and 4 fl oz / ac, Plateau at the same rates with each being tank mixed with Escort at 0.25 and 0.5 oz / ac, Escort alone at 0.25, 0.33, and 0.5 oz / ac, and an untreated control. Color evaluations were made 1, 6, and 12 WAT at both sites using a 0 to 9 scale (0 = severely damaged, 9 = fully green). Color data were analyzed using the GLM procedure in SAS® and treatment means were compared using Fisher's LSD at $p = 0.05$. Tall fescue seedhead density measurements were made 6, 8, and 10 WAT at Princeton and 4, 6, and 8 WAT at Lexington. Density was estimated using categorical data and analyzed using nonparametric macros in SAS that incorporated the RANK and MIXED procedures.

The Princeton site experienced higher degrees of discoloration (means ranged form 3.3 to 7) across all treatments at 6 WAT as compared to the Lexington site (means ranged from 4.5 to 7). This was attributed to the higher precipitation levels at Lexington in the month following application than the Princeton site. The high precipitation at Lexington (5 inches above normal for the month of May) may have ameliorated the effect of the herbicide on tall fescue vegetative growth. A general rate response was observed at both sites as increasing rates increased discoloration.

Stronghold at 12 fl oz / ac and Stronghold at 3 fl oz plus Escort at 0.25 oz provided complete inhibition of tall fescue seedhead growth from 6 WAT through 10 WAT at the Princeton site. Plateau alone at 2 and 3 fl oz was also effective in complete inhibition through the same time period at Princeton. Several Plateau plus Escort treatments, 1 fl oz + 0.25 oz, 3 fl oz + 0.25 oz, 4 fl oz + 0.25 oz, and 2 fl oz + 0.5 oz respectively, were effective in complete inhibition at the same time period at Princeton. Only Plateau at 1 fl oz, Plateau at 1 fl oz and 2 fl oz + Escort at 0.25 oz, and Plateau at 2 fl oz + Escort at 0.5 oz provided total suppression at the Lexington site and this occurred 8 WAT. No one treatment of Escort alone was effective in satisfactory seedhead suppression at either site.

It is known that timing of application is crucial because seedheads developed before the application of these compounds are not suppressed. The timing of the application at Lexington may have been too late as this site saw limited suppression of seedheads at the same time intervals compared to the Princeton site. Different environmental factors between the two sites such as precipitation amounts also may have influenced the results.

VEGETATION MANAGEMENT WITH OVERDRIVE COMBINED WITH SULFONYLUREA HERBICIDES ALONG ROADSIDES. R.S. Wright, J.D. Byrd, Jr., and J.M. Taylor, Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Three experiments were conducted between 2002 and 2004 along roadsides across Mississippi to evaluate Overdrive alone or in combination with other MDOT approved products. All treatments were applied using a CO_2 pressurized backpack sprayer delivering 25 gallons per acre, and each experimental unit was 10 feet by 25 feet. Visual evaluations were made using a scale from 0 to 90% with 0 indicating no control and 90 indicating best control. All treatments were applied with an 80/20 non-ionic surfactant (NIS) at 0.25% V/V or methylated seed oil (MSO) at 24 fl oz/A.

Experiment 1 was initiated November 25, 2002. The treatments consisted of Overdrive 70WG at 4 and 6 oz/A, or Vanquish 4L at 0.125, 0.25, and 0.5 lb ae/A. At 116 and 175 days after application (DAA), Overdrive at 4 oz/A provided 88 and 90% control of spiny sowthistle [*Sonchus asper (*L.) Hill], while Vanquish at 0.125 lb ae/A provided only 53 and 58% control at the same rating date, respectively. No differences were observed when Overdrive at 4 or 6 oz/A was compared to Vanquish at 0.25 or 0.5 lb ae/A for control of spiny sowthistle 116 DAA. Carolina geranium (*Geranium carolinianum* L.) was controlled 67 and 73% with Overdrive at 4 and 6 oz/A respectively, and similar control was observed with Vanquish at 0.5 lb ae/A 116 DAA. Although, lower rates of Vanquish provided less Carolina geranium control compared to either rate of Overdrive 116 DAA.

Experiment 2 was initiated March 3, 2003. Treatments were as follows: Overdrive 70WG at 4 and 6 oz/A, Garlon 3A at 16 and 32 fl oz/A, or Overdrive at 4 oz/A combined with Garlon at 16 and 32 fl oz/A. Overdrive alone was applied with a NIS or MSO for comparison purposes. At 31 DAA, Overdrive at 4 and 6 oz/A with a NIS or MSO or Overdrive at 4 oz/A combined with Garlon at 16 and 32 oz/A controlled crimson clover (*Trifolium incarnatum* L.) 80 to 90%, which was higher than Garlon at 16 fl oz/A. The lowest level of Carolina geranium control was observed with Garlon at 16 fl oz/A 31 and 60 DAA. All treatments provided 70 to 90% control of wild carrot (*Daucus carota* L.), except Garlon at 16 fl oz/A 100 DAA.

Experiment 3 was initiated March 8, 2004. Treatments are as follows: Overdrive 70WG at 4 oz/A, Escort 60DF at 0.125, 0.25, and 0.5 oz/A, Telar 75DF at 0.125, 0.25, and 0.5 oz/A, or Overdrive at 4 oz/A combined with Escort at 0.125 and 0.25 oz/A, or Telar at 0.125 and 0.25 oz/A. All treatments provided excellent control (87 to 90%) of red sorrel (*Rumex acetosella* L.), except Telar at 0.25 and 0.5 oz/A which provided 63 or 70% control 57 DAA, respectively. Telar at 0.125 oz/A or Escort at 0.125, 0.25, or 0.5 oz/A provided 63% control of hairy vetch (*Vicia villosa* Roth), and Overdrive at 4 oz/A alone or combined with Escort or Telar provided 90% control 57 DAA. Escort at 0.125 oz/A provided 77% control of Canada goldenrod (*Solidago canadensis* L.), and all other treatments provided 90% Canada goldenrod control 57 DAA.

SYMPOSIA

WEED MANAGEMENT IN RIGHTS-OF-WAYS

UTILITY RIGHT-OF-WAY MANAGEMENT – POWER COMPANY PERSPECTIVE. G.E. MacDonald, University of Florida, Gainesville, FL; D. Marsh, Florida Power and Light, Ormond Beach, FL; J. House, Progress Energy, Monticello, FL; T. Maxwell, Gainesville Regional Utilities, Gainesville, FL; J. Hohman and T. Hayes; East Kentucky Power Cooperative, Inc., Winchester, KY; and D. Gabriel, Florida East Coast Railroad, Jacksonville, FL.

ABSTRACT

Vegetation management is a major component of the operational programs of both railroads and power company utilities. Railroads are required to maintain a vegetation-free zone along and within the track line. This is accomplished using a combination of pre-emergence and postemergence herbicide applications. Glyphosate is used extensively along with residual herbicides such as imazapyr and diuron. Vegetation is also maintained along the railroad easement, where a 12-inch height maximum is required. Many vegetation management schemes in this area are designed to promote bermudagrass (<i>*Cynodon dactylon*</i>). Mowing is used in residential areas, but chemical species control is employed whenever possible. Side-trimming of woody brush and trees along easement corridors is also chemically controlled with fosamine. The use of aerial application with helicopter is increasing due to logistical issues with personnel and downed track time.

Vegetation management in power line rights-of-way has changed dramatically over the last 10-15 years. Prior management focused on periodic vegetation removal when conditions became critical to proper power transmission. Since then, vegetation is managed to promote grasses, forbs and low-growing, low density shrub species. Aggressive mechanical removal is employed as the initial step, followed by a broad-spectrum herbicide application the following year. Vegetation management is typically on a 3-4 year cycle, but this depends on regrowth rate and species. Mechanical control is gradually being replaced by chemical control methods due to cost effectiveness and selectivity. Aerial applications are not employed; all herbicides are applied on the ground via backpack sprayers, tractors, ATV’s, etc. Side trimming and removal of danger trees remains a major concern, especially with the 2004 hurricane season. Substation vegetation control is entirely chemical based, utilizing a combination of pre-emergence and post-emergence herbicides.

Nearly all vegetation management is contracted to private sources. There is an increasing level of herbicide selection and vegetation decision-making process is being regulated to the contractor, resulting in performance-based contracts that require >95% control. In addition, mowing and herbicide contracts are being combined into an overall vegetation management system.

SYMPOSIA

WEED MANAGEMENT IN RIGHTS-OF-WAYS

WILDFLOWER ESTABLISHMENT IN VIRGINIA – CHALLENGES AND PERSPECTIVES.

P.L. Hipkins; Department of Plant Pathology, Physiology and Weed Science, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061.

ABSTRACT

Roadside beautification is an effort embraced by much of the traveling public. Often thought of as an apology for the scar a road imposes on the landscape, todays roadside managers view wildflower plantings as a way of inserting color into the landscape and helping to relieve the stress of driving on often overcrowded highways. To this end, roadside managers face two critical problems; a) to achieve adequate germination of wildflower seeds and b) to achieve adequate weed control.

Adequate germination is usually a function of purchasing high quality seed from a reputable dealer, planting at the prescribed rate and manner and having the luck of favorable temperatures and timely moisture. Weed control, on the other hand, can be more complicated.

Weed control efforts in Virginia have been varied with initial research focused on chemically sterilizing the soil of weed seeds and other living tissues. Methyl bromide provided excellent weed control and excellent flower plantings were realized. However, the product was rejected by the Virginia Department of Transportation due to its toxicity and the threat of plastic tarps being carried onto the highway in high wind situations. Sodium methyldithiocarbamate was evaluated and rejected due to the special equipment required and the amount of product needed per acre. Additionally, poor control of bermudagrass (*Cynodon dactylon*) and yellow nutsedge (*Cyperus esculentus*) was observed. Dazomet, a granular product was also evaluated and subsequently rejected due to the amount of product required per acre.

Preemergent compounds were evaluated, but found to control the wildflowers as well as the weeds when used at meaningful rates. However, the use of activated carbon as a seed protectant for drill sown wildflowers was shown to be a feasible option for post-planting preemergent herbicide applications. Carbon rates as low as 38 lb/A, applied in a liquid slurry over each furrow, were found to protect the seed from diuron, pendimethalin, and prodiamine at rates up to 0.75 lb a.i./A and oryzalin up to 0.50 lb a.i./A. The carbon slurry did not adequately protect the seed from imazapic, isoxaben, metholachlor, or simazine when used at rates adequate for weed control. This system did not adequately control established perennials, even with the addition of glyphosate at rates up to 6.0 lb a.i./A.

The most successful method required location siting and preparation beginning a minimum of two years in advance of any perennial seeding and one year in advance of the seeding of annuals. Light tillage and timely applications of glyphosate usually were adequate to reduce weed competition though willingness to sacrifice overly weedy plots is imperative.

SYMPOSIA

WEED MANAGEMENT IN RIGHTS-OF-WAYS

INTEGRATED APPROACHES TO COGONGRASS CONTROL ON HIGWAY RIGHTS-OF-WAY: A FOUR-YEAR SUMMARY. W.H. Faircloth, M.G. Patterson, D.H. Teem, and J.H. Miller, Auburn University and U.S.D.A. Forest Service, Auburn, AL.

ABSTRACT

Integrated vegetation management strategies were investigated for treating cogongrass infestations on highway ROW and restoring them to more desirable plant communities. Management strategies included herbicides, competitive exclusion utilizing grass and clover species, and mechanical control (mowing). Two studies were designed to compare multiple combinations of herbicides, both chemistry and timing, and competitive exclusion. In order to investigate multi-year treatments, both studies were replicated three times such that a time factor could be examined. The three series were designated as ‘regimes.’ At initiation, all three regimes were treated. In yr two of the study, only the two yr and three yr regimes were retreated. During the third and final yr of the study, only the three yr regime was retreated. Thus, each of the original test treatments could be evaluated using one, two, and three years of treatment (regimes).

Study one was initiated near Loxley, AL, in 2000. Fall herbicide treatments were ranked from highest control to least control as follows at Loxley: imazapyr alone, followed by the tank-mix of glyphosate plus imazapyr, followed by glyphosate alone. Data from Loxley indicated that multiple year treatment of cogongrass was necessary for control. Mean control increased from 35% to 88% between a one and three year regime 12 months after final treatment (MAT) at Loxley, and a three year regime gave both the greatest visual control and the lowest stand densities 24 MAT. Within the three year regime, the tank mix combination of glyphosate plus imazapyr consistently increased control and decreased density versus other fall-applied herbicides. Spring re-treatment with glyphosate was needed to reduce density but not to increase visual control. The establishment of either bahiagrass or bermudagrass was not achieved in this field study.

Study two was initiated at Malbis, AL. in 2001 and based on preliminary findings from Loxley. Mean control was greater at Malbis as control increased from 62% to 94% between the one and two year regimes 12 MAT. Fall-applied glyphosate plus imazapyr increased visual control and decreased stand density versus glyphosate. Spring re-treatment with glyphosate was significant for neither visual control nor stand density at Malbis. The establishment of either bahiagrass or bermudagrass was achieved only at Malbis in a two year regime. The use of cover crops between fall and spring herbicide application was inconsistent in affecting control or stand density between both locations. The three year regime has yet to be evaluated 12 MAT.

A third study was designed to explore possible interaction between mowing and the herbicides imazapyr and glyphosate. The mowing study was initiated in May 2002 near Theodore, AL. Mowing was performed with a flail-type mower to a height of 8 cm, or approximately the same height as ROW maintenance crews. Mowing alone neither positively nor negatively affected growth of cogongrass at frequencies up to twice per month. A sequential (spring followed summer) application of glyphosate gave complete above-ground control at the end of year one, however, regrowth was evident at the end of year two.

SYMPOSIA

WEED MANAGEMENT IN RIGHTS-OF-WAYS

COMPARISON OF COMBINED MOWER AND SPRAYER SYSTEMS FOR WEED MANAGEMENT.

G.E. MacDonald, University of Florida, Agronomy Dept., Gainesville, FL; B.J. Brecke and J.B. Unruh, University of Florida, West Florida REC, Milton, FL.

ABSTRACT

There has been a dramatic increase and interest in the use of mowers (primarily PTO driven) that combine herbicide application into a single operation. This is attractive to many agencies and contractors due to increased cost savings, decreased public concerns regarding pesticide application and potentially more effective weed management. There are two basic types of systems available. One system deposits spray material onto the blade, which is subsequently transferred to the stem during the cutting process (cutting blade delivery system – CBDS) while the other system broadcast sprays material onto the cut material immediately after the cutting operation. Each system provides acceptable control but the cost of each system is extremely variable. This had lead many agencies to question which system is more effective and if higher initial costs can be offset by better long term weed management.

To address this concern, studies were conducted at the University of Florida. The first addressed the amount of spray material that would be deposited onto a cut stem surface as a function of mower system. Coffee stirrers were mounted vertically from the ground surface and mowed using the CBDS unit at 1, 2 or 2.5 gallons per acre. The simulated broadcast treatment was mowed and then sprayed with a conventional boom sprayer at 20 gallons/acre. The treatment solution for all applications was a blue dye (a 50:50 mix of Lesco Tracker Dye and water). Each stirrer was clipped at the base and placed in 10 ml water. The solution was then measured spectrophotometrically to determine the amount of material deposited onto the stirrer. The conventional boom sprayer 5.5 to 11 times more material compared to the CBDS. However, a greater percentage of the total spray is deposited onto the stem with CBDS compared to the conventional application method.

An additional study was conducted using 14C radiolabeled triclopyr and glyphosate on seedling Chinese tallow, a common invasive species. Treatments included: 1) non-treated control, 2) mowed only control, 3) conventional foliar application, 4) conventional cut-stump application and 5) simulated CBDS application. There were similar results for both herbicides. In the cut, then spray treatment (4), most of the treated material was translocated to the leaves and stem tissue. In addition, the total amount absorbed by the tissue (whole plant) was 46% of the total amount applied. This is compared to the relatively low amount absorbed by the plants in the blade-cut treatment, where only 7.5% of the material was recovered in the plant from the triclopyr treatment while no glyphosate recovery occurred. From counts on the wash of the cutting blade (data not shown), most of the treatment solution remained on the blade during the cutting operation and was not moved into the plant tissue as readily as the cut, then apply treatment. Interestingly, the cut, then spray treatment showed nearly the level of total triclopyr uptake as the foliar spray (52 vs. 46%). In summary, applying the herbicide to the foliage or to the cut stem of a plant showed more uptake and movement of both glyphosate and triclopyr compared to applying the herbicide during the cutting action. This was primarily due to the lack of absorption by the stem tissue from the cutting blade and/or losses during the cutting operation.

CHARACTERIZATION OF *ASPERGILLUS FLAVUS*, AFLATOXIN, FUMONISIN IN CORN: EFFECTS OF COVER CROP, ROTATION, AND GLYPHOSATE. K.N. Reddy, H.K. Abbas, C.H. Koger, R.M. Zablotowicz, and C.A. Abel. USDA-ARS, Southern Weed Science Research Unit, Crop Genetics and Production Research Unit, and Southern Insect Management Research Unit, Stoneville, MS 38776.

ABSTRACT

Corn and cotton seed are frequently contaminated with aflatoxins (AF) and fumonisins (FUM) produced by *Aspergillus* and *Fusarium* fungi, making them unfit for human and animal consumption. Mycotoxin contamination is influenced by the level of infestation by toxigenic fungi and environmental factors that stress crop plants. In 1998, drought and high temperatures in Mississippi contributed to significant levels of both AF and FUM in corn. Because of food safety concerns, it is critical to investigate cultural practices and crop management techniques that maximize crop yields and minimize inoculum potential of the causal fungi and mycotoxin production. Glyphosate inhibits the enzyme 5-enolpyruvylshikimate-3-phophate synthase (EPSPS) in the shikimate pathway. Roundup Ready corn and cotton created by stable integration of a transgene that code for insensitive EPSPS are resistant to glyphosate. Fungi possess a sensitive EPSPS and are susceptible to glyphosate. Three field studies examined the effects of simple agronomic practices including crop rotation, cover crop, and selection of conventional and Roundup Ready cultivars on *Aspergillus flavus* in soil and levels of AF and FUM in corn and cotton seed.

A 5-yr cotton-corn rotation study was conducted during 2000 to 2004 on a Dundee silt loam at the Southern Weed Science Research Unit (SWSRU) farm, Stoneville, MS. There were four rotation systems (continuous cotton, continuous corn, cotton-corn, and corn-cotton) for each conventional and Roundup Ready cultivar arranged in a randomized complete block design with four replications. Glyphosate-based program in Roundup Ready cultivars and non-glyphosate-based program in conventional cultivars were used for weed control. *A. flavus* populations in surface 5-cm soil before planting (March/April) and harvest (September) ranged from 2.0 to 3.2 log (10) cfu/g soil with no clear trend among eight rotation systems in 2002, 2003, and 2004, although populations of *A. flavus* were significantly greater in plots with Roundup Ready cultivars compared to conventional cultivars on several sampling dates. In cotton seed, AF and FUM levels were (≤3 ppb and non-detectable, respectively) similar regardless of rotation and glyphosate. In corn grain, AF was above the regulatory level (≥20 ppb) only in Roundup Ready cultivar in 2004. Fumonisin was higher in conventional cultivar (4 ppm) regardless of rotation in 2004; however, in 2002 and 2003, the mycotoxins levels were similar regardless of rotation and glyphosate.

Field studies were conducted in 2002-2003 on a Dundee silt loam soil at SWSRU farm, Stoneville, MS. Two separate experiments were conducted for conventional (Pioneer 3223) and Roundup Ready (AG RX 738RR or DKC 69-72RR) corn in a split plot arrangement of treatments in a randomized complete block design with cover crop (hairy vetch and no hairy vetch) as main plot and glyphosate (applied in a 38-cm band over crop row, broadcast, and no herbicide) as subplot with four replications. Glyphosate only in Roundup Ready corn and non-glyphosate preemergent and postemergent herbicides in conventional corn were used. In corn grain, AF and FUM levels were low or non-detectable and unaffected by either hairy vetch cover crop or glyphosate in both years. These results indicate the potential for increased aflatoxin levels (1 of 3 years) in corn and a stimulation of *A. flavus* populations in a Roundup Ready cropping system under climatic conditions encountered in Mississippi.

FACTORS INFLUENCING COFFEE SENNA GERMINATION AND EMERGENCE. J.K. Norsworthy and M.J. Oliveira; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC 29634.

ABSTRACT

Laboratory and greenhouse experiments were conducted to determine the influence of light, temperature, moisture stress, solution pH, and burial depth on coffee senna germination and emergence. Seeds germinated equally with or without light and pretreatment with red or far-red light had no influence on germination. Optimum temperature for germination was 25 C, and a high germination percentage (>70%) occurred from 12.5 to 30 C. The lower temperature threshold for germination was between 10 and 12.5 C while the upper threshold was near 45 C. Temperature affected coffee senna germination in response to moisture stress and solution pH. No germination occurred at -0.4 MPa at 15 C, while 1% germination occurred at 30 C and -1.0 MPa. Optimum germination occurred at pH 6, with further increases in pH having a more negative affect on germination at 15 C than at 30 C. Coffee senna was more tolerant of acidic than basic solutions. Seed germination ranged from 9 to 12% at pH 3, while no germination occurred at pH 10, regardless of temperature. Depth-mediated emergence inhibition was sigmoidal with greatest emergence on the soil surface. In a sandy loam soil, emergence of seed from 2- to 10-cm depths reached 95% of the total emergence 1 to 3 d earlier than in a sand soil type. Mean emergence depth in the sand and sandy loam soils was 1.7 and 2.4 cm, respectively. Knowledge gained from this research will be instrumental in developing a better understanding of the requirements for coffee senna germination and emergence, allowing further development and improvement on integrated weed management strategies specific for this troublesome weed.

TOXICITY OF ISOTHIOCYANATES ON TROUBLESOME WEEDS OF THE SOUTHEASTERN UNITED STATES. J.T. Meehan, IV and J.K. Norsworthy; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC 29634.

ABSTRACT

Isothiocyanates are a family of chemicals primarily derived from Brassicaceae plants following hydrolysis of glucosinolates. Isothiocyanates are inherently effective in suppressing numerous soil-borne pests. With few herbicides labeled in fruiting vegetables and the impending loss of methyl bromide, producers will be left with few options to control weeds and protect highly valuable crops from weed interference. Our hypothesis was that isothiocyanates would exhibit herbicidal activity on the most troublesome weeds of fruiting vegetables of the southeastern United States. To test this hypothesis, our objective was to evaluate the herbicidal activity of eight isothiocyanates to understand the relationship between isothiocyanate structure and suppression of certain weed species. The compounds tested were five aliphatic (3-methylthiopropyl, allyl, butyl, ethyl, and propyl) and three aromatic (benzyl, phenyl, and 2-phenylethyl) isothiocyanates. The weeds evaluated were Palmer amaranth, large crabgrass, Texas panicum, sicklepod, pitted morningglory, and yellow nutsedge. Isothiocyanates were applied at 0; 10; 100; 1,000; and 10,000 nmol/g of soil, incorporated, and immediately placed in a greenhouse where each species was planted. Weed emergence was recorded 21 d after emergence of the non-treated control. The lethal concentration to reduce emergence by 50% (LC_{50}) was estimated using linear or non-linear regression.

Herbicidal activity varied by species and among isothiocyanates, without a clear and consistent relationship between structure and weed suppression. Emergence of most species was stimulated or not affected at low concentrations (10 or 100 nmol/g of soil), while at higher concentrations, isothiocyanates were often suppressive of emergence. All isothiocyanates exhibited herbicidal activity on the evaluated species, except 2-phenylethyl on yellow nutsedge. 3-Methylthiopropyl isothiocyanate was very biologically active, often being the most suppressive of all aliphatic isothiocyanates, based on LC_{50} values. Except for sicklepod, 3-methylthiopropyl and phenyl isothiocyanate reduced emergence of all species by at least 90% at 10,000 nmol/g of soil. Ethyl, propyl, and butyl isothiocyanate were generally the least effective among all compounds, except on Texas panicum in which emergence was suppressed at least 98% at 10,000 nmol/g of soil. This research demonstrates that isothiocyanates can be effective in suppressing the most troublesome weeds of the southeastern United States. Future research should focus on field application techniques that would minimize loss of volatile isothiocyanates which may further improve their potential as an effective means of controlling these and other troublesome weeds.

INTERFERENCE AND SEED RAIN DYNAMICS OF PALMER AMARANTH (*AMARANTHUS PALEMERI*) IN PEANUT. M. Schroeder, I. C. Burke, S. B. Clewis, C. M Wilcut, and J. W. Wilcut, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Palmer amaranth possesses many growth characteristics that make it one of the more competitive summer annual broadleaf weeds in peanut (*Arachis hypgaea* L.). It is capable of very high growth rates, prodigious seed production, and an extended period of germination. Palmer amaranth has been the subject of considerable research. It was ranked highest of four pigweed spp. (including common waterhemp (*Amaranthus rudis* Sauer), redroot pigweed (*A. retroflexus* L.), and tumble pigweed (*A. albus* L.)) based on various growth parameters including dry weight, leaf area, and height. Palmer amaranth reportedly produced up to 600,000 seeds per plant. Currently marketed postemergence herbicides allow growers to utilize economic thresholds for Palmer amaranth management in peanut. No studies have evaluated interference relationships or seed rain dynamics of Palmer amaranth and peanut. Therefore, studies were conducted to evaluate the competitiveness of Palmer amaranth and determine seed production when plants are grown at several densities in peanut.

Studies (RCBD, 3 replications) were conducted at Goldsboro and Rocky Mount in 2004. Each species was planted 10 cm from the peanut row at 0, 0.16, 0.32, 0.66, 1.31, 2.62, and 5.2 plants m^{-1} crop row. Undesirable weeds were removed throughout the season. Height and diameter of four peanut plants and height of up to four weed plants $plot^{-1}$ were determined bi-weekly throughout the season. Just before peanut harvest, all seed remaining on four plants in each plot were hand harvested. All weeds were then carefully removed and fresh and dry weights of four weeds $plot^{-1}$ were obtained. Peanut was then inverted, harvested and pod yield determined. Bi-weekly height data were fit to the Gompertz growth equation by plot and estimated parameters and year effects were evaluated by multivariate analysis of variance (Proc MANOVA) in SAS statistical software. For other dependent variables, ANOVA was conducted with sums of squares partitioned to test for linear and nonlinear effects of weed density and year effects. Regression analysis (linear or nonlinear depending on ANOVA) was used for the seven densities in peanut and trends with significant correlation coefficients were interpreted.

Palmer amaranth density did not influence peanut height or Palmer amaranth height, but it did influence peanut diameter. Palmer amaranth were taller than peanut for the majority of the season and were much taller (1.3 to 1.8 m for Palmer amaranth versus 0.2 m for peanut) during the last 5 to 7 weeks of the season. Maximum height was 175 cm for Palmer amaranth. Density-dependent effects on dry biomass $plant^{-1}$ were not significant ($P>0.05$) when Palmer amaranth was grown with peanut. Average dry biomass of Palmer amaranth when grown with peanut at various densities were 281 and 350 g $plant^{-1}$ for Goldsboro and Rocky Mount, respectively. Weed dry biomass m^{-1} was linearly related to peanut yield. Yield reductions do not account for harvesting efficiency since weeds were removed prior to peanut harvest. The large amount of plant material on mature plants and corresponding root biomass would likely reduce peanut harvest efficiency. The hyperbolic function ($Y=IX/(1+(IX/100))$), with asymptote constrained to 100%, explained the relationship between Palmer amaranth density and percent yield loss. The estimated value of I was 39. These data indicate that the Palmer amaranth is more competitive than common cocklebur (*Xanthium strumarium* L.) ($I=20.6$), fall panicum (*Panicum dicotomiflorum* Michx.) ($I=20.8$), and less competitive than common ragweed (*Ambrosia artimisiifolia* L.) ($I=68.3$). Palmer amaranth in this study formed a complete canopy at the higher densities and likely competed more effectively than all the aforementioned weeds but common ragweed for light. An economic threshold for application of imazethapyr ($46.23 ha^{-1} for chemical plus application) would be 1 plant in every 11.9 m of crop row. Palmer amaranth seed production was explained by the rectangular hyperbola equation. At the aforementioned economic threshold plant densities, seed production would be 44 million seed ha^{-1}. Seed production indicates that even at 1% germination in the subsequent season, Palmer amaranth would exist at a minimum of 44 plants m^{-2} following seed rain of an economic-threshold plant population. Thus, economic-threshold management in peanut would result in continual replenishment of Palmer amaranth seed.

IDENTIFICATION OF RICE-RED RICE CROSSES IN IMI- AND NON-RESISTANT RICE FIELDS OF ARKANSAS. D.R. Gealy[1], C.E. Wilson[2], L.E. Estorninos, Jr[2], H.L. Black[1] and H.Agrama[2]. USDA-ARS, Dale Bumpers National Rice Research Center, Stuttgart, AR[1], University of Arkansas, Division of Agriculture, Stuttgart, AR[2]

ABSTRACT

Interest in the dynamics of outcrossing between herbicide resistant rice and red rice has increased since the introduction of IMI herbicide resistant rice cultivars because of their almost synchronous flowering. Numerous suspected red rice crosses were collected from five neighboring counties in eastern Arkansas. Allele profiles developed from 17 simple sequence repeat (SSR) markers showed that most suspected crosses share alleles that are normally specific to either rice or red rice. Ten selected SSR markers from the original group of 17 were used in all subsequent analyses. Multidimensional scaling (MDS) analysis and clustering produced similar patterns. SSR data were used to infer population structure and assign individuals to seven populations. Genetic similarity and relationships among the genotypes were examined using the Euclidean genetic distance matrix. Plants collected from Jackson County were obtained from fields that had been planted to IMI rice in the previous year or in both the current and previous years and had survived at least two applications of imidazolinone herbicide. They were bushy, rough leaved, and headed much later than the IMI resistant rice. DNA analysis showed that these plants had heterozygous alleles consistent with CL 161 (IMI rice) and a common strawhull red rice in almost all of the 10 SSR markers and grouped in between strawhull red rice and cultivated rice standards in MDS plots and dendogram plots, suggesting that the plants were F_1 hybrids of IMI rice and a strawhull red rice. In Prairie County, short-statured suspected crosses had rough, green leaves, and green basal leaf sheaths (stems), and produced seeds with awns, blackhull, and red pericarp. They produced mostly homozygous alleles among red rice or cultivated rice standards. The tall-statured suspected cross from the same farm had some plants with smooth, light purple leaves and purple basal leaf sheaths, and produced awned, blackhulled or strawhulled, and red or white seeds. They produced several heterozygous alleles or had homozygous alleles consistent with red rice for some markers and CL 161 with other markers. These different phenotypic characteristics and heterozygous alleles suggest that variability was probably greater in the tall- than in the short-statured crosses. Both tall and short types appear to be crosses that have undergone multiple generations of self fertilization because they have a relatively low incidence of heterozygous alleles. Other suspected rice and red rice crosses were collected from Arkansas, Lawrence, and Woodruff Counties. They generally produced homozygous alleles of red rice or cultivated rice standards. Most of them were genetically grouped near the blackhulled and awned red rice standards although some were strawhulled and awnless. These results show the value of phenotypic characterization and SSR analysis to follow the red rice and rice gene flow.

INTERFERENCE OF CUTLEAF EVENINGPRIMROSE IN STRIP-TILLAGE COTTON. M.G. Burton and A.C. York; North Carolina State University, Raleigh, NC 27695-7620.

ABSTRACT

Cutleaf eveningprimrose (*Oenothera laciniata* Hill) has often been identified as a troublesome weed of cotton in North Carolina strip tillage (reduced tillage) systems. Where glyphosate alone was used as a burndown treatment, producers have often complained of failure to kill this winter annual weed. Although winter annual weeds are not often considered pests in cotton production, the observation that leaves of cutleaf eveningprimrose remained green long after other weeds had died, as well as the large size attained by some plants, was cause for concern among producers. Yield loss studies were conducted in 2003 and 2004 to quantify cotton yield loss caused by untreated cutleaf eveningprimrose populations over a range of densities. Weed population density was randomly assigned from among those plots with sufficient naturally occurring population density. Cutleaf eveningprimrose was thinned to 0, 8, 15, 30, 60 or 120 pl/plot (i.e. 50 ft of row). Although weed-crop competition has, in recent years, most often been modeled using Cousens' hyperbolic yield loss model, it did not describe the data well in either year. The model assumes increasing interspecific competition (between the weed species and the crop) with increasing weed density. The model also accounts for increasing intraspecific competition as weed density increases to result in interference between weeds. Yield loss in 2003 reach a maximum of 23% at 30 pl/plot. However, insignificant yield loss occurred in 2003 at the highest weed density. Competition from cutleaf eveningprimrose in 2004 did not result in significant yield loss at any density. The hyperbolic yield loss model was therefore inappropriate in both years. Differences between years were notable in that 2003 had a long, cool spring compared to the near ideal cotton production conditions of 2004. Crop yield was notably lower in 2003 and cutleaf eveningprimrose plants were more abundant and longer-lived. Expressing plant density as percent cover might reveal a clearer indication of the competitive relationship of winter annual weeds with cotton than traditional yield loss models that are based upon weed density.

DALLISGRASS AND BAHIAGRASS RESPONSE TO SOIL MOISTURE IN A SIMULATED TURF ENVIRONMENT. G.M.Henry, M.G. Burton, and F.H. Yelverton, North Carolina State University, Raleigh, NC 27695.

ABSTRACT

Paspalum dilatatum Poir. (dallisgrass) and *Paspalum notatum* Fluegge (bahiagrass) are rhizomatous, perennial grass species that reportedly tolerate both droughty, sandy soils and moist, clay soils. These reports are anecdotal and have never been investigated in controlled experiments. The objective of our research was to determine the effect of soil moisture on the vegetative characteristics of dallisgrass and bahiagrass when grown alone or in competition with bermudagrass in sand or sandy loam soils. Techniques used to investigate the response of weed species to soil moisture based on frequency or volume of watering are often criticized for problems associated with rooting volume and unnatural soil moisture profile and root distribution. Water table depth gradient tanks allow for natural capillary action (soil water) and surface irrigation to simulate rainfall. When filled with soil and regulated by an outfall, capillary rise keeps the low end of the tank near field capacity and plants growing along higher elevation are subjected to progressively lower soil moisture levels. Six water table depth gradient tanks were constructed and the experiment will be replicated over time. Each tank was steeply sloped and had a volume of nearly 4 m^3. Rhizomes of each grass were planted perpendicular to the slope (moisture gradient) to allow examination of growth characteristics at several moisture levels. Surface irrigation was used during establishment and periodically throughout the experiment to prevent permanent wilting. Artificial lighting was used during winter months to supplement natural light and approximate summer light intensity and photoperiod. Sand or sandy loam soils were used. Dallisgrass and bahiagrass were tested individually and in competition with bermudagrass. Soil moisture levels were expressed as centimeters above the water table and ranged from 28 to 144 cm. Growth occurred more rapidly in the sandy loam soil irrespective of species composition. Establishment of both species was slower in the presence of bermudagrass. In general, survival of transplanted dallisgrass was lower than bahiagrass survival. Percent survival and weekly growth rates were taken between weeks 3 and 4 after the initiation of the experiment. Bahiagrass survival and growth was less affected by differences in soil moisture irrespective of soil type. Dallisgrass survival and growth decreased as depth to water table increased. Results suggest that it may be possible to disadvantage *Paspalum* spp. in competitive interactions with bermudagrass by altering soil moisture. Substrate selection during construction and aeration may help create a landscape that discourages *Paspalum* spp. Infestation.

EFFECT OF SOYBEAN CANOPY FORMATION AND TILLAGE ON TEMPORAL EMERGENCE OF PALMER AMARANTH. P. Jha, and J.K. Norsworthy; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC 29634.

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) is one of the most troublesome weeds of crops in the southeastern United States due to its extended period of germination, rapid growth, and prolific seed production. Knowledge of Palmer amaranth temporal emergence would aid weed management by allowing adjustment of planting dates and herbicide application timings to minimize its occurrence in crops. A field experiment was conducted at the Simpson Research Station in Pendleton, SC, during the summer of 2004 to study the effect of soybean canopy formation and tillage on temporal emergence of Palmer amaranth. The experiment was conducted on a site containing a natural infestation of Palmer amaranth. Tillage operations were performed on May 19, and soybean was planted on May 21, 2004. Palmer amaranth seedlings were enumerated and removed at least once weekly throughout the year. Soil temperature and moisture at a 2.5-cm depth along with air temperature were monitored bi-hourly. Light interception by soybean was measured to quantify canopy development and its influence on emergence.

Palmer amaranth emerged from May 10 through October 23, with four major emergence periods from May through August. Emergence during these periods was affected by tillage only. Soybean light interception averaged over tillage systems was 77% on July 15, with 91 to 99% of the total emergence occurring prior to this date, indicating soybean canopy formation had minimal potential to affect temporal emergence. Tillage affected weekly emergence of Palmer amaranth throughout most of the growing season; however, soybean presence had no effect on emergence. Total emergence averaged 794 and 1,060 plants/m^2 in no-tillage plots with and without soybean, respectively. Total emergence in tilled plots averaged 737 and 844 plants/m^2 in the presence and absence of soybean, respectively. Earlier planting of soybean would have allowed better assessment of whether canopy formation reduces emergence, since Palmer amaranth emergence was minimal by mid-summer. Based on temporal emergence in 2004, Palmer amaranth appears to be most problematic when planted during May in South Carolina, which is the recommended planting date for soybean.

CARBOHYDRATE FLUCTUATIONS IN TRUMPETCREEPER [*CAMPSIS RADICANS* (L.) SEEM.] ROOTS AS AFFECTED BY TIMING OF GLYPHOSATE APPLICATIONS. M.W. Marshall, J.D. Green, and W.W. Witt; Department of Plant and Soil Science, University of Kentucky, Lexington, KY 40546.

ABSTRACT

Trumpetcreeper is a perennial vine that infests no-tillage fields across Kentucky. Delaying herbicide treatment of trumpetcreeper to late-summer and/or early-fall could potentially move more herbicide into the root system or impact storage carbohydrate levels. The objective of this study was to quantify carbohydrate fluctuations in trumpetcreeper roots and evaluate the impact of glyphosate relative to application timing. Field experiments were conducted in Southeast Kentucky near Quicksand. Experimental design was a randomized complete block design with four replications. Plot sizes were 3.6 by 12 m. Herbicide treatments included an in-season timing of glyphosate applied at 0.84 kg ha^{-1}, a post-harvest timing of glyphosate applied at 1.68 kg ha^{-1}, and an untreated control. The post-harvest (fall) glyphosate treatment was applied before significant trumpetcreeper leaf senescence. Beginning in June of 2002 and following every month afterward, two trumpetcreeper roots were excavated per plot to depth of 15 cm. Roots were washed, clipped into smaller pieces, freeze-dried for 72 hours, and ground to pass through a 1 mm screen using a Wiley Mill. A 15 ml solution of 80% aqueous ethanol (v/v) was added to ground samples to extract the water soluble carbohydrates. Following the extraction phase, a 1 ml aliquot of supernatant was removed and dried in a centrivap for 4 hours. The extracted carbohydrates in the dried samples were derivatized into trimethylsilyl compounds and samples were analyzed using gas chromatography (GC). Derivatization imparts greater volatility characteristic to carbohydrates. Carbohydrates were quantified using external standards of the following sugars fructose, glucose, sucrose, raffinose, stachyose, and verbascose. In addition, phenyl-β-D-glucopyranoside was added to both carbohydrate standards and samples as an internal standard. Data were subjected to ANOVA and means were separated at the 5% level using Fisher's protected LSD. A significant year by month interaction occurred, but depth by herbicide was not significant. Therefore, data were presented by year pooled across depth. Similar to previous trumpetcreeper control studies (data not shown), fall glyphosate applications significantly reduced shoot regrowth the following season compared to the in-season glyphosate treatments in both years. Trumpetcreeper roots contained the following non-structural carbohydrates, which were identified as fructose, glucose, sucrose, raffinose, stachyose, and verbascose. Overall, significant variation was observed in all sugars except raffinose. Differences among treatments were not evident based upon the carbohydrate data. Seasonal fluctuations were not impacted by either timing of glyphosate. In addition, carbohydrate trends in treated trumpetcreeper roots tracked similarly as the control. The fall glyphosate application coincided with an increased movement of sucrose to the root system. Therefore, research results suggest that seasonal carbohydrate levels were not affected by the glyphosate treatments at either timing; however, fall glyphosate treatments impacted the ability of the vegetative buds located on the root system to generate new shoots.

EVALUATION OF GLYPHOSATE RESISTANT HORSEWEED ACCESSIONS FOR CROSS-RESISTANCE TO OTHER HERBICIDES. Thatsaka Saphangthong and W. W. Witt; Department of Agronomy, University of Kentucky, Lexington.

ABSTRACT

A horseweed population in Kentucky 2001 was not controlled by glyphosate; furthermore, in 2002 horseweed populations in Kentucky was confirmed glyphosate tolerant by University of Kentucky weed scientists. This experiment was to evaluate of glyphosate resistant horseweed accessions for cross-resistance to other herbicides. Mature seed heads of horseweed were collected five biotypes (Spindletop, Trigg, Hardin, Henderson and Calloway) in the fall of 2003. These biotypes were treated with glyphosate (Roundup WeatherMax = 0, 32, 64 oz/A). The experimental design was a randomized complete block, each treatment was replicated ten times and the experiment was repeated. Horseweed seeds were planted and seedlings thinned to one per cup after energence. Later –emerging plants were removed. Plants were subirrigated, and supplemental fertilizer (MiracleGro) containing macro- and micronutrients was applied weekly. Herbicides were applied about 5-7 cm diameter horseweed rosettes. Horseweeds were harvested 21 days after treatment (DAT) dried for 72 hours at 70 C and dry weights determined. Herbicides evaluated were glyphosate (32oz/A, 62oz/A), chlorimuron (0.75 oz/A, 1.52 oz/A), cloransulam (0.30 oz/A, 0.60 oz/A), paraquat (1.33 pt/A, 2.66 pt/A) and atrazine (2 qt/A, 4 qt/A). Data were analyzed using PROC GLM of SAS. A significant herbicide rate and horseweed accession interaction was detected for horseweed dry weights. The Spindletop accession showed a high degree of susceptibility to glyphosate. However, the Trigg, Hardin, Henderson and Calloway accessions showed a high degree of tolerance. The Spindletop, Trigg, Hardin, Henderson and Calloway accessions did not show a high degree of tolerance to classic. The Hardin accession had a higher degree of susceptibility than Spindletop, Henderson and Calloway accessions. The Spindletop, Trigg, Hardin, Henderson and Calloway accessions had a high degree of susceptibility to FirstRate at 0.30 oz/A and 0.60 oz/A. The Hardin accession showed the highest degree of susceptibility. Spindletop, Trigg, Hardin, Henderson, and Calloway accessions had a very high degree susceptibility to Gramoxone Max applied at rates of 1.33 pt/A and 2.66 pt/A. The AAtrex treatment applied at 2qt/A and 4qt/A showed good control for Spindletop, Trigg, Hardin, Henderson and Calloway accessions. The Trigg, Hardin, Henderson and Calloway accessions were tolerant to Roundup WeatherMax at 32 and 64 oz/A. However, the Spindletop accession was susceptible. Classic, FirstRate, Gramoxone Max and AAtrex at normal rates killed Spindletop, Trigg, Hardin, Henderson and Calloway horseweed populations confirming that they were susceptible. The Spindletop, Trigg, Hardin, Henderson and Calloway horseweed populations indicated that they were not cross-resistant to herbicides evaluated.

DIURON EFFECTS ON ABSORPTION AND TRANSLOCATION OF GLYPHOSATE IN SHARPPOD MORNINGGLORY (*Ipomoea cordatotriloba*). G.L. Steele, S.A. Senseman, A.S. Sciumbato, and J.M. Chandler. Texas Agricultural Experiment Station, College Station, TX 77843-2474.

ABSTRACT

The combination of diuron and glyphosate is used post-directed in cotton to control morningglories and other broadleaf weeds. Although diuron addition generally improves glyphosate efficacy on some species, the consequences of its inhibition of photosynthesis may reduce glyphosate translocation. Reduced glyphosate translocation to the roots of the perennial sharppod morningglory could allow increased plant survival despite improving aboveground dessication. Experiments evaluating sharppod morningglory growth reduction with glyphosate or glyphosate plus diuron combinations were conducted in the field and laboratory from 2002 to 2004. In addition, the effect of diuron addition on ^{14}C-glyphosate absorption and translocation in sharppod morningglory was determined using liquid scintillation spectrometry. In 2002, the addition of 560 g ai/ha diuron to 840 g ae/ha glyphosate increased control of 10- to 20-cm sharppod morningglory from 60 to 94%. The following year, sharppod morningglory control was improved by 10% when diuron was applied in combination with glyphosate. Glyphosate at 840 g/ha controlled growth chamber-grown sharppod morningglory 43%, compared to 64 and 63% control with glyphosate plus 420 or 840 g/ha diuron, respectively. Freshweight of glyphosate-treated sharppod morningglory did not differ from untreated plants. However, glyphosate plus diuron treatments resulted in significant freshweight reductions. Laboratory experiments revealed that sharppod morningglory absorbed 75% of applied glyphosate, but only translocated 2% of the absorbed ^{14}C to roots. Moreover, combination with either rate of diuron significantly reduced root translocation of glyphosate. However, we conclude from efficacy evaluations that glyphosate plus diuron improves visual desiccation of sharppod morningglory. Although diuron inhibition of glyphosate translocation may allow survival of sharppod morningglory, increases in glyphosate concentration in treated tissue, and the activity of diuron, may result in improved aboveground desiccation.

FACTORS AFFECTING GERMINATION OF HORSEWEED (*CONYZA CANADENSIS*). C.H. Koger, USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS; and D.H. Poston and T.W. Eubank, Delta Research and Extension Center, Mississippi State University, Stoneville, MS.

ABSTRACT

Horseweed (*Conyza canadensis*) is an erect summer or winter annual herbaceous weed species that is native to north North America. It is commonly found in cultivated and abandoned fields, roadsides, pastures, utility right-of-ways, and waste areas of the continental United States. It has also become problematic and difficult to control in glyphosate-resistant (GR) crop production systems of the eastern United States.
Achenes of horseweed are easily spread by wind and individual plants are capable of producing 500,000 seed . Horseweed is often susceptible to common tillage practices of conventional-tillage cropping systems; whereas, it often thrives in conservation- or no-tillage systems. In recent years, it has proliferated in minimum tillage GR cropping systems. Emergence of horseweed is typically observed in late summer to early fall, but flushes have been documented throughout the year when sufficient moisture is available. Little is known about the biology of this species or population and emergence dynamics of horseweed under different timings of cultural and chemical weed management practices.
Field studies were conducted in 2003 – 2005 to investigate the effects of soil temperature and timing of tillage and non-selective herbicide application on emergence and populations of GR and glyphosate-susceptible horseweed in Mississippi. Studies were conducted on two fields containing glyphosate-susceptible horseweed populations and two fields containing GR populations. Treatments included disking or glufosinate (0.5 kg ai ha^{-1} plus 0.25% v/v non-ionic surfactant) in September, November, January, or March; disk in September followed by glufosinate in March; and nontreated check. Glufosinate was applied with a CO_2 pressurized backpack sprayer calibrated to deliver 95 liter ha^{-1} at 190 kPa. Plot size was 4.5 by 9 m and treatments were replicated four times in a randomized complete block design experiment within each field.

Horseweed seedling were counted bi-weekly in two 1-m^2 quadrats in each nontreated plot beginning September 1. Emerged seedlings were killed with glufosinate after counting. Plant counts were recorded from two 1-m^2 quadrats per plot just prior to initiation of each treatment. Total plant counts were recorded from one 1- by 3-m quadrat per plot on August 1 just prior to study termination. One automated soil temperature logger was placed 2.5 cm deep in a nontreated check plot of each study and set to record temperature every 4 h.

Horseweed germinated in the late summer, fall, and spring of each year. Extensive germination occurred in September and October of both years, with densities ranging from 70 to 155 plants m^{-2}. Horseweed germinated in both years when soil temperatures were above 10 C, and no differences were observed in germination patterns between GR and susceptible populations. Burial of horseweed seed with tillage reduced densities compared to nontreated plots, but densities remained above 10 plants m^{-2}. Fall tillage followed by spring burndown reduced populations, but flushes emerged in April and May after burndown. Plasticity of horseweed germination was evident, and tillage alone or coupled with non-residual herbicide control did not eliminate germination of horseweed.

SOME FACTORS AFFECTING GENE FLOW FROM CLEARFIELD™ RICE TO RED RICE. V.K. Shivrain, N.R. Burgos, S.N. Rajguru, and M.A. Sales; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

Red rice (*Oryza sativa* L.) is hard to control due to its genetic similarity to cultivated rice. Herbicide-resistant Clearfield™ (CL) rice now offers an excellent option for red rice control. This technology, however, accentuates the risk of gene flow. Experiments were conducted at the Rice Research and Extension Center, Stuttgart, AR, Vegetable Substation, Kibler, AR, and Cotton Research Station, Marianna, AR. in 2002 to 2004. The effects of cultivar, planting date, and distance from pollen source on the extent of natural outcrossing between CL rice and Stuttgart strawhull red rice and the morphology of hybrids were evaluated. The first experiment was planted in April and the second in May 2002. CL cultivars CL161 and CL121 were planted in circles, 10 m in diameter with three replications. Natural red rice population was maintained in the outer concentric circle, 22 m in diameter. There was synchronization in flowering between red rice and CL rice in both experiments. Red rice sample panicles were hand-collected at 0.0, 0.5, 1.0, 2.0, 3.0, 4.0, and 5.0 m from the interface of CL rice and red rice. At maturity, CL rice was harvested from the inner circles and red rice was allowed to shatter. In the spring of 2003, volunteer red rice in field plots and seedlings from hand-collected samples were sprayed with three applications of imazethapyr at 0.07 kg ai/ha. Survivors were counted and morphologically characterized. DNA analysis of survivors using SSR primer RM 180 was performed to verify hybridization with CL rice.

All resistant red rice plants were confirmed hybrids (F_1) between CL and red rice. Outcrossing rate was calculated based on the number of hybrids detected among the total number of red rice sprayed in the field and from hand-collected samples. Outcrossing was higher with CL161 (0.008%) than with CL121 (0.003%). The number of hybrids detected was higher in CL161 plots than CL121 but the trend of decreasing number of hybrids with increasing distance from the interface was similar in both cultivars. Hybrids were located within 6 m from CL rice. Distribution of hybrids was random in all directions showing no influence of wind on pollen movement in both planting dates as well as in both cultivars. There was no significant difference in outcrossing rate between April (0.004%) and May (0.006%) planting. All the F_1 hybrids observed were taller and had longer flag leaf than their parents. F_1s had rough-textured, pale-colored leaves similar to the red rice parent. Most of the hybrids were late in flowering, and their seeds did not mature in the field due to onset of cold weather.

Cultivar CL161 had a higher outcrossing rate than CL121. Planting date did not affect outcrossing rate in these experiments. Effective cross-pollination can occur at a distance of at least 6 m. In general, hybrids between CL and red rice were bigger than their parents, indicating that hybrids would be more weedy than the red rice parent.

INTERACTION OF SWEET CORN WITH A WILD RADISH (*Raphanus raphanistrum*) COVER CROP.
M.S. Malik, and J.K. Norsworthy; Department of Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC 29634.

ABSTRACT

Wild radish, a member of the Brassicaceae family, is an annual, allelopathic broadleaf common throughout the southeastern US. Because of its common occurrence in production fields and allelopathic suppression of many weeds, it has potential to aid weed management in tolerant summer crops, replacing currently used cover crops such as rye. A field experiment was conducted at the Edisto Research and Education Center in Blackville, SC, during the summer of 2004 to evaluate the effect of wild radish and rye cover crops on weed suppression and sweet corn tolerance and yield when used in conjunction with lower than recommended herbicide rates. Cover crop treatments included wild radish, rye, and no cover crop alone and in conjunction with one-half and full recommended rates of atrazine (1.68 kg/ha) plus *S*-metolachlor (0.87 kg/ha) applied prior to sweet corn emergence. Glucosinolates, the precursors for isothiocyanates (allelochemicals), in wild radish were quantified using High Pressure Liquid Chromatography.

Wild radish produced 486 g/m^2 biomass compared to 323 g/m^2 by rye. Glucosinolates produced by wild radish included glucoiberin, progoitrin, glucoraphanin, glucoraphenin, gluconapin, glucotropaeolin, glucoerucin, glucobrassicin, and gluconasturtin. Florida pusley, large crabgrass, spreading dayflower, and ivyleaf morningglory were the predominant weeds infesting the test site. Wild radish or rye in conjunction with one-half and full recommended rates of atrazine plus *S*-metolachlor provided 79 to 97% and 64 to 95% weed control, respectively, 4 wk after planting (WAP). In the absence of a cover crop, weed control with atrazine plus *S*-metolachlor ranged from 54 to 90%. One-half rates of atrazine plus *S*-metolachlor generally failed to provide effective weed control through 8 WAP, regardless of cover crop. Wild radish in conjunction with the full rate of atrazine plus *S*-metolachlor provided superior control of Florida pusley, large crabgrass, and ivyleaf moringglory compared with rye or no cover crop treated with a full herbicide rate. Wild radish and rye cover crops produced 38,000 to 48,000 and 33,000 to 35,000 marketable ears/ha, respectively, in herbicide treated and handweeded plots; however, marketable ear production was 39 to 83% lower than total ear production across all treatments. Wild radish and rye cover crop plots in the absence of herbicides produced less marketable ears than herbicide treated plots, indicating that a combination of cover crops and herbicides are required to optimize yields. This research shows wild radish or a rye cover crop in conjunction with one-half rates of atrazine plus *S*-metolachlor can provide adequate early-season weed control and optimize yields; however, effective season-long weed control may not be obtainable.

DETERMINING WEED DEVELOPMENT MEASURING GROWING DEGREE DAYS. J.L. Alford and L.R. Oliver. Department of Crop, Soil, and Environmental Sciences. University of Arkansas, Fayetteville, AR 72704.

ABSTRACT

Numerous studies have been used to determine crop growth and development using climatic environmental conditions. However, limited research has been conducted evaluating the effects of weather on weed growth and development, which could provide information for improved weed control models. Explanations of weed growth and developmental rates are crucial for modifying existing growth models that predict weed interference in crop production. These weed management models use weed density, time of emergence, and crop and weed growth stages to optimize weed control. Empirical models have been developed by linear regression to relate environmental effects such as temperature, soil moisture, and growing degree days (GDD) to weed emergence. Present development rate models are used to determine or predict weed seedling emergence and crop development rates, but have not been used for weed growth and development after the weed seedling stage. Due to the relationship between plant emergence and development and GDD, there is a need to use this information to develop more precise management practices. Because knowledge of weed growth and development could be crucial information to improve weed control and weed control methods, the objective of this study was to determine whether GDD can be measured for sicklepod (*Senna obtusifolia*) and velvetleaf (*Abutilon theophrasti*).

The experiment was conducted in 2004 at Fayetteville, AR. The study evaluated velvetleaf and sicklepod, chosen because of their competitive characteristics. Both species were seeded in the greenhouse in 7.5-cm by 10-cm styrofoam cups and transferred to the field when cotyledons were fully opened. Transplanting was initiated April 1, 2004, and weekly transplants continued until July 8, 2004, 2 weeks after summer solstice. Seedlings were transplanted to the center of a 2- by 2-m plot in the field to prevent competition within the population. Number of main stem leaves and plant height were measured every 2 days until flower initiation occurred. Data were collected from four randomly selected plants within each population for each planting. Air and soil maximum and minimum temperatures were collected from an on-site weather station and recorded daily. Soil moisture levels were recorded using a volumetric water content meter to assure adequate moisture for plant growth, and plants were watered as needed. Data were analyzed using PROC REG and subjected to ANOVA at P=0.05. Linear regression was used to evaluate development rate as a function of temperature and photoperiod and to determine base temperatures for each species. Degree days (DD) were calculated using the formula DD = (Tmax + Tmin / 2) – Tbase, where Tmax is the maximum daily temperature, Tmin is the minimum daily temperature, and Tbase is the base temperature.

Development rate differed according to species evaluated. Sicklepod development rate increased as temperature increased; however, development rate decreased for sicklepod as photoperiod increased. Development rate for velvetleaf increased as temperature and photoperiod increased. Linear regression analysis determined that both sicklepod and velvetleaf have base temperatures that are photothermal, suggesting that as daylength changes so does the base temperature. For daylengths between 14.5 and 15.5 h sicklepod and velvetleaf had base temperatures from 19.56 to 20.74 C and 14.65 to 18.06 C, respectively. Sicklepod base temperatures were found to increase at a rate of 1.17 C for every hour change in daylength. Velvetleaf had a greater temperature change per hour than did sicklepod, resulting in 3.44 C for every hour change in daylength. The greater change in temperature per hour for velvetleaf (3.44 C) compared to sicklepod (1.17 C) suggests that photoperiod is more influential on the rate of development of sicklepod than velvetleaf. Data suggested that accumulated heat units were related to the changes in daily temperature. The warmer daily temperatures resulted in increased levels of accumulated heat units required for the weeds to develop from emergence to flower. Sicklepod emerging from April 22 to July 8 required between 231.35 and 330.08 C heat units to develop from cotyledon stage to first flower. Velvetleaf emerging from April 1 to July 8 required between 221.89 and 330.90 C heat units to develop from cotyledon stage to first flower.

In conclusion, data from this study suggest weed growth and developmental models can be used to determine weed development. Weed development information can be applied to development rate models to predict weed growth, thereby providing information to improve weed management models.

THE EFFECT OF CITRUS ROOTSTOCKS ON SWEET ORANGE INTERFERENCE WITH SPANISH NEEDLES (*Bidens pilosa*). R.S. Buker III and R. Rouse. Horticultural Sciences Department. University of Florida/Institute of Flood and Agricultural Sciences.

ABSTRACT

Spanish needles (*Bidens pilosa*) have become one of the most common weeds in Florida citrus production. Additive studies were conducted in from July to December to determine the impact of Spanish needles on vegetative growth of 'Hamlin' orange, and the effect of rootstock on weed/crop interactions. The experiment was established as a split plot design with the main plot being weed population and the sub-plot as rootstock. After tree planting Spanish needles were hand seeded and maintained at population densities of 0, 2.5, 5, and 7.5 plants m^{-2}. Trunk diameter and canopy diameter measurements were recorded at the bud union and in the north-south and east-west orientations after 150 days of interference.

Data analysis (ANOVA) revealed tree trunk growth was significantly reduced by Spanish needles populations with both rootstocks (p0.05). At 2.5 Spanish needles m^{-2}, trees on Swingle citrumelo (SC) rootstocks exhibited greater trunk diameter reduction than trees on Volkamer lemon (VL) rootstocks. Compared to the control trees, trees on VL and SC were reduced 2.8 and 6.8 %, respectively, at low populations. As Spanish needles populations increased the percent reduction in VL trunk diameters increased to levels observed in SC rootstocks. At the highest Spanish needles population tree trunk diameters of both rootstocks were reduced 9%.

On both rootstocks, canopy growth decreased as Spanish needles populations increased, but the interference was influenced by the rootstocks in this study. Canopy growth of trees on VL rootstocks was reduced 5 to 28% with 2.5 and 7.5 Spanish needles m^{-2}, respectively. The majority of canopy growth reduction of trees on SC rootstocks occurred at populations <1 plants m^{-2} compared to 7.5 Spanish needles m^{-2}, with trees on Volkamer. As Spanish needles populations increased the growth reductions of trees on SC plateaued between 14 and 11% at the lowest and highest populations, respectively.

In a relatively short time period even young slow growing trees can be negatively impacted by Spanish needles populations. The present study demonstrates reductions in citrus trunk diameter ranging from 0.2 to 9.8% and canopy reductions between 0 to 28% after 150 days of Spanish needles interference. At juvenile stages the impact of Spanish needles populations was more evident on canopy growth compared to trunk growth. Since canopy and root growth are physiologically related, then reductions in canopy growth is expected to reduce root growth. Ultimately, greater weed pressure would be expected from trees that are slow to capture space.

To the authors knowledge this is the first report of a weed population affecting citrus growth and evaluation of rootstock effect on weed tolerance. The impact of Spanish needles reported here may change as the citrus trees mature. A comparison of the performance of SC and VL rootstocks suggests that citrus and Spanish needles may be directly competing for moisture.

PLANTING AND CULTIVAR EFFECT ON SYNCHRONIZATION IN FLOWERING OF CLEARFIELD™ RICE AND RED RICE. V.K. Shivrain, N.R. Burgos, H.L. Black, M.A. Sales, and D.R. Gealy; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701; USDA-ARS- DB NRRC, Stuttgart, AR.

ABSTRACT

Clearfield™ (CL) rice has been the best option to control red rice thus far. Adoption of CL rice is increasing rapidly. Herbicide-resistant gene transfer from CL rice to red rice has been already documented. Gene transfer depends on synchronization of flowering between CL rice and red rice. Experiments were conducted at the Rice Research and Extension Center (RREC), Stuttgart, AR in 2002 to 2004. The objective of these experiments was to determine the effect of planting date on the synchronization of flowering between CL rice and strawhull red rice. Clearfield™ cultivars, CL121, CL161, and Stuttgart strawhull red rice were drill-planted in 10-ft long, 9-row plots starting from the mid-April to third week of May at weekly interval. Each CL cultivar was replicated four times in each planting date. Data on flowering were collected twice a week. At maturity plant height was measured and seed samples were collected to observe the hybridization. Plots were also screened with imazethapyr (0.07 kg ai/ha) in the following year to observe the number of hybrids resulting from the shattering of red rice in the previous year. Seed samples collected were planted and sprayed with imazethapyr (0.07 kg ai/ha) at the Vegetable substation, Kibler, AR in 2004 to observe the number of hybrids.

Red rice, CL121, and CL161 planted in mid-April (first planting) started flowering 90, 95, and 97 days after planting (DAP), respectively. In the second planting (last week of April), flowering started 85, 90 and 95 DAP for red rice, CL121, and CL161, respectively. In subsequent plantings, flowering time decreased by 5 to 7 days in CL cultivars as well as in red rice. Synchronization in flowering was highest between CL121 and red rice compared to CL161 and red rice in all planting timings. Survivors of screening from seedlings were confirmed as hybrids using simple sequence repeat (SSR) primer RM 180. The six planting dates in 2003 produced 48, 8, 25, 18, 8, and 9 hybrids, respectively, for both cultivars. The highest number of survivors was from the first planting as expected due to the highest synchronization of flowering between red rice and CL rice. Seeds collected in 2004 will be evaluated for hybrids next year in the field. Gene-specific primers will be used to identify the CL parent of each hybrid.

PHYSIOLOGICAL ASPECTS OF HERBICIDE RESISTANT HYDRILLA IN FLORIDA. A. Puri, [1] G.E. MacDonald, [1] W.T. Haller, [1] M. Singh, [1] G. Bowes, [1] F. Altpeter, [1] and D.G. Shilling. [2]
[1] University of Florida, Gainesville, FL, [2] University of Georgia, Athens, GA.

ABSTRACT

Hydrilla (*Hydrilla verticillata*) is one of the most serious invasive aquatic weed problems in the United States. Since its discovery in 1959, hydrilla had become the dominant submersed weed in the majority of large public lakes in Florida, requiring annual expenditures in excess of $10 million for control. Hydrilla is managed in large water bodies (> 100–12,000 ha) by sustaining a concentration of 4–12 ppb fluridone herbicide in lake water for several weeks. Fluridone disrupts the carotenoid biosynthetic pathway by non-competitive inhibition of enzyme phytoene desaturase (PDS) and results in bleached (white) tissue. Only the dioecious form of hydrilla is found in Florida, with spread and reproduction limited to asexual means (subterranean turions, axillary turions, fragments, and root crowns). Therefore, the development of herbicide resistance was not expected. However, fluridone resistant biotypes of hydrilla have recently been discovered in several waterways in Florida. Molecular studies have discovered that changes in the enzyme phytoene desaturase (point mutations) confer changes in susceptibility of hydrilla to fluridone. It was also discovered that several types of mutations may exist; each with the potential to confer a different level of resistance. However, characterization of these changes has not been directly correlated with differing populations in the field.

The overall objective of this study is to characterize fluridone resistant hydrilla populations in various waterways of Florida. Experiments were conducted under laboratory and greenhouse conditions to monitor changes in pigment levels (phytoene and β-carotene) as a function of population and fluridone treatment. Phenotypic studies were performed to assess differences in growth and reproductive physiology. All the studies were performed with a minimum of 4 replications, data analyzed with ANOVA and means separated with Fisher's LSD procedure (0.05). Significantly higher β-carotene and lower phytoene content was observed in all resistant hydrilla populations compared to the susceptible population. Regression analysis was utilized to quantify the relationship between fluridone dose and pigment levels. From this, a phytoene/ β-carotene index value was developed. Hydrilla tissue injury (I_{50}) occurred at an index value of 7.5-8.0, but the herbicide dose required to reach this value was highly variable among populations. Susceptible hydrilla reached this critical level at 14 ppb fluridone, while certain resistant populations required 74 ppb fluridone to elicit the same level of injury. There was little difference between resistant/susceptible populations with respect to growth (biomass) and reproductive parameters (subterranean and axillary turions). This suggests the lack of fitness penalty associated with fluridone resistance. Research is ongoing to further characterize and correlate differential fluridone herbicide resistance at the physiological and molecular level.

PERFORMANCE OF CL161, WELLS, AND XL8 IN COMPETITION WITH BARNYARDGRASS (*Echinochloa crus-galli*): IMPLICATIONS FOR MANAGEMENT. B.V. Ottis, A.T. Ellis, and R.E. Talbert; University of Arkansas, Fayetteville, AR.

ABSTRACT

New rice cultivars have been released that have yield potential greater than 10,000 kg ha^{-1}. 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 barnyardgrass control levels and plant densities. It is well known that rice has the ability to compensate for voids in the canopy by producing more reproductive tillers; however, producers are hesitant to plant lower seeding rates due to potential problems that may occur, requiring replanting.

The rice-seed industry is unique compared with other major crops grown in the Mid-south in that, until recently, producers have relied on University breeding programs for their seed. With the introduction of herbicide-tolerant and hybrid rice, privatization of rice germplasm development has entered into the industry, causing seed costs to rise; therefore, the objectives of this research were to determine if rice seeding rates could be reduced by analyzing the effects of rice density and barnyardgrass control on yield and yield components of three popular rice cultivars.

Studies were established in 2002 through 2004 at the Rice Research and Extension Center near Stuttgart, AR, to evaluate three new rice cultivars at various seeding rates in competition with barnyardgrass. Representatives from each of the three classes of long-grain rice were selected. ‘Wells’ represented conventional long-grain rice, ‘CL161’ represented semidwarf, imidazolinone-tolerant, long-grain 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 (52, 104, 208, and 416 plants m^{-2}) and four levels of barnyardgrass control (25, 50, 75, and 100%). Planting rates for each cultivar were established based on seed weights of the respective 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. Canopy closure among weed-free plots was evaluated weekly for the first 8 wk after emergence using digital imagery. Harvest index and combine yield from each plot were also collected. Grain yield was measured and adjusted to 12% moisture prior to analysis. Regression analysis was conducted using the PROC GLM function in SAS, and best-fit models were verified using residual plots.

Results indicated that cultivar, rice density, and thermal time were significant for canopy closure. XL8 achieved canopy closure sooner than the other cultivars. As rice density increased, canopy closure increased by 3% for every additional 100 plants m^{-2}. As thermal time increased, canopy closure increased 0.4% $^{o}Cd^{-1}$ (heat unit). Rice density had no effect on yield; therefore, data were pooled over rice densities to analyze the main effect of barnyardgrass control. Cultivar yields were affected similarly by barnyardgrass, and increased 750 kg ha^{-1} for each 10% increase in barnyardgrass control. XL8 produced the highest average yields, with CL161 producing the lowest over the 3-yr experiment. Harvest index increased as rice density decreased and as barnyardgrass control increased. XL8 harvest index was unaffected by barnyardgrass at low population densities, but became more sensitive to barnyardgrass as densities increased, indicating that XL8 is highly sensitive to intra- and interspecific competition at high plant populations.

Based on these results, the recommended seeding rate for XL8 (151 seeds m^{-2}) appears to be appropriate for maximum yield. The data also indicate that it is possible to reduce the seeding rates of CL161 and Wells without sacrificing yield or competitiveness.

IDENTIFICATION AND MECHANISM OF RESISTANCE TO CLETHODIM IN A JOHNSONGRASS (*SORGUM HALEPENSE*) BIOTYPE. I.C. Burke, J.D. Burton, J.W. Wilcut, North Carolina State University, Raleigh, NC.

ABSTRACT

Greenhouse and laboratory experiments were conducted to determine the level and mechanism of resistance of a johnsongrass (*Sorghum halepense*) biotype from Washington Co., MS. Whole plant dose response to clethodim was examined on rhizome johnsongrass. Eight rates of clethodim (formulated as Select) at 0.063, 0.125, 0.25, 0.5, 1.0, 2.0, 4.0, and 8.0 lb ai/A were applied to greenhouse-grown susceptible and resistant plants. A nontreated check was included for comparison purposes. Applications included a crop oil concentrate at 1.0% v/v. The study had a split-plot treatment arrangement with herbicide rate as the whole plot factor and johnsongrass biotype as the split plot factor. Johnsongrass plants were 6-8" tall at treatment. Fourteen days after treatment, plants were harvested and fresh and dry weights were recorded. To examine the mechanism of resistance, absorption, translocation, and metabolism studies were conducted on rhizome johnsongrass. When plants reached 6-8", the second fully expanded leaf was covered. The plants were sprayed with a non-radiolabeled mixture containing clethodim (0.125 lb ai/ha). Immediately after application, 5 1-μL droplets of ^{14}C-clethodim solution containing ^{14}C-clethodim (1.7 kBq of radioactivity), Select™ 2EC, deionized water, and crop oil concentrate were placed on the adaxial surface of the second fully expanded leaf. Plants were harvested at 4, 8, 24, or 72 h after treatment (HAT) and then divided into the treated leaf, roots, shoot above and shoot below the treated leaf. For absorption and translocation, plant parts were oxidized to recover ^{14}C. For metabolism, plants were harvested at 4, 8, 24, 48 or 96 HAT, and only the treated leaf contained sufficient ^{14}C for detection. The ^{14}C was extracted, concentrated, and fractionated using thin layer chromatography. Enzyme assays were conducted to determine if resistance was caused by altered enzyme activity, and materials and methods followed Burton et al. (Pest. Biochem. Physiol. 39:100-109) 1989 with slight modifications.

I_{50} values for the susceptible and resistant johnsongrass, respectively, were 0.04 and 0.103 lb ai/ha clethodim. The resultant R/S ratio for clethodim was 2.6, indicating resistance. Absorption of ^{14}C-label was significantly higher in the resistant than the susceptible biotype 4 HAT, but by 24 HAT, similar levels of radioactivity were detected in both johnsongrass biotypes. Absorption was biphasic in nature, with more than 67% of the applied radiolabel absorbed by 24 HAT and a further 15% by 72 HAT. There was a significant difference in absorption of ^{14}C-label between the susceptible and resistant biotypes at 4 and 24 HAT, with more radioactivity present in the treated leaves of the resistant biotype. However, there was no difference between the resistant and susceptible biotypes in the translocation of ^{14}C-label out of the treated leaf at any sampling time. At each sampling time, the majority of the absorbed radioactivity remained in the treated leaf. Overall, there was no consistent trend of differential translocation in the resistant compared to the susceptible biotype at any sampling time. These results are consistent with the absorption and translocation of clethodim – clethodim is reportedly rapidly absorbed into the treated leaf but very little is moved out of the treated leaf. Based on R_f values provided by Valent, USA and radiolabeled and nonradiolabeled standards, clethodim was identified as a major component of the 4 and 8 HAT harvests. Eight other major and minor peaks were detected with varying Rf values. Little to no clethodim was recovered from the 24 or 96 HAT harvests. Due to the complex isomerism of clethodim, multiple R_f values may represent the same compound. However, partitioning of ^{14}C into each potential metabolite occurred similarly between susceptible and resistant biotypes.

There was no difference in the specific activity of ACCase from the susceptible and resistant johnsongrass biotypes (means of 0.221 and 0.223 nmol/mg protein/min, respectively). ACCase from the susceptible biotype was sensitive to clethodim, with an I_{50} value of 3.44 μM clethodim. ACCase from the resistant biotype was less sensitive, with an I_{50} value of 10.9 μM clethodim. The resultant R/S ratio for clethodim was 3.1, which correlated well with resistance at the whole plant level. Therefore, the mechanism of resistance appears to be a resistant form of the ACCase enzyme.

IMPACT OF WATER STRESS ON HERBICIDAL CONTROL OF BENGHAL DAYFLOWER (*COMMELINA BENGHALENSIS.* P. J. Steptoe and W. K. Vencill; University of Georgia, Athens GA.

ABSTRACT

Benghal dayflower (*Commelina benghalensis)* is a noxious weed that has gone from a relatively unknown weed to one of the most problematic weeds in row crop agriculture. Benghal dayflower is a particularly problem weed in glyphosate-resistant crops, such as cotton. Benghal dayflower is poorly controlled by glyphosate and control decreases with plant age. Greenhouse and laboratory studies were initiated to examine the response of Benghal dayflower to moisture stress. Benghal dayflower plants were grown in the greenhouse under three different moisture levels (25, 50 and 100% maximum relative soil capacity). Sections from each leaf sample were cryogenically fixated and observed under a scanning electron microscope. Cuticle thickness and number of trichomes were recorded for each sample. As the level of moisture decreased, the cuticle thickness (0.3 to 1.1 µM at 100 and 25% soil moisture capacity, respectively) and number of trichomes increased (0.020 to 0.045 trichomes μM^2 at 100 and 25% soil moisture capacity, respectively). The response of Benghal dayflower to glyphosate, flumioxazin, metolachlor and glyphosate plus metolachlor were examined under moisture stress conditions previously described. The ED_{50} values for glyphosate reflected poor Benghal dayflower control at all moisture regimes. ED_{50} values for flumioxazin, metolachlor, and glufosinate increased with soil moisture stress. These studies indicate that soil moisture has a critical role in the development of weed management systems for Benghal dayflower.

CHARACTERIZATION OF THE ACTIVITY OF FUSILADE ON BRISTLY STARBUR. Shilpy Singh, Greg MacDonald, Megh Singh, W.M.Stall; University of Florida, Gaines ville, Florida.

ABSTRACT

Fluazifop-p-butyl is the active ingredient in Fusilade DX, a post gramicide herbicide that is registered for use in several agronomic and horticultural crops. Fluazifop inhibits acetyl-CoA carboxylase (ACCase) activity, which is the initial step in fatty acid synthesis. This leads to the inhibition of lipid biosynthesis which causes a cessation of growth and death occurs over a period of 14-21 days. Although this mode-of-action has been well documented in grasses, an alternative mode-of-action has been observed on the broad leaf species bristly starbur (*Acanthospermum Hispidium* DC). In previous studies under greenhouse conditions, fluazifop was observed to cause complete death of starbur at 0.25 lb ai /A. Moreover this injury occurred in 3-5 days, atypical of the reported mode-of-action on grassy weeds. Additional research suggests that fluazifop activity occurs at the membrane level in starbur, possibly through lipid peroxidation. To further characterize fluazifop activity on bristly starbur, ion leakage and chlorophyll fluorescence studies were performed.

All assays utilized 0.7 cm diameter leaf discs obtained from greenhouse grown starbur and all experiments were conducted twice with a minimum of three replications. There was differential response of fluazifop rate under light and dark conditions. The rate which caused 50% ion leakage was significantly higher in light compared to dark. The I_{50} rate under dark conditions was 600 µmol and this level of leakage within 18 hours after exposure. In addition, there was a decreasing affect of rate as exposure time increased, with >90% ion leakage occurring after 96 hours exposure time. Ion leakage caused by fluazifop (600 µmol) was also compared to compounds with known mechanisms of action. These included paraquat, diuron, 2, 4-dinitrophenol and the proton ionophore, gramicidin. Fluazifop behaved most similarly to paraquat under light conditions, with complete ion leakage observed after 24 and 96 hours for paraquat and fluazifop, respectively. In contrast, >95% ion leakage by fluazifop occurred after only 24 hours under dark conditions. Chlorophyll fluorescence studies were also performed using comparative compounds that have known effects on photosynthesis. Fluazifop increased chlorophyll fluorescence, behaving similarly to the photosynthetic inhibitors diuron and paraquat.

These results of these studies indicate the mechanism of action of fluazifop is not light dependent due to the increased activity under dark conditions. This suggests some level membrane activity, similar to previous research, but results indicate a more direct impact possibly membrane uncoupling.

SHIKIMATE ACCUMULATION PROFILES IN GLYPHOSATE RESISTANT HORSEWEED. C.L. Main, R.M. Hayes, L.E. Steckel, and T.C. Mueller. Department of Plant Sciences, University of Tennessee, Knoxville, TN 37996.

ABSTRACT

The response of shikimic acid levels in shoot and root tissue of glyphosate-susceptible (GS) and glyphosate-resistant (GR) horseweed biotypes was investigated to determine shikimic acid flux over time after application of glyphosate at the normal field use rate of 0.84 kg ae/ha. Glyphosate was applied at 0 or 0.84 kg ae/ha with water carrier at 190 L/ha to horseweed plants grown from seed. Plants were harvested 8, 24, 48,72, 96, and 168 hours after treatment (HAT) for shikimic acid analysis.

Both horseweed biotypes displayed an increase in shikimic acid indicating that 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) remained sensitive to glyphosate. Shikimic acid levels in both shoots and roots of GS horseweed displayed an increasing sigmoidal response to glyphosate, while in GR horseweed shikimic acid levels displayed an increasing hyperbolic response with a maximum concentration occurring around 72 hours after treatment (HAT) in both shoot and root tissue. Shikimic acid concentration in GR horseweed began to decrease between 72 and 96 HAT indicating that the shikimic acid pathway resumed at least partial function in the presence of glyphosate. At 168 HAT shikimic acid levels in GS horseweed shoot tissue displayed a 6:1 increase and a 3:1 increase in root tissue when compared to GR horseweed. This ratio corresponds to previously observed differences in whole plant sensitivity to glyphosate for GS and GR horseweed. These results imply that horseweed resistance to glyphosate is not due to change in the site of herbicide action.

REDUCING WEED SEED RAIN WITH GLYPHOSATE APPLICATIONS. C.E. Brewer and L.R. Oliver. Crop, Soil, and Environmental Sciences Dept., University of Arkansas, Fayetteville, AR 72704.

ABSTRACT

Field trials were established in Fayetteville, AR, in 2002 and 2003 to determine the effects of glyphosate application on biomass and seed production of spurred anoda (*Anoda cristata*), entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula*), and hemp sesbania (*Sesbania exaltata*). Previous work has shown that glyphosate application often provides inadequate control of these weed species, which allows them to reproduce and enrich the soil seedbank. Seeds of these plants were planted in 2-m strip plots on 1-m raised beds with a 2-m alley between plots. Following glyphosate application at rates of 0.42, 0.84, and 1.68 kg ae ha^{-1} applied at 3, 6, or 9 weeks after emergence (WAE) plant dry weight and seed number were taken 2 weeks after the first killing frost and these responses were compared to an untreated control.

The main effects of glyphosate rate and timing were significant for biomass accumulation for spurred anoda. Glyphosate applied at 1.68 kg ha^{-1} reduced biomass of spurred anoda by nearly 90% regardless of timing. There was no difference between 0.42 and 0.84 kg ha^{-1}, both of which reduced biomass accumulation approximately 65%. Applications made at 3 and 6 WAE had a greater effect on biomass accumulation than did the later 9 WAE application. Seed production of spurred anoda was affected by the main effect of rate only. There was no difference between 0.42 and 0.84 kg ha^{-1} both of which reduced seed production >90%. However, 1.68 kg ha^{-1} applications reduced seed production >99%.

The interaction of glyphosate rate and application timing was significant for biomass accumulation and seed production of entireleaf morningglory. In general, applications made at 3 WAE reduced biomass accumulation more than later applications. Biomass and seed production was reduced most by 1.68 kg ha^{-1} applied at 3 WAE resulting in death of the plants. However, application rates 0.84 or 1.68 kg ha^{-1}applied at 6 or 9 WAE, which coincided with weed flowering and seed fill, reduced seed production >85%. These applications reduced seed production more than any other non-lethal application and represent treatments that may be useful in field situations.

The interaction of rate and timing was also significant for biomass accumulation and seed production of hemp sesbania. Glyphosate applied at 1.68 kg ha^{-1} at 3 WAE reduced biomass >93%. Glyphosate applied at 0.42 kg ha^{-1} at 3 WAE failed to reduce biomass accumulation compared to the untreated control. This was due to considerable regrowth. No application at 9 WAE reduced biomass compared to the control regardless of rate, primarily because hemp sesbania had reached maximum size by this application date. There was limited regrowth from glyphosate applications made at 6 WAE. Glyphosate applied at 0.42 and 0.84 kg ha^{-1} reduced biomass production approximately 65%, and applications made at 1.68 kg ha^{-1} reduced biomass >85%. Hemp sesbania seed production was extremely sensitive to glyphosate application. Glyphosate at 0.42, 0.84, and 1.68 kg ha^{-1} applied at 3 WAE reduced seed production approximately 75%, 85%, and 100%, respectively. Among the later applications at 6 and 9 WAE, glyphosate applied at 1.68 kg ha^{-1} at 9 WAE reduced seed production >99%. This application coincided with hemp sesbania flowering and pod fill.

These data show that glyphosate application is a valid option for late-season suppression of seed production in spurred anoda, entireleaf morningglory, and hemp sesbania. Late-season applications will not replace the need for early applications to prevent weed interference with the crop, but are intended to control the replenishment of the weed seedbank. Therefore, after a number of successful seasons utilizing late-season glyphosate applications to reduce weed seed rain the weed seedbank may be depleted and reduce producer inputs for weed control.

SYMPOSIA

GLYPHOSATE-RESISTANT HORSEWEED & GLYPHOSATE-RESISTANT CROPPING TECHNOLOGIES

MANAGEMENT CHALLENGES ASSOCIATED WITH GR HORSEWEED CONTROL IN COTTON AND SOYBEANS. K.L. Smith, L.E. Steckel, and D.H. Poston; University of Arkansas, Monticello, AR, University of Tennessee, Jackson, TN; and Mississippi State Uiiversity, Leland, MS.

ABSTRACT

Horseweed (*Conyza canadensis* also known as *Erigeron canadensis*) is an annual that germinates from September through May. Mature plants may reach five to six feet in height. Flowers are 5 mm in diameter, and seeds are 1 mm in length. Each plant is capable of producing 50,000 seed which mature in August. Seeds have small white bristles that assist with wind dispersal. The Weed Science Society of America has placed horseweed as the ninth on its "Most Important Herbicide-Resistant Species List." Currently however, horseweed is probably the most important herbicide resistant species in the Mid-South. Glyphosate resistant horseweed was confirmed in Tennessee in 2001, in Arkansas and Mississippi in 2003. Numerous burndown studies in the Mid-South have shown 2,4-D alone at 1 and 1.25 lb ae/A, glufosinate (Ignite) at 0.3 lb ai/A plus 2,4-D at 1.25 lb ae/A, glufosinate at 0.42 lb ai/A plus 2,4-D at 0.5, 0.7, and 1 lb ae/A and glyphosate (Roundup WeatherMax) at 0.75 lb ae/a plus 2,4-D at 1 lb ae/A provided greater than 76% control of horseweed 43 days after application. Dicamba (Clarity) alone at 0.25, 0.375, and 0.5 lb ae/A, glyphosate at 0.75 lb ae/A plus dicamba at 0.25 lb ae/A, glufosinate at 0.3 and 0.42 lb ai/A plus dicamba at 0.125, 0.25, 0.375, and 0.5 lb ae/A all provided an average of 95% and greater control of horseweed at 43 DAT. The 2,4-D alone at 1.25 lb ae/A, flumioxazin (Valor) at 0.032 lb ai/A plus 2,4-D at 1.25 lb ae/A, dicamba alone at 0.25 lb ae/A, and the flumioxazin at .032 lb ai/A plus dicamba at 0.25 lb ae/A all provided greater than 90% control of horseweed at 43 DAT. Carfentrazone (Aim) at 0.0078 lb ai/A plus dicamba at 0.187 lb ae/A and carfentrazone at 0.0078 lb ai/A plus diflufenzopyr (Distinct) at 0.142 lb ai/A provided 95 and 98% control of horseweed at 43 DAT.

Plant back restrictions encourage 2,4-D use prior to planting soybeans and dicamba use prior to planting cotton. A residual herbicide is recommended to provide control after planting. Glufosinate resistant (Liberty Link) cotton has proven to be a viable system to control glyphosate resistant horseweed in crop. Glyphosate resistant horseweed can also be controlled with conventional tillage. In a Tennessee survey, glyphosate resistant horseweed was the major reason given for a 50% reduction in no-till acres in 2004.

SYMPOSIA

GLYPHOSATE-RESISTANT HORSEWEED & GLYPHOSATE-RESISTANT CROPPING TECHNOLOGIES

GLYPHOSATE RESISTANT HORSEWEED: IMPACT FROM THE FARMERS' PERSPECTIVE.

L.E. Robinson, S.G. Matthews, K.L. Smith. Robinson Farms Corp. Osceola, AR, University of Arkansas Cooperative Extension Service, Blytheville, AR and Southeast Research and Extension Center, Monticello, AR.

ABSTRACT

Glyphosate-resistant horseweed was confirmed on my farm in 2003 after tractor drivers had noticed isolated areas in 2002. We took control measures in those areas in 2003 but soon realized that glyphosate-resistant horseweed was a bigger problem than we initially thought. For the past five years I have no-tilled the majority of my cotton crop. A typical herbicide program included glyphosate applications for perplant burndown, once or twice before the fifth true leaf, once or twice post-directed and one layby application. We have enjoyed growing cotton without preemergence herbicides or incorporating yellow herbicides. Only sometimes would we add a residual herbicide in-season. Little did we know we were creating a new environment that is perfect for glyphosate resistant horseweed.

A lack of information was one of the biggest barriers we faced as we began planting cotton in 2003. The products that control horseweed were not options due to the plantback restrictions. At that time, Aim and Gramoxone were the only choice and were ultimately ineffective. Finally, chopping crews were brought in and were the only effective tool for 2003. We still faced limited knowledge regarding horseweed response to typical preemergence herbicides and limited options for residual control in 2004. Dicamba and 2,4-D were applied early and Ignite was used at planting to provide a weedfree seedbed. In-season, Envoke provided enough control to last until layby. Suprend was also effective post-direct. However, we still need more options for preplant and in-season control and more in formation on effective residual herbicides.

The agricultural community should take this opportunity to see glyphosate-resistant horseweed as a wake-up call. Producers faced a knowledge lag as researchers scrambled to find efficacy data on what had been an insignificant weed because of its easy control with glyphosate.

SYMPOSIA

GLYPHOSATE-RESISTANT HORSEWEED & GLYPHOSATE-RESISTANT CROPPING TECHNOLOGIES

"WANTED DEAD NOT ALIVE" – A MULTI-COUNTY EXTENSION EDUCATIONAL PROGRAM DEVELOPED FOR MANAGEMENT OF GR HORSEWEED. M.K. Hamilton*, S.G. Matthews, and R.L. Thompson, University of Arkansas Cooperative Extension Service, Marion, AR, Blytheville, AR and Harrisburg, AR. **.**

ABSTRACT

Cotton producers using conservation tillage practices are facing a new opponent. Glyphosate resistant horseweed has spread from western Tennessee to northeast Arkansas. Approximately one third of the cotton produced in Arkansas is grown in Mississippi, Crittenden and Poinsett counties. Producers in those counties are abandoning conservation tillage practices and/or spending up to $35 per acre to control glyphosate resistant horseweed. A few producers even plowed up perfect stands of cotton because they failed to realize soon enough that glyphosate resistant horseweed was present in their field. County Extension Agents are going to create awareness and educate cotton producers about glyphosate resistant horseweed.

Horseweed: Wanted Dead Not Alive is the theme of the educational blitz undertaken by County Extension Agents in Mississippi, Crittenden and Poinsett counties. Posters and educational folders will help agents create awareness of issues relating to controlling glyphosate resistant horseweed. Once producers have become aware that they have a problem, follow up educational efforts include a CD with efficacy data, producer interviews and herbicide resistance strategies. The information from the CD will be formatted into a four page color fact sheet. The educational folders and posters which help create awareness and educational CD's and fact sheets will serve as a pilot program for other areas that become infested with glyphosate resistant horseweed.

SYMPOSIA

GLYPHOSATE-RESISTANT HORSEWEED & GLYPHOSATE-RESISTANT CROPPING TECHNOLOGIES

GLYPHOSATE-RESISTANT HORSEWEED HAS JUMPED THE FENCE: THE TRIALS AND TRIBULATIONS IN DELAWARE. M.J. VanGessel, B.A. Scott, and Q.R Johnson, University of Delaware, Georgetown, DE 19947.

ABSTRACT

Glyphosate-resistant horseweed has received considerable attention in the past four years as the number of states and counties infested with this biotype continues to increase. Glyphosate-resistant horseweed was first reported in Delaware in 2000 and it is estimated that 150,000 acres in Delaware were infested in 2004. Glyphosate-resistant horseweed has been a problem primarily in no-tillage soybeans, since fields with no-tillage corn are treated earlier and often include a triazine herbicide. Current university recommendations in the mid-Atlantic region rely on 2,4-D or dicamba as the primary herbicide for control, as part of a non-selective herbicide program. Chlorimuron, as a portion of a pre-packaged soil-applied herbicide, has been effective but those products will not be available for the 2005 growing season. Paraquat-resistant horseweed has been identified in commercials fields in Delaware as well, further limiting control options.

A recent survey conducted in Delaware of soybean producers shows that altering the non-selective herbicide program is the most common management tactic used to deal with this biotype. Thirty percent of the growers who have glyphosate-resistant horseweed on their farms implemented two changes to combat it. Forty percent of the respondents said they used three or more changes to combat the resistant biotypes. Fifty-nine percent felt that the presence of glyphosate-resistant horseweed decreased the value of Roundup Ready technology and 78% said it was worthwhile to incur greater costs to ensure the long-term viability of this technology. Ninety percent felt other glyphosate-resistant weeds were likely to develop; and 85% felt another herbicide mode of action would be developed to combat glyphosate-resistant weeds. The presence of glyphosate-resistant horseweed has not reduced the use of glyphosate in the region, but it has highlighted the importance of implementing resistant management strategies to ensure that this valuable weed management technology remains viable for the foreseeable future.

SYMPOSIA

GLYPHOSATE-RESISTANT HORSEWEED & GLYPHOSATE-RESISTANT CROPPING TECHNOLOGIES

IMPACT OF GLYPHOSATE-RESISTANT TECHNOLOGY ON CROPPING SYSTEMS AND FARMING OPERATIONS. J.R. Cox, Cox Brothers Farm, Monroe, NC; G.T. Pegram, North Carolina Cooperative Extension Service, Monroe, NC; and A.C. York, North Carolina State University, Raleigh, NC.

ABSTRACT

Cox Brothers Farm (CBF) is located in the southern Piedmont of North Carolina, about 25 miles from Charlotte. This region has long been a major row crop production area, but urban sprawl from Charlotte is becoming a significant concern. This region of the state has clay or clay loam soils and rolling hills. The southern Piedmont was the first area in North Carolina to significantly adopt no-till production, and almost all acreage is now no-till. The predominant weeds in row crops include sicklepod, morningglory species, common cocklebur, common lambsquarters, pigweed species, common ragweed, prickly sida, johnsongrass, broadleaf signalgrass, and nutsedge species. Predominant weeds in small grains are Italian ryegrass, common chickweed, and henbit.

CBF produces grain and cotton on 10,500 acres and has a large poultry and swine operation. CBF has adopted Roundup Ready technology on 100% of its 1,500 acres of cotton and 5,500 acres of soybean and 15% of its 3,500 acres of corn. Several benefits from the technology account for the extensive use. Safety to applicators and to the environment are important to CBF. Equally important is the simplicity of weed management in Roundup Ready crops. One herbicide handles most of the problems rather than having to tailor programs to specific fields. This leads to fewer application errors. Also, less herbicide inventory is necessary, a factor of importance on a large operation. Weed control has been excellent and there have been no concerns over carryover regardless of the rotation. Reduced crop stress from herbicides is also an attractive benefit. The technology has reduced labor requirements through fewer applications and increased speed of application due to reduced mixing time. A further benefit is flexibility in timing of application, especially on soybean. While the intent is to treat timely to avoid weed competition, Roundup Ready technology allows one a better chance to control larger weeds should weather or other enterprise obligations keep growers from timely application.

Although benefits of Roundup Ready technology are many, CBF has concerns with the technology. There is increasing concern over reliance on a single chemistry and the potential for weeds to become resistant to glyphosate. Weed shifts have also been noted. There have been increases in morningglory and nutsedge species, curly dock, and the winter weeds common chickweed and henbit. Off-site drift of glyphosate to non-Roundup Ready crops is a concern as is volunteer Roundup Ready crops from the previous season. Growers also are concerned that labeling of genetically modified crops, should it take place, might adversely impact markets. Last, but not least, there is rising concern over the continued increase in technology fees.

In Roundup Ready corn, paraquat is still used for burndown but no preemergence herbicides are applied. Glyphosate plus atrazine is applied postemergence. In non-Roundup Ready corn, atrazine plus simazine is applied preemergence. Basis, Basis Gold, or Steadfast is applied postemergence. Evik may be applied at layby in heavily infested fields.

About three-fourths of CBF soybeans are double-cropped behind wheat. Full-season soybean receives a burndown application of paraquat, but burndown herbicides are seldom used in double-cropped soybean. No residual preemergence herbicides are used. Glyphosate is applied 20 to 25 days after planting, and Classic or Firstrate is often added with the glyphosate to improve control of morningglory. Even with purchase of new seed annually and technology fees, the cost of a weed management program in Roundup Ready soybean is similar to or less than what was previously spent in non-Roundup Ready soybean.

Roundup Ready technology has had the greatest impact in cotton. Prior to Roundup Ready, glyphosate plus Cotoran plus Prowl or Dual were applied at planting. Cotoran plus MSMA was directed early, and this was a very time-consuming operation. Bladex plus MSMA or Caparol plus MSMA were directed at layby. MSMA was sometimes applied topically for escaped weeds. In Roundup Ready cotton, paraquat is applied for burndown but no residual

preemergence herbicide is used. Glyphosate is applied twice over the top early in the season and again after September 1. Directed sprays have been eliminated on most of the acreage.

RAPID, NON-DESTRUCTIVE ASSAYS FOR SCREENING POTENTIAL GLYPHOSATE-RESISTANT CROP AND WEED POPULATIONS. C.H. Koger, USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS; and D.L. Shaner, USDA-ARS, Water Management Research Unit, Fort Collins, CO.

ABSTRACT

Repeated use of glyphosate over years in GR crops and non-crop areas has resulted in the selection of weeds resistant to glyphosate. Resistance to glyphosate has been documented in six species worldwide. In the U.S., biotypes of horseweed (*Conyza canadensis*) resistant to glyphosate have been confirmed in thirteen states east of the Mississippi river. The mechanism of glyphosate resistance has been found to be limited translocation or an alteration of 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) in resistant plants depending on biotype and species. Glyphosate blocks the EPSPS pathway in susceptible plants, resulting in an increase in the amino acid precursor shikimate.

A quick and relatively simple method to confirm glyphosate resistance in suspected populations would be useful to growers and consultants, and would help to reduce the spread of resistant populations through quicker implementation of alternative weed management practices. Two rapid, non-destructive assays were developed and tested for their potential in differentiating glyphosate-resistant from glyphosate-susceptible plants. In one assay, leaves of glyphosate-resistant and -susceptible corn (*Zea mays*), cotton (*Gossypium hirsutum*), and soybean (*Glycine max*) plants as well as glyphosate-resistant and -susceptible horseweed plants were dipped in solutions of 0, 300, 600, and 1200 mg ae L^{-1} glyphosate for 3 d and subsequent injury was evaluated. In the second assay, the sensitivity of the EPSPS enzyme was evaluated in vivo by incubating excised leaf-disc tissue from the same plants used in the first assay in 0.7, 1.3, 2.6, 5.3, 10.6, 21.1, 42.3, and 84.5 mg ae L^{-1} glyphosate solutions for 16 h and measuring shikimate levels with a spectrophotometer.

The leaf-dip assay differentiated between glyphosate-resistant and -susceptible crops and horseweed biotypes. The 600 mg L^{-1} rate of glyphosate was more consistent in differentiating resistant and susceptible plants compared with the 300 and 1200 mg L^{-1} rates. The in vivo EPSPS assay detected significant differences between susceptible and glyphosate-resistant plants of all species. Shikimate accumulated in a glyphosate dose-dependent manner in leaf discs from susceptible crops, but shikimate did not accumulate in leaf discs from resistant crops and levels were similar to nontreated leaf-discs. Shikimate accumulated at high ($\geq$ 21.1 mg ae L^{-1}) concentrations of glyphosate in leaf discs from all horseweed biotypes. Shikimate accumulated at low glyphosate concentrations ($\leq$ 10.6 mg L^{-1}) in leaf discs from susceptible horseweed biotypes, but not in resistant biotypes. Both assays were able to differentiate resistant from susceptible biotypes of horseweed and may have utility for screening other weed populations for resistance to glyphosate.

SYMPOSIA

GLYPHOSATE-RESISTANT HORSEWEED AND GLYPHOSATE-RESISTANT CROPPING TECHNOLOGIES

OUTLAW TECHNOLOGY- FOR WEED CONTROL IN SEVERAL CROPPING SYSTEMS AND RESISTANT WEED MANAGEMENT. H R. Smith, R. Browning, R.Underwood; Biological Research Service, Inc., College Station, TX; and Albaugh Inc. Ankeny, Ia.

Weed control in crop production systems has changed considerably with the introduction of glyphosate tolerant crops. There have been weed shifts in many areas and resistant weeds such as horseweed (*Conysa canadensis*), waterhemp pigweed(*Amaranthus tuberculatus*) and giant ragweed(*Ambrosia trifida*), developing in the glyphosate weed management systems. This may have been caused by the non-use of old stand-by pre-herbicides and the continuous use of glyphosate alone in all glyphosate tolerant crops. To better address the problem, different chemistries must be added to all weed control systems. Outlaw Technology (dicamba acid + 2, 4-D LVE) is basically a change in a hormone herbicide to be more compatible, and less volatile with more flexible products for applications used in sensitive cropping systems. These products can be used as pre-plant, pre- and post-harvest application in many crops and in rotational crops to prevent weed shifts and the onset of weed resistance.

SYMPOSIA

MANAGING WEED RESISTANCE TO HERBICIDES

REDUCING RISKS OF FUTURE RESISTANCE TO HERBICIDES. R.L. Nichols, Cotton Incorporated, Cary, NC.

ABSTRACT

Herbicides control unwanted plants (weeds), while sparing desired plants (crops or ornamentals). Since their utility depends on differential toxicity among types of plants, herbicides also are differentially toxic among species of weeds. Moreover, all toxicants differ in their affects on individuals within populations. Never-treated weeds that remain uncontrolled by herbicide treatment are termed naturally tolerant. Species that are incompletely controlled tend to multiply in treated areas, and instigate the changes in the species composition of plant communities called weed shifts. Species that were at-first controlled, but after repeated treatment (selection) are no longer controlled by the dose that was originally effective are termed resistant. Resistance has adverse economic effects on growers, manufacturers, and society, because resistance reduces options for economic pest control, directly increases the costs of production, and indirectly increases the costs of agricultural commodities.

Three factors principally affect the rate and intensity of resistance development: the expressed genetic variability of the treated species, the mode of action of the toxicant, and the intensity of treatment. In weed management, these factors are respectively, the exposed weed population, the formulated herbicide, and the rate and frequency of the mode of actions use. Weeds exhibit reaction to treatment based on their inherent biological capacities. Herbicidal modes of action are biochemical resources that are discovered, developed, and commercialized by human ingenuity, endeavor, and investment, respectively. Patterns of herbicide use are based upon the product’s technical utility, and result from an interaction of the manufacturer’s economic interest, the grower’s perception of comparative benefit, and society’s regulation to protect health and the environment. Thus neither the potential for a weed species to change in response to selection, nor the essential biochemical effects of an herbicide can be greatly affected by human manipulation. However, the pattern of herbicide use is a result from human activity and is subject to modification.

If resistance is an unavoidable consequence of selection, then it is a predictable counter-effect of use; strategies for resistance management could be integrated into product utilization. Use patterns are comprised of the rate of toxicant applied and the frequency of application. Principles for establishing rates and frequencies of application to reduce the rate of resistance development are known. First, pesticides should be applied at sufficient doses to eliminate reproduction by r,s heterozygotes (high dose strategy). Secondly, pesticides should be applied no more frequently than at an interval twice the life-cycle of the pest, thereby minimizing the opportunity for exposure of two consecutive generations to the same mode of action.

Development and implementation of effective programs of stewardship for herbicides would result in the long-term utility of modes of action, protection of manufacturer’s investments, and reduction of grower's weed management costs. Development of resistance management plans requires technical knowledge to effectively and economically balance a product's current utility and its projected longevity. Implementation of resistance management plans requires a means to achieve general compliance.

SYMPOSIA

MANAGING WEED RESISTANCE TO HERBICIDES

ACCASE RESISTANT RYEGRASS IN ARKANSAS WHEAT.

R.C. Scott, N.R. Burgos and L.R. Oliver; University of Arkansas, Fayetteville, AR.

ABSTRACT

ACCase- or diclofop (Hoelon)-resistant ryegrass developed in Arkansas in the mid 1990s. It was first reported by Baldwin et al. in 1997. Since that time the University of Arkansas has received 116 samples of ryegrass from all over the State and in the Bootheel of Missouri. Of the samples tested, 85 have been found to be ACCase-resistant. Hoelon-resistant ryegrass now occurs in practically all of the major wheat-producing counties in Arkansas. Although several types of ryegrass are found in the State it appears that Italian ryegrass (Lolium multiflorum) is the only species to become resistant at this time. Research efforts to control this weed have included both cultural and chemical over the past 10 years. Chemical or mechanical fallow, chlorsulfuron:metsulfuron (Finesse), pendimethalin (Prowl), metribuzin (Sencor), imazamox (Beyond) for Clearfield wheat, and flufenacet:metribuzin (Axiom) among others, have all been evaluated for Italian ryegrass control. Each of these options however, did not provide the ease of application, crop safety, consistency, rotational crop flexibility, and efficacy of Hoelon. Recently the development of mesosulfuron (Osprey) herbicide has provided Arkansas wheat producers with a true Hoelon replacement. University studies on Osprey have included crop safety, timing and rate trials, adjuvant studies, broadleaf tank mix studies and residual tank-mix partners. Osprey has provided consistent ryegrass control for the past several years in these research plots. It has more tank-mix flexibility than Hoelon. Osprey also provides a broader spectrum of weed control than Hoelon. The lack of any residual activity with Osprey is an area of concern and future study. In Arkansas, Italian ryegrass may germinate at several times during the growing season of wheat. More research is also needed to fully evaluate the broadleaf weed control spectrum of Osprey. In addition, future work will focus on controlling ryegrass that is both ACCase- and ALS-resistant. Because of the history of this and other species of ryegrass, the assumption is that over time resistance to Osprey will also develop in Arkansas wheat fields, if it is not already there.

SYMPOSIA

MANAGING WEED RESISTANCE TO HERBICIDES

MANAGEMENT OF ALS-RESISTANT RED RICE. N.R. Burgos, R.C. Scott, and K.L. Smith; Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

Red rice has plagued the southern U.S. rice belt since the time it got introduced into the country. Traditional herbicide technology could not effectively control it in rice production because red rice is biologically like rice. The commercialization of Clearfield technology, which allows selective control of red rice in rice through the use of imazethapyr (Newpath) herbicide on a herbicide-resistant rice cultivar, has revolutionized red rice management. If used properly and under optimum environmental conditions, Newpath can provide 100% control of red rice. There are many cases, however, when red rice survives or escapes the Newpath treatment because of inadequate soil moisture, insufficient spray coverage, inappropriate growth stage, excessive red rice infestation, or natural tolerance in some population variant. When red rice survives or escapes herbicide treatment, and its flowering synchronizes with Clearfield rice, cross pollination occurs at low rates (usually <0.1%). This translates to a few hundred plants per acre in the field as what was observed in a producers' field in Arkansas in 2004. Since herbicide resistance trait is dominant, all hybrids are herbicide-resistant and, if allowed to produce seed, will lead to the introgression of resistance trait to Newpath in the succeeding red rice generations. One thing in our favor is that, first generation red rice crosses are extremely late in flowering so not all of them will be able to produce viable seed before the first frost. Early plantings and warm fall, however, leave much time for the late red rice to reproduce. Resistant red rice populations could also develop as a result of herbicide selection pressure. This will happen if Newpath, or other herbicides with the same mode of action, is used repeatedly for red rice control. Research has determined that red rice populations in the U.S. are genetically diverse and have the propensity to be selected for resistance to ALS inhibitor herbicides like Newpath. We now have the technology to manage red rice better, even possibly eliminate it. It hinges on how effectively we integrate all the tools that are available. Therefore, red rice management has to be done with the immediate goal of mitigating the development of herbicide-resistant red rice populations. A sound management strategy should consider all of the following: 1) do everything possible to ensure maximum herbicide efficacy; 2) prevent remaining red rice from producing seed together with rice; 3) follow crop rotation recommendations; 4) rotate herbicide mode of action; 5) find herbicide options, in addition to glyphosate, in the rotational crop; 6) prevent remnant red rice from producing panicles in the fall after harvest; and 7) do everything possible to prevent spreading red rice seed from one field to another.

*Funding for various projects conducted related to Clearfield rice and red rice was provided by The Arkansas Rice Research and Promotion Board, BASF Co., and Monsanto Co., Inc.

SYMPOSIA

MANAGING WEED RESISTANCE TO HERBICIDES

GLYPHOSATE-RESISTANT HORSEWEED: A CASE STUDY. R.M. Hayes, L.E. Steckel, T.C. Mueller and C.L. Main. University of Tennessee, Knoxville, TN.

ABSTRACT

Bradshaw et al. 1997 (Weed Technol. 11:189-198) noted that few plants are resistant to glyphosate and that the long history of extensive use of the herbicide had resulted in no verifiable instances of weeds evolving resistance under field conditions. Three years later, VanGessel presented a poster at the WSSA annual meeting describing a glyphosate-resistant horseweed from a no-till soybean field in Delaware (Weed Sci. 49:703-705).

In the spring of 2001, UT weed scientists heard from a soybean producer in Lauderdale County, TN who failed to control horseweed with 0.75 lb ae/ac glyphosate, and did not achieve control after retreating with 1.5 lb ae/ac. An area of horseweed in a 60-acre field on the Milan Experiment Station, with a 5-yr history of glyphosate use for burndown followed by two or more 'in-crop' applications of glyphosate to Roundup Ready soybeans or cotton, was not controlled. More than 100 similar reports were received from producers, dealers, consultants, extension agents and scouts from Gibson, Lauderdale, Crockett and Haywood counties. Glyphosate rate response experiments performed in the greenhouse on seed collected from suspected resistant plants confirmed 8- to 12-fold resistance to glyphosate. Field experiments in Lauderdale, Gibson, Crockett, and Haywood counties also confirmed resistance. In each case, there was a history of two or more years with glyphosate being the only herbicide used.

We believe much of the resistance seen today developed in these fields. The rapid spread was most likely due to seed produced by glyphosate-resistant (GR) horseweed being disseminated by wind. At both the Jackson and Milan Experiment Stations, fields with little glyphosate use plus residual herbicides became infested with GR-horseweed, even with tillage. By 2004, most of the cropland in West Tennessee was infested with GR-horseweed. GR-horseweed was also being reported and confirmed in the neighboring states, KY, MS, MO and AR.

Among the unique features of horseweed was that it appeared to germinate throughout the growing season. In the fall of 2002, field emergence studies were initiated. Results to date indicate optimum emergence periods are September through November and from late March through May. Little or no emergence was observed from December through mid-March and from June through August.

In subsequent greenhouse and laboratory studies, we discovered that shikimate accumulates similarly in both GR- and susceptible horseweed, indicating an altered site on the enzyme EPSP synthase is not responsible for resistance. Sammons et al. 2002 confirmed that resistance was not due to uptake, metabolism, differential expression or amplification of EPSP synthase. Susceptible plants translocate 2-fold more glyphosate than resistant plants. They also noted that resistance was a nuclear-encoded dominant trait. In a follow-up study, Feng (Weed Sci. 52:498-505) stated that resistance in GR-horseweed was likely due to altered cellular distribution of glyphosate that impaired translocation and plastid import.

GR-horseweed, -rigid ryegrass and -goosegrass should be a 'wake-up call' that glyphosate resistance does occur under field conditions. Thankfully, several herbicides with uncompromised modes/sites of action were available to manage GR-horseweed. GR-resistant weed species will likely increase unless preventative resistance management strategies are implemented to protect glyphosate and associated technologies. GR-horseweed can be managed through a systems approach with a proactive strategy. In today's production systems, it is imperative that weed management strategies prevent the development of weeds with multiple resistances to herbicide chemistries. Equally important, we must insure the availability of alternate chemistries to manage unforeseen weed resistance.

SYMPOSIA

MANAGING WED RESISTANCE TO HERBICIDES

VULNERABILITIES OF HERBICIDE MODES OF ACTION TO WEED RESISTANCE: A MOLECULAR PERSPECTIVE. S.R. Baerson; USDA-ARS, Natural Products Utilization Research Unit, University, MS 38677

ABSTRACT

Weed resistance to herbicides impacts the agricultural industry at all levels, and poses a serious threat to the future effectiveness of available weed management strategies. Herbicide resistance can occur due to the modification of target proteins, however non target-based resistance is also commonplace, and can involve factors such as reduced herbicide uptake, translocation, or the ability of a weed to metabolize the herbicide to a less toxic compound. While the likelihood for non target-based resistance is extremely difficult to predict, some herbicide target enzymes can, for example, more readily tolerate mutations which interfere with herbicide binding, and this ability may be predictive for the increased likelihood of target-based resistance. The pros and cons of experimentally predicting mode-of-action vulnerability to weed resistance will be discussed, as well as some of the genetic and biochemical approaches that could be employed.

SYMPOSIA

MANAGING WEED RESISTANCE TO HERBICIDES

THE ROLE OF HERBICIDE RESISTANCE IN STRUCTURING WEED COMMUNITIES. D.A. Mortensen, J. Dauer , and E. Leguizamon; Department of Crop and Soil Sciences, The Pennsylvania State University and Catedra de Malezas, Departamento de Produccion Vegetal, National University of Rosario, Zavalla, Argentina.

ABSTRACT

The floristic composition of weedy species in agricultural fields and field edges is largely influenced by the nature of the cropping system and the management used for weed suppression. Generally, a reduction in diversity of mortality sources selects for an adapted flora. Success for an individual species is dependent on avoidance, tolerance and resistance traits. Avoidance results when a species' germination periodicity and time to reproductive maturity is asynchronous with mortality source. Species or biotypes within a species are known to show a wide range in tolerance to specific mortality sources, this is particularly true with repeated use of a single herbicide active ingredient. Finally, reduced mortality diversity is much more likely to select for resistance in a species carrying a heritable resistance mechanism. In this paper, four small scale and two larger scale studies are reviewed that assess the influence of mortality diversity and heavy reliance on glyphosate in particular, on weed infestation level and floristic composition. All of the studies are short-term, yet short-term dynamics reveal several interesting and consistent trends. In general, glyphosate-based weed control (where glyphosate was the principle mortality source) reduced weed abundance to very low levels. At the same time, this practice selected for an adapted flora, one where species either avoided treatment by germinating after glyphosate application, or had higher glyphosate tolerance, or both. Species that increased in these studies included common lambsquarter, several morningglory species, common sunflower and black nightshade. In the short-term, these populations slowly increased in abundance. It is likely therefore, that without management adjustments weed density in fields could increase to pre-glyphosate use levels but be dominated by a flora with several dominants. In several studies, the floristic diversity declined in a glyphosate-based system. However, others found diversity increased as representation of the winter annual flora increased with glyphosate use. It is difficult to design and conduct a small-scale study to assess the role resistance in one or several species plays in determining weed floristic composition. It can be inferred from field observation that the effect is profound. In regions where populations of glyphosate resistant horseweed have increased, the flora is dominated by this species. Selection for resistance therefore will alter weed communities with the likely result of decreased floristic diversity while one or several dominant species persist. A common theme of these studies and field-based observations is that dominant species will likely be selected for in less diverse weed management systems. These dominants may be analogous to keystone species in an agro-ecological sense. They are species that drive the biological dynamic of a system. In this case they will also drive the management dynamic of the system. The selection for dominants will almost certainly result in “management creep”, the ratcheting up of weed management inputs and costs to manage this adapted flora.

SYMPOSIA

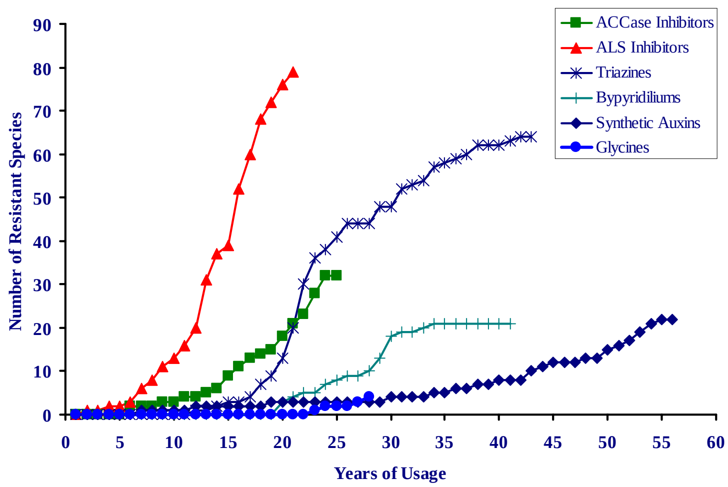
MANAGING WEED RESISTANCE TO HERBICIDES

HERBICIDE RESISTANCE RISK FACTORS. I.M. Heap, WeedSmart, Corvallis, Oregon 97339.

ABSTRACT

Most cases of herbicide resistance have occurred due to the repeated use of the same herbicide/herbicide mode of action in minimum tillage systems where herbicides have been relied upon for high levels of weed control. Resistance risk factors associated with the herbicide include the mode of action of the herbicide, the efficacy of the herbicide, the frequency of it's use, the number of years that it has been used, the area treated by the herbicide and the number of species that it controls.

Herbicide mode of action is one of the greatest variables in the rate of evolution of resistance (Fig 1).



For some herbicides, such as the ALS and ACCase inhibitors, there are many viable point site mutations that can confer resistance. Thus the initial frequency of resistant individuals is high and resistance appears quicker and more frequently than for some other herbicide modes of action such as synthetic auxins and glycines.

Some herbicides control a relatively small number of weed species and thus the opportunity for resistance is reduced. Given that glyphosate has been used for more than 27 years on a large number of acres, and that it controls more weed species than any other herbicide it is astounding that only seven weed species have evolved resistance to it.

Clearly mutations conferring glyphosate resistant weeds are rare. However the introduction of Roundup Ready crops has greatly increased the number of acres treated and the frequency of glyphosate usage. This will result in a greater number of glyphosate resistant weeds reported each year.

Because the initial frequency of glyphosate resistant mutations in weed populations is extremely low it will be more important to prevent the spread of resistant populations once they appear. For ALS and ACCase inhibitor herbicides many farmers selected their own resistant populations within 7 to 12 years of use. Spread of resistance certainly occurred but it was not a major issue as resistant individuals were likely already present on farmers' properties prior to any herbicide use. This is not necessarily the case for glyphosate resistant weeds. The appearance of glyphosate resistance will be rare "per unit area treated" so it will be important to prevent their spread once resistance is detected. The biggest problems will be presented by those weeds that have excellent dispersal mechanisms, such as *Conyza canadensis*. In such cases the prevention of spread is impractical. However for the recently discovered glyphosate resistant *Ambrosia artemisiifolia* in Mississippi there is merit in attempting to contain and delay its spread to other regions.

FIRST-YEAR HERBICIDE RELEASE OPTIONS FOR COGONGRASS CONTROL IN LOBLOLLY PINE PLANTATIONS. W.H. Faircloth, M.G. Patterson, J.H. Miller, and D.H. Teem, Auburn University and U.S.D.A. Forest Service, Auburn, AL.

ABSTRACT

In the southeastern U.S., cogongrass [*Imperata cylindrica* (L.) Beauv.] is invading forest lands, especially loblolly pine (*Pinus teada* L.) plantations. These even-aged silvicultural systems are prone to cogongrass establishment and growth due to clear-cutting and site preparation treatments that expose soil on large, contiguous areas in a short period of time. Such disturbance may create a mineral seed-bed that favors cogongrass seedling establishment and movement of machinery between infested and un-infested areas may introduce vegetative propagules. Deep tillage and high rates of the herbicides glyphosate and imazapyr are known to suppress cogongrass in a variety of situations, including site preparation for reforestation. Often control is needed after plantation establishment, but before pines become large enough to tolerate the high rates needed for control or a directed application can be made. The objective of this study was to investigate first-year release herbicide options for loblolly pine with respect to cogongrass control and pine response.

Release options were investigated on an existing field study that was designed to determine establishment options for loblolly pine into cogongrass. Field plots in the existing study were 100 loblolly pine seedlings spaced on a 25m x 25m grid (1600 trees/ha) planted Jan. 15, 2002. Field plots were subdivided, based on four prior site preparation (SP) types in the original study: 1) mechanical, 2) herbicide, 3) herbicide followed by (fb) mechanical, and 4) no SP. Release herbicides were imazapyr (0.17 kg/ha) applied alone, imazapyr (0.11 kg/ha) plus sulfometuron (0.11 kg/ha), and imazapyr (0.11 kg/ha) plus sulfometuron (0.11 kg/ha) plus metsulfuron (0.04 kg/ha). Four replications of each SP-release combination were used. Where no prior SP treatments were applied, release herbicides were compared in spring (May 21, 2002) and fall (Oct. 9, 2002) application timings. Where SP treatments had been implemented, release herbicides were applied on Oct. 9, 2002, only. Plant biomass was measured in August of 2003 and partitioned into 3 categories: 1) live cogongrass, 2) thatch, and 3) other remaining woody and herbaceous plants. Tree height (HT) and ground-line diameter (GLD) were measured at age 1 and 2, and diameter breast height (DBH) was measured at age 2. Mortality was recorded as percent survival. Contrasts were performed both within and between site preparation methods using Mixed Models analysis at the 0.05 level.

Release treatments showed no significant differences in second year plant biomass when preceded by the following SP methods: mechanical SP only (P=0.9916), herbicide SP only (P=0.7114), and mechanical SP plus herbicide SP (P=0.5852). Release treatments were significant for plant biomass where no SP was used. Tree response, as measured by GLD and HT in the second year, showed no significant differences for the various release treatments when applied after either herbicide SP only (P=0.6444) or mechanical SP plus herbicide SP (P=0.5713). Release treatments were significant in pine growth response for both the mechanical SP only and no SP. Spring-applied herbicides decreased live grass biomass and thatch compared to fall-applied, regardless of herbicide or prior SP method. Application timing of imazapyr alone made no significant difference in live grass biomass, while the spring-applied combination of imazapyr plus sulfometuron significantly decreased live grass biomass 33% compared to fall application. Contrary to both live grass and thatch, other species biomass was reduced by fall application of imazapyr plus sulfometuron, indicating that spring-applied tank-mixes increased the recruitment of possible successional species, which aid in the rehabilitation process. The tank-mix combination of imazapyr plus sulfometuron yielded larger trees in GLD (both years) and HT (year two), for mechanical SP and no SP. However, when the same tank-mix was applied as a release-only treatment, GLD was increased by 26% and 47% in years one and two, respectively, by application in the spring. Mechanical SP followed by fall application of the imazapyr plus sulfometuron tank-mix resulted in seedlings 70% and 34% larger in GLD and HT, respectively, when compared with the same tank-mix applied without prior SP. Release herbicides increased GLD regardless of SP treatment when applied in the spring compared to fall. A fall application of either imazapyr alone or imazapyr plus sulfometuron was near equivalent, with the tank-mix yielding a significant increase in HT only in the second year. There was no apparent response in tree size when sulfometuron was added to the tank mix with imazapyr and metsulfuron applied in the fall after an initial herbicide SP.

COGONGRASS [*Imperata cylindrica* (L.) Beauv.] MANAGEMENT USING SEQUENTIAL APPLICATIONS OF IMAZAPYR AND GLYPHOSATE. B.S. Peyton, J.D. Byrd, K.D. Burnell, B.K. Burns, and M.T. Myers; Department of Plant and Soil Science, Mississippi State University, Mississippi State, MS.

ABSTRACT

Two field studies were conducted from 2002 to 2004 in southern Mississippi to determine 1) the effectiveness of sequential glyphosate (Roundup Pro 4L) applications at various rates for cogongrass control and 2) number of applications (NOA) over years of glyphosate and imazapyr (Arsenal 2 AS) to maintain >50% control. Treatments for test 1 were 3 glyphosate rates by number of applications (1, 2, 3 or 4) 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. The experimental design for test 2 was a RCB with 3 replications at each location. Visual control data were recorded monthly at 30-day intervals until dormancy and presented as days after initial treatment (DAIT). 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 and April and May 2004 to foliage 36 to 40 inches tall. Following treatment, monthly visual ratings were collected and when the average control for a treatment fell to or 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 until cogongrass is completely eradicated. Both tests were applied using a CO_2 pressurized backpack equipped with a 4-nozzle boom sprayer delivering 20 GPA with 8002XR nozzles.

Results for objective one averaged over years indicated a range of control from 77 to 96%, 30 DAIT. All sequential applications were made from 60 to 90 DAIT and resulted in higher control compared to a single application. By 120 DAIT, which was only 30 days after the fourth sequential treatment, five qt/A applied twice, as well as all rates applied three or four times provided 81 to 98%. Data for 180 DAIT was the last collected before dormancy. Five qt/A glyphosate applied three or four times, as well as 2.5 qt/A applied four times performed similarly with 82 to 94% control. By 365 DAIT, 5 qt/A glyphosate applied four times maintained the highest control of 62% averaged over years. All others were below 45% control. Data for objective two pooled over years and locations, revealed that 79 to 87% control was achieved with imazapyr (16 oz/A and 1% V/V) and glyphosate (2.5 qt/A and 2% V/V) 30 DAIT. When averaged over years and rates, control was 77 or 81% when treated with imazapyr or glyphosate. By 60 DAIT, imazapyr at 1% V/V or 16 oz/A, and glyphosate at 2.5 qt/A showed the highest levels of control from 85 to 73%, while the remaining treatments were below 70%. Imazapyr maintained approximately 75% control when averaged over years and rates, while control with glyphosate fell to 65%. Imazapyr 1% V/V or 16 oz/A increased cogongrass control to 89 and 82% by 90 DAIT when combined over years and locations. At that same evaluation interval, all glyphosate treatments controlled cogongrass 67 to 71%. When averaged over years and rates, imazapyr maintained 76% control, while glyphosate increased to 69%. By 120 DAIT, data averaged over years and locations indicated imazapyr at 1%V/V, and glyphosate at 2% V/V or 2.5 qt/A provided 78 to 84% control. Pooled over years and rates at 120 DAIT, glyphosate and imazapyr provided comparable control of 76 or 73%, respectively. Cogongrass control combined over years and locations at 150 DAIT was highest for glyphosate at 2% V/V and 2.5 qt/A with 89 and 81%, while control with all other treatments ranged between 64 and 70%. When averaged over years and rates, glyphosate and imazapyr had 79 and 67% control, respectively. To provide the level of control observed in this study, imazapyr at 8 oz/A needed at least 1 additional application, while 16 oz/A and 1% V/V required no more than 1 additional application. All glyphosate treatments needed at least 1 additional application.

CARFENTRAZONE IN COMBINATION WITH 2,4-D FOR THE CONTROL OF EURASIAN WATERMILFOIL (*Myriophyllum spicatum*) AND PARROTFEATHER (*Myriophyllum aquaticum*). C.J. Gray[1], J.D. Madsen[1], R.M. Wersal[1], and K.D. Getsinger[2], [1]Mississippi State University, Mississippi State, MS; and [2]U.S. Army Engineer Research and Development Center, Vicksburg MS.

ABSTRACT

Invasive plants degrade aquatic ecosystems throughout the United States. These weedy species destroy fish and wildlife habitat and interfere with water uses and ecological processes. Currently, there are only eight herbicides labeled for use in aquatic sites. In order to control newly introduced invasive plants and implement resistance management stewardship, additional chemistries and active ingredients need to be developed for managing aquatic and wetland systems. Carfentrazone-ethyl is being evaluated and holds promise for control of aquatic plants.

In a preliminary experiment, results from outdoor mesocosms (Lewisville, TX) suggested only moderate control of the invasive species Eurasian watermilfoil (*Myriophyllum spicatum* L.) and parrotfeather [*M. aquaticum* (Vell.) Verdc.] when carfentrazone-ethyl was used alone. Two experiments were conducted in Starkville, MS to evaluate the efficacy of carfentrazone-ethyl in combination with 2,4-D in outdoor mesocosms. Treatments in the first experiment consisted of carfentrazone (100 µg ai L^{-1}) and 2,4-D (1.0 mg ae L^{-1}) applied alone and in combination (carfentrazone:2,4-D = 100:0.25, 100:0.5, 100:1.0 and 100:2.0) and an untreated control. Treatments in the second experiment consisted of carfentrazone (150 and 200 µg ai L^{-1}) and 2,4-D (0.1 mg ae L^{-1}) and in combination (carfentrazone:2,4-D = 100:0.1) and an untreated control. Visual herbicide efficacy ratings were assessed based on a scale of 0 (no control) to 100% (death of plant) and growth of shoot biomass were collected at 3 weeks after treatment (WAT).

In the first experiment, Eurasian watermilfoil control 1 WAT was more than 90% for all treatments containing a combination of carfentrazone and 2,4-D. Carfentrazone and 2,4-D alone 1 WAT controlled Eurasian watermilfoil 82 and 78%, respectively. Eurasian watermilfoil control was 100% 3 WAT for all treatments except carfentrazone alone (70%). Parrotfeather control 1 WAT was at least 90% for all treatments except 2,4-D alone (72%). At 3 WAT, parrotfeather control was 100% for all treatments with the exception of carfentrazone alone (70%). Shoot biomass of both species were collected for only carfentrazone alone and the untreated control due to complete control obtained from all other treatments; however, shoot biomass for both Eurasian watermilfoil and parrotfeather (0.9 and 1.8 g/pot) were lower compared to the untreated control (1.7 and 10.0 g/pot).

In the second experiment, Eurasian watermilfoil control 1 WAT was 95% for all treatments with the exception of 2,4-D alone (55%). At 3 WAT treatment, Eurasian watermilfoil control with 2,4-D alone decreased to 43%, while control with respect to all other treatments had increased to at least 98%. Parrotfeather control 1 WAT was at least 90% for all treatments except 2,4-D alone (62%). Parrotfeather control with 2,4-D 3 WAT decreased to 53% while all other treatments were statistically the same, with control ranging from 88 to 100%. Only the combination of carfentrazone and 2,4-D controlled both species 100% 3 WAT. Eurasian watermilfoil biomass was not decreased with 2,4-D alone when compared to the untreated control. The decrease in 2,4-D control of both species may be attributed to the decreased rate used and also the decrease in water temperature.

Results from these studies suggest carfentrazone applied with 2,4-D will completely control both Eurasian watermilfoil and parrotfeather. Eurasian watermilfoil control may be obtained using a carfentrazone rate of 150 µg ai L^{-1} or greater. Carfentrazone applied alone initially controlled parrotfeather; however, tissue viability 3 WAT indicated that plant recovery was likely.

THE IMPACT OF IMAZAPYR RESIDUES ON NATIVE PLANT ESTABLISHMENT. Melissa Carole Barron, G.E. MacDonald, D.G. Shilling, A.M. Fox, and N.B. Comerford; University of Florida, Gainesville, FL; University of Georgia, Athens, GA.

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. This aggressive weed has spread rapidly throughout the southeastern U.S., covering several thousand acres in Florida, Mississippi, and Alabama. Current control strategies often incorporate burning and herbicide application, yet rarely provide long-term control. An extensive rhizome system allows for persistent regrowth and spread of cogongrass. 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.

Field experiments were conducted in June and July 2004 at the Plant Science Research and Education Unit (PSREU) in Citra, Florida. The soil type at Citra is a Sparr sand (loamy, siliceous, hyperthermice Grossa-renic paleudult) with 1% organic matter and a pH of 6.4. The field area was conventionally prepared using standard tillage practices. Imazapyr (Arsenal 4 SC) was applied at 0.0, 0.016, 0.032, 0.063, 0.125, 0.25, 0.5, and 1.0 lbs-ai/A using a backpack CO_2 sprayer calibrated to deliver 20 gallons per acre. Immediately after application, the herbicide was lightly incorporated into the soil to a depth of 2-3 inches. The entire experiment was conducted twice, with 20 x 25 ft² plots arranged in a completely randomized block design with four replications. Within 24 hours of herbicide application, 8 native and 2 non-native seedling species were hand-planted into each plot. Species were evaluated for survival/mortality at 6 weeks after transplanting and evaluated for percent injury at 6 and 10 weeks after planting where 0 = no injury and 100 = plant death.

Regression equations were generated to aid in the prediction of imazapyr injury and plant mortality. Using the regression equations from percent mortality data, P_{40} values were generated, which define the highest amount of imazapyr present in the soil that will allow for at least 40% survival of the particular species. Wax myrtle and longleaf pine showed less than 40% survival at the lowest rate of imazapyr, while mimosa and both *Eucalyptus* species show greater than 40% survival at the highest rate of 1.0 lbs-ai/A. In addition to the predicted P_{40} values, I_{20} values were also generated based on the injury data regression equations. These are the values of imazapyr in the soil that are predicted to cause less than 20% injury to the plant species. Both broomsedge and silkgrass showed at least 20% injury at all rates of imazapyr, and only *Eucalyptus grandis* showed less than 20% injury at rates above 0.03 lbs-ai/A. Although percent injury was high for many of the species tested, percent mortality data indicates several species have the ability to survive and eventually out-grow imazapyr injury. This provides a mechanism to establish desirable species as quickly as possible before cogongrass regrowth.

If complete cogongrass control is the main objective, utilizing current management techniques has been shown to be only marginally successful. Ideally, cogongrass should be gradually eliminated while desirable species are introduced. Taking considerations such as residual herbicide amount, plant tolerance levels, and soil types can be very beneficial to an overall cogongrass control strategy. By combining this plant tolerance information with current bioassay data, a replant interval model can be generated for each species. This will be useful in determining which plant will perform best in a specific soil type for further suppression of cogongrass, which is the ultimate goal.

EFFECT OF HEAT ON COGONGRASS VIABILITY. 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

Cogongrass [*Imperata cylindrica* (L.) Beauv.], a rhizomatous perennial grass, is among the most troublesome weeds worldwide. Following introduction into the southern U.S., cogongrass has spread at an alarming rate and is now an invasive weed in many states of the Coastal Plain Region of the southeastern U.S. Research was conducted at the Southern Weed Science Research Unit facilities, Stoneville, MS to determine the effectiveness of heat in killing cogongrass rhizomes and evaluate survival and mortality with tetrazolium chloride rather than a greenhouse bioassay. Rhizomes were harvested from a small patch of cogongrass maintained in a containment area at Stoneville, MS on a on a Dundee silt loam (fine-silty, mixed, thermic Aeric Ochrsaqualf). Rhizomes of 0.6 to 0.7 cm diam were cut into 10-cm-long segments and subjected to temperatures of 52, 65, 79, 93, 107, 121, 149, 177, and 187 C for 0.5, 1, 1.5, 2, 2.5, 5, 10, 15, 20, 25, and 30 min. Following heat treatment, five rhizome segments were cut in half and placed in a vile with 5 ml 1% tetrazolium chloride and five rhizomes were placed in 8 by 15 cm trays in a 50/50 v/v Bosket sandy loam soil (Mollic Hapludalfs)-sphagnum mixture, covered lightly with the soil mixture, and allowed to sprout in the greenhouse. Soil was watered lightly to maintain soil moisture. The greenhouse was maintained at temperatures of 20/30 C night/day with no supplemental lighting. Fresh and dry weight of rhizomes and leaves were recorded at 6 wk. Cogongrass rhizomes treated with tetrazolium chloride in vials were placed in the dark for 24 h, split longitudinally, and visually determined to be pink or not. The experiment was conducted as a factorial design with four replications and was repeated. All data were analyzed according to analysis of variance. Cogongrass rhizome mortality increased with increasing temperature and longer duration of heat exposure. Cogongrass rhizome mortality was 100% at 65, 79, 93, 107, 121, 149, 177, and 187 C at time periods $\geq$ 25, 5, 2.5, 2.5, 2.5, 2, 2 and 1 min, respectively. The duration of heat required for cogongrass mortality was less as temperature was increased. Tetrazolium chloride was ineffective in predicting viability of cogongrass rhizomes following heat treatments. Of the 99 treatment combinations, tetrazolium chloride predicted 100% mortality correctly 5 times and correctly determined 100% survival of cogongrass rhizomes 25 times when compared to the standard greenhouse bioassay. A standard greenhouse bioassay for cogongrass rhizome mortality was more accurate than a chemical test using tetrazolium chloride.

WATER PASPALUM (*PASPALUM HYDROPHILUM* HENR.) MANAGEMENT IN RICE (*ORYZA SATIVA* L.) R.M. Griffin, E.P. Webster, W. Zhang, and C.T. Leon. Louisiana State University AgCenter, Baton Rouge.

ABSTRACT

Two field studies were conducted at the LSU AgCenter Rice Research Station located near Crowley, La in 2004 to evaluate existing herbicide programs for control of *Paspalum hydrophilum.* Soil was a Crowley silt loam (fine montmorillonitic, thermic Typic Albaqualf) with 1.4% organic matter and pH 5.5. Imidazolinone resistant 'CL-161' rice was drill-seeded on 15-cm rows at a rate of 78 kg/ha. Plot size was 1.5 by 5.2 m. The first study herbicide treatments included: 208 g ai/ha cyhalfop early postemergence (EPOST) fb 315 g/ha cyhalofop late POST (LPOST), 22 g ai/ha bispyribac EPOST fb 22 g/ha bispyribac LPOST, 66 g ai/ha fenoxaprop EPOST fb 86 g/ha fenoxaprop LPOST, 70 g ai/ha imazethapyr EPOST fb 70 g/ha imazethapyr LPOST and 50 g ai/ha penoxsulam mid-POST (MPOST). Each herbicide treatment was assessed with and without 448 g ai/ha clomazone preemergence (PRE). The second study preemergence herbicide treatments included: 448 g/ha clomazone PRE, 448 g/ha clomazone plus 420 g ai/ha quinclorac PRE, 448 g ai/ha pendimethalin plus 420 g/ha quinclorac PRE, 70 g/ha imazethapyr at rice spiking, and 175 g ai/ha mesotrione PRE. Each herbicide application was followed by a MPOST application of 314 g/ha cyhalofop.

P. hydrophilum control and rice injury were visually estimated 7 days after the final postemergence application (DAT) and continued weekly until 49 DAT on a scale of 0 to 100%, where 0 = no control and 100 = plant death for both trials. Rice plant height was measured from the soil surface to the tip of the extended panicle immediately prior to harvest. Rough rice grain yield was determined by harvesting the center 0.74-m area of each plot with a small-plot combine and adjusted to 12% moisture. Data were subjected to the mixed procedure of SAS. Weed control data were analyzed as repeated measures and means separated by Tukey's pairwise test at the P=0.05% probability level.

In the first study, treatments that contained applications of cyhalofop or imazethapyr, with and without a preeemergence application of clomazone, controlled *P. hydrophilum* at least 81% across all rating dates. Additionally, programs that included applications of fenoxaprop or a preemergence application of clomazone controlled *P. hydrophilum at* least 89% at 7 DAT . However, for treatments containing fenoxaprop, bispyribac, or penoxsulam, control did not exceed 75% after 21 DAT. Rice heights were at least 85-cm for all treatments and differed from the height of the nontreated rice which was 80-cm. Rice yields were 3710 to 5830 kg/ha and differed from the nontreated rice with a yield of 1800 kg/ha.

In the second study, control of *P. hydrophilum* was at least 90% following a MPOST application of cyhalofop and was not affected by any preemergence herbicide treatment at 14 to 49 DAT. Rice height was at least 84-cm for all treatments and differed from the height of the nontreated rice which was 80-cm. Rice yield was 3280 to 5010 kg/ha. Herbicide treatments containing imazethapyr or mesiotrione had yields of 5010 and 4750 kg/ha, respectively and were among the highest yielding treatments.

Herbicide programs that included applications of cyhalofop or imazethapyr were effective in controlling *P. hydrophilum* in drill-seeded rice. The addition of a PRE herbicide did not affect *P. hydrophilum* control, but could be used in herbicide programs with cyhalofop or imazethapyr to address other weed problems. Even though *P. hydrophilum* control did not affect rice height or yield, populations of this weed that are allowed to survive and propagate could impact future rice production.

HERBICIDE CONTROL OF SEEDLING SERICEA LESPEDEZA. R.L. Farris and D.S. Murray; Oklahoma State University, Stillwater, Ok.

ABSTRACT

A field experiment was conducted at the Agronomy Research Station near Stillwater, OK to evaluate herbicide control of newly-planted seedling sericea lespedeza (*Lespedeza cuneata*). The experimental design was a randomized complete block with three replications. The plot size was 1.6 m wide by 3 m long. Sericea lespedeza was planted at a rate of 34 kg/ha. Various herbicides and/or tank-mix combinations were applied pre-plant incorporated (PPI), preemergent (PRE), early-postemergent (EPOST), or late-postemergent (LPOST) to the seedling sericea lespedeza. One PPI, 10 PRE, 16 EPOST, and 17 LPOST herbicides or herbicide tank-mix combinations were applied in the experiment. Visual control ratings were recorded with ratings based on a scale of 0 to 100.

Levels of sericea lespedeza control varied somewhat between herbicides and herbicide application strategies used. The PRE application strategy resulted in sericea lespedeza control of 47-100 % from Strongarm (0.0003 kg ai/ha; 47% control), Cotoran (2.24 kg ai/ha; 98 % control), and 100% season-long control from Plateau (0.105 kg ai/ha) and Valor (0.107 kg ai/ha). The EPOST application resulted in 8-100 % control from herbicides such as Basagran (1.12 kg ai/ha; 8% control), Ally (0.017 kg ai/ha; 98 % control), and Remedy (6.7 kg ai/ha) with 100 % sericea lespedeza control. The LPOST application resulted in 8-100 % control from herbicides such as Plateau (0.105 kg ai/ha; 8% control), Weedmaster (2.17 kg ai/ha; 78 % control), and Remedy (6.7 kg ai/ha) with 100 % control. In conclusion, the early herbicide application strategy (PRE) resulted in the best season-long control of seedling sericea lespedeza. The EPOST herbicide application group used was second in efficacy. Results also showed that as the seedling sericea lespedeza plant matures, the more difficult control becomes, as seen with the LPOST herbicides used.

SEEDHEAD MANAGEMENT FOR COGONGRASS (*Imperata cylindrica*). K.D. Burnell, J.D. Byrd, JR., P.D. Meints, B.S. Peyton, and B.K. Burns. Department of Plant and Soil Sciences, Mississippi State University, MS 39762.

ABSTRACT

In 2003 (2) and 2004, experiments were conducted to evaluate plant growth regulators (PGR's) applied at various phenological stages for eliminating cogongrass seedhead production. All tests were designed as randomize complete blocks with three replications at two locations each year with checks for comparison. In 2003, test one was a 6 (chemical) by 4 (application stage) factorial arrangement. Chemicals included trinexapac-ethyl at 0.08 lbs ai/A, sulfometuron at 0.05 lbs ai/A, imazapic at 0.19 lbs ae/A + 0.25% v/v NIS, clethodim at 0.26 lbs ai/A + 1% v/v COC, glyphosate at 0.38 and 0.76 lbs ae/A. Applications were made at dormant, joint to boot (JT/BT), boot to seedhead emergence (BT/SHE), and seedhead emergence to anthesis (SHE/ANT). Test two was a 5 by 4 factorial with imazapic and glyphosate rates the same as in test one, along with imazapyr at 0.25 lbs ae/A + 0.25% v/v NIS and clethodim at 0.13 lbs ai/A + 1% v/v COC. Applications were made at joint (JT), JT/BT, BT/SHE, and SHE/ANT. In 2004, same rates were used for trinexapac-ethyl, imazapic, imazapyr, and glyphosate, with the addition of sulfometuron at 0.09 lbs ai/A and clethodim at 0.13 or 0.26 lbs ai/A + 1% v/v COC. Applications were made at all 5 stages dormant, JT, JT/BT, BT/SHE, and SHE/ANT for an 8 by 5 factorial. Seedhead control (SHC) was visually estimated (0-100%), 0% indicated no control and 100% indicated complete seedhead elimination/no seedhead (s).

In 2003, test one applications at either JT or JT/BT provided 87 to 97% SHC when averaged over locations and chemicals. Most effective chemicals were glyphosate at 0.38 and 0.76 lbs ae/A, imazapic at 0.19 lbs ae/A, and clethodim at 0.26 lbs ai/A when applied before or at BT/SHE stage. In test two, all applications before SHE/ANT provided 74 to 89% SHC. Data indicated seedheads could be controlled with glyphosate or imazapic when applied at JT/BT or BT/SHE. From 2004 data, only trinexapac-ethyl at 0.08 lbs ai/A was ineffective, while all others provided 78 to 96% SHC. Most effective and consistent SHC was obtained with applications made from dormant up to JT/BT stage, with 80 to 99%, BT/SHE 75 to 90% and SHE/ANT 43 to 72%, respectively. Overall, sulfometuron at 0.05 lbs ai/A and trinexapac-ethyl at 0.08 lbs ai/A were ineffective. In 2003, clethodim at 0.13 lbs ai/A + 1% v/v COC was not effective, while the 0.26 lbs ai/A was effective; however, both rates performed well and showed no differences among each other in 2004. The 0.26 lbs ai/A rate of clethodim would be recommend due to more consistent results over the two years. No differences were seen between rates of glyphosate rates 2003 or 2004. The most effective and consistent chemicals were glyphosate at 0.38 and 0.76 lbs ae/A, imazapic at 0.19 lbs ai/A + 0.25% v/v NIS, sulfometuron at 0.09 lbs ai/A, imazapyr at 0.25 lbs ai/A + 0.25% v/v NIS, and clethodim at 0.26 lbs ai/A + 1% v/v COC. Best application times being at dormant through BT/SHE, with applications closer to the boot stage being more effective.
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SYMPOSIA

INVASIVE SPECIES MANAGEMENT

DEVELOPING A STATE INVASIVE SPECIES ALLIANCE FOR MISSISSIPPI. J.D. Madsen, J.D. Byrd, Jr., D.R. Shaw, and R.G. Westbrooks, Mississippi State University, GeoResources Institute, Mississippi State, MS 39762-9652 and U.S. Geological Survey, Biological Resources Discipline, Whiteville, NC 28472

ABSTRACT

Invasive species are a multi-billion dollar problem in the mid-south states. While a number of federal, state, and local agencies have responded with small programs to manage these problems, cost-effective management requires early detection and management. The proliferation of programs lacks effective communication and coordination between states and agencies. Individual development of tracking new infestations and data sharing would be wasteful duplication of funds. We are developing a task force of federal, state, and local government agencies, nongovernmental organizations and concerned citizens focused on the early detection and management of invasive noxious species in Mississippi, the Mississippi Invasive Species Alliance (MISA). The organization will be tiered, having an executive council of decision-makers from each state, a technical steering committee, and an advisory council composed of those interested in participating.

The invasion of a profusion of species impacting all aspects of our national ecosystem has generated considerable concern among natural resource managers and scientists, resulting in the formation of a number of groups focused on invasive species issues. Some focus on a given species, while others focus on resource types or habitats. Many of these groups have been effective in their targeted goals, others less so. Why do we need another group?

First, scientists or resource managers start most of these groups, for scientists and natural resource managers. They do not specifically include decision makers and people of influence, to enact their goals into policy. The Mississippi Invasive Species Alliance incorporates these state policymakers into an executive council, to include them in the process. Second, the very proliferation of these groups has created a new problem – these groups compete for attention and resources. While MISA does not seek to replace these groups in any way, it does seek to present a coordinated front to the public to minimize competition for resources. Third, most of these groups cannot devote the necessary resources to develop and maintain web-based databases and information resources on the invasive species problems in the state. We are seeking to provide this information node for invasive species groups and target species for the state.

The Mississippi Invasive Species Alliance will actively seek cooperation and collaboration with existing invasive species in the state and country. We will also provide information through a broader network on invasive species concerns. We will work with state and federal agencies to provide timely information on the locations of target invasive species through a web-based database. We will work with professionals and volunteers in training, education, and resources to find new locations of invasive species, and monitor their distribution.

SYMPOSIA

INVASIVE SPECIES MANAGEMENT

SIGNIFICANT INVASIVE SPECIES OF THE MID-SOUTH STATES. V. Maddox, J. Byrd, and J. Madsen. GeoResources Institute, Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

There are approximately 223,000 species of vascular plants on Earth. Of these, around 8,000 are considered invasive weed species and approximately 250 weed species are serious invasives. Various lists have been generated on invasive species, from the noxious weed lists to more comprehensive lists of all known invasive plants in a given locale or state. The intent here is to focus on invasive species that pose a serious threat to natural areas in the mid-south. Web databases and other information were assimilated to identify twelve species that might be considered the most invasive species in mid-south natural areas. Based upon information gathered, the twelve species identified were: alligator weed (*Alternanthera philoxeroides*), Brazilian vervain (*Verbena brasiliensis*), callery pear (*Pyrus calleryana*), Chinese privet (*Ligustrum sinense*), Chinese tallow tree (*Triadica sebifera*), cogongrass (*Imperata cylindrica*), Eurasian water milfoil (*Myriophyllum spicatum*), hydrilla (*Hydrilla verticillata*), Japanese honeysuckle (*Lonicera japonica*), Kudzu (*Pueraria montana* var. *lobata*), Nepalese browntop (*Microstegium vimineum*), and water hyacinth (*Eichhornia crassipes*). Alligator weed, Eurasian water milfoil, hydrilla, and water hyacinth are aquatic exotic invasives. The remaining species are terrestrial, although most are facultative species. Of the twelve species Japanese honeysuckle is the most widespread terrestrial species and Eurasian water milfoil is the most widespread aquatic species in the United States. They are likewise widespread in the mid-south. Japanese honeysuckle was introduced into cultivation in 1806. Chinese tallow tree, a facultative species introduced into cultivation in 1850, is a very serious exotic invasive in the mid-south coastal plain. It is on the noxious weed list in Mississippi, but still used as an ornamental in parts of the mid-south. Another serious facultative species is Chinese privet. Introduced into cultivation in 1912, Chinese privet is still sold and utilized as an ornamental, although awareness has intensified. Callery pear was introduced into cultivation in 1908. 'Bradford' callery pear is a common cultivar used in residential and commercial landscapes. Now escaped, it is found in at least 12 states. Kudzu was introduced from Japan in 1876 and recognized as forage in 1905. Forty-one years later 300,000 acres of kudzu were in forage production and it was also extensively planted for soil erosion control. Now considered a serious weed, it is found in at least 24 states. Cogongrass is not as widespread in the United States, but it is considered highly invasive. Of the twelve species mentioned, it is one of only three herbaceous terrestrial invasive species. Brazilian vervain, another facultative species, has escaped in at least 15 states. It has been sold as an ornamental and widely naturalized in much of the mid-south. Nepalese browntop is a shade tolerant grass species listed as a state noxious weed in 43 states since its introduction into Tennessee in 1919. It has been listed as a class C noxious weed in Alabama and one of the top ten worst weeds in Georgia according to the Georgia EPPC. Of the four aquatic invasive species, two are emergent and two are submergent species. Alligator weed and water hyacinth are emergents native to the New World and now widespread in the Southeast. Eurasian water milfoil and hydrilla are mostly submergent, but flower above the water's surface. Aside from natural dispersal, all four invasive aquatic species can be spread by boating equipment. For some of the twelve species, control would not be economically feasible. However, control of emerging invasive species may prove more feasible. Control efforts are currently being directed toward other species mentioned. Multifaceted, multidisciplined approaches may be required to more fully understand the ecology of emerging exotic invasives. Predictive modeling, Mapping, GIS, and other existing and developing tools will be essential in this effort. Aside from existing invasives, more attention is needed in prevention of other invasive species.

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INVASIVE SPECIES MANAGEMENT

COMPETITIVE EFFECTS OF COGONGRASS ON LOBLOLLY PINE SEEDLINGS; SECOND YEAR RESULTS. C.L. Ramsey, S. Jose, and B.J. Brecke; USDA-APHIS-PPQ-CPHST, Fort Collins, CO. 80526 and UFL/IFAS, University of Florida, Milton campus, Milton FL. 32583.

ABSTRACT

A cogongrass competition 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. An objective of the study was to determine the competitive effects of four vegetation conditions on loblolly pine seedling survival and growth. The majority of the cutover site was aerially applied on October 15, 2002 with a site preparation, 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 so that four vegetation conditions could be included in the study: 1) control (untreated), or cogongrass competition (CGC), 2) site preparation inside the cogongrass infestation, or mixed vegetation competition (MVC), 3) site preparation plots outside of the cogongrass infestation, or native vegetation competition (NVC), and 4) site preparation plots outside of the cogongrass infestation that were kept weed-free/no competition (WF). Bare-root loblolly pines were planted on March 6, 2003 on a 1.8 x 1.1 m spacing. Pine survival ranged from 55 – 75%, and was not affected by the four vegetation conditions. Pine heights were 32, 36, 36, and 44 cm, two years after spray application, for CGC, NVC, MVC, and WF treatments, respectively. Groundline pine diameters (GLD) were 6.7, 16.8, 11.5, and 30.4 mm, two years after spray application, for CGC, NVC, MVC, and WF treatments, respectively. All four vegetation conditions affected pine diameters ($p = 0.0001$), with GLD ranked in the following order WF>NVC>MVC>CGC. Stem volume index ($SVI = GLD^2 \times Ht$) was 25, 273, 133, and 1139 cm^3, two years after spray application, for CGC, NVC, MVC, and WF treatments, respectively. All four vegetation conditions affected SVI ($p = 0.0001$), with SVI ranked in the following order WF>NVC>MVC>CGC. Cogongrass competition (CGC) reduced loblolly GLD and SVI by 60 and 78% when compared to the NVC treatment. Cogongrass competition (CGC) reduced loblolly GLD and SVI by 90 and 98% when compared to the WF treatment. Differences in pine GLD and SVI between the NVC and MCV treatments 16.8 vs 11.5 mm, and 273 vs 133 cm^3, respectively, indicate that there may be allelopathic root exudates stunting pine growth in the MVC treatment. Visual observations of the site preparation area inside the previous cogongrass infestation show that cogongrass re-infested approximately 40 – 80% of that area by the end of the second year. The time period between the site preparation application and the time that the cogongrass re-infests that area may not extend long enough for the loblolly pine seedlings to achieve canopy closure. If pine canopy closure could be achieved before significant competition from cogongrass reduces/halts pine growth, then shade inhibition from the closed canopy could provide long-term control of cogongrass.

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INVASIVE SPECIES MANAGEMENT

TORPEDOGRASS (*PANICUM REPENS*) MANAGEMENT IN FLORIDA. G.E. MacDonald, K.A. Langeland and D.L. Sutton, University of Florida, Gainesville, FL.

ABSTRACT

Torpedograss continues to be one of most troublesome and costly invasive species in Florida. It invades aquatic, wetland and upland native plant communities, displacing desirable flora and fauna. In Lake Okeechobee alone, torpedograss infests over 7,000 acres, from transitional wetland areas to water 3 feet in depth. Management of torpedograss is limited to chemical control methods, with glyphosate being the primary herbicide used. This broadspectrum herbicide provides control but is injurious to successional plants. In addition, the level of control with glyphosate is highly variable. Therefore, upland and aquatic field studies were conducted to evaluate the effect of several herbicides and herbicide combinations for torpedograss control and native plant species tolerance. Under upland conditions, all treatments provided less than acceptable control (<50%) when evaluated 9 months after application. Imazapyr @ 0.75 lbs-ai/A and glyphosate @ 2.0 lbs-ai/A provided the best control of torpedograss but also caused the greatest level of damage to sagittaria (*Sagittaria latifolia*) and buttonbush (*Cephalanthus occidentalis*). Conditions in the plot area during the summer months were flooded and this may have contributed to the problems with control. In greenhouse evaluations, imazapyr and glyphosate applied alone or in combination provided excellent control of torpedograss, regardless of application rate. There also appeared to be no advantage of combining glyphosate and imazapyr. In addition to glyphosate and imazapyr, several additional compounds were tested. These were tested alone or in combination with imazapyr and glyphosate. Clethodim, hexazinone and imazapic showed some promise in reducing shoot regrowth, but this study failed to identify an herbicide treatment that would perform equally to glyphosate or imazapyr, or would provide an increase in control compared to imazapyr or glyphosate alone. However, this study did provide valuable information as to those compounds that have little impact on torpedograss, and those combinations that may warrant further evaluation. Desirable native plant species were evaluated for tolerance to herbicides potentially used for torpedograss control. Of the plants evaluated (Sagittaria, spikerush [*Scirpus spp*.] and buttonbush), several herbicides including clethodim, fluazifop, and quizalofop showed good tolerance when applied at labeled rates. Unfortunately, these materials did not provide good control of torpedograss in the other trials. Therefore, selective torpedograss control with these materials may not be possible. Radiolabeled studies were also conducted to evaluate the potential leakage and translocation of glyphosate and imazapyr in torpedograss. These studies suggest that herbicide leakage from applications made to plants along ditch banks would not be a significant loss. However, these studies also suggest that herbicide translocation to plant tissue submerged or surrounded by water would be limited, especially with applications of imazapyr. Although further studies should be conducted, it suggests translocation may be impeded in those tissues in water.

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INVASIVE SPECIES MANAGEMENT

FORMING A MID-SOUTH INVASIVE SPECIES ALLIANCE. D.R. Shaw, Mississippi State University, GeoResources Institute, Mississippi State, MS 39762-9652.

ABSTRACT

Invasive species are a multi-billion dollar problem in the Mid-South states. While a number of federal, state, and local agencies have responded with small programs to manage these problems, cost-effective management requires early detection and management. The proliferation of programs lacks effective communication and coordination between states and agencies. Individual development of tracking new infestations and data sharing would be wasteful duplication of funds. Mississippi has begun efforts to develop a mid-south organization (MISA) with the primary purpose of developing a data-sharing network for the occurrence of invasive species, and secondarily to increase the acquisition of funding and efficiency of fund utilization to deal with Mid-South problem invasive species. Through funding from the US Geological Survey, efforts have been initiated to develop and implement a task force of federal, state, and local government agencies, nongovernmental organizations and concerned citizens focused on the early detection and management of invasive noxious species in Mid-South states. The organization will be tiered, with coordination at both the state and regional level. Our target states include Alabama, Arkansas, Louisiana, Mississippi, and Tennessee. However, other states have expressed interest, and will be included as well.

We anticipate a tiered approach, with coordination at both the state and regional level. The MISA will also have tiered participation, each having an executive council of decision-makers from each state, a technical steering committee, and an advisory council composed of those interested in participating. While MSU will act to coordinate early formation and serve as the data clearinghouse and GIS center, the task forces will be self-governing. The MISA will coordinate the sharing of data, act as a clearing house for locations of invasive species in the region, facilitate information exchange at the appropriate federal level, and act to coordinate funding of regional management efforts.

Intended participants include the following groups. Federal agencies: USDA, USGS, USFWS, USFS, USACE, and others; State agencies (agriculture, natural heritage, natural resources) from AL, AR, LA, MS and TN; Local agencies at the county and municipal level; Nongovernmental organizations such as Nature Conservancy, Ducks Unlimited, and others.

In October 2004, a field tour was conducted in South Mississippi to demonstrate the efforts going into invasive species management, highlight the need for more research, educate the public on efforts underway, and educate policy-makers on the support for management efforts. Over 200 participated in the field day. On the third and final day of the tour, the Mississippi Invasive Species Alliance hosted an informational and organizational meeting to discuss the possible formation of a Mid-south Invasive Species Alliance. Twenty-two invited participants from state and federal agencies from Alabama, Arkansas, Louisiana, Mississippi and Tennessee attended this meeting. During the meeting, presentations were made on the impetus for a regional effort at cooperation and coordination between agencies and groups focused on all invasive species efforts. These presentations were followed by a state-by-state discussion of invasive species management activities. The attendees agreed to the need for an effort between these states and the diverse efforts on managing invasive species to cooperate and coordinate more fully, and outlined future steps to take towards a more formal organization.

COMPARISON OF SAMPLING STRATEGIES AND INTERPOLATION TECHNIQUES FOR ACCURATELY MAPPING WEED POPULATIONS. W.A. Givens, D.R. Shaw, and M.L. Tagert; Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Weed management in production agriculture may benefit from site-specific applications is the area of weed management. Previous research has shown that weeds often occur in patches on the agricultural landscape. Because of this growth pattern, there is great potential for site-specific application technologies in weed management. To accomplish this, there must be a way to rapidly produce accurate and reliable weed maps to derive herbicide application maps from.

The objective of this research was to examine the results from different sampling methods and interpolation techniques and their ability to produce accurate weed maps. This study was conducted on soybean field at the Black Belt Branch Experiment Station during the 2004 growing season. The soybeans were planted in rows with a north-south orientation. A 70 x 70 meter area located in this field was divided into 1m quadrants. At each quadrant, weed species present and density was recorded. From this dataset, a Z-shaped and 50m meter grid sampling scheme were simulated. From these simulated sampling schemes, horsenettle (*Solanum carolinense* L.) weed density maps were made using the kriging, inverse distance weighted (IDW) power of 2, and inverse distance weighted power (IDW) of 4 interpolation methods. The accuracies of each were assessed through residual analysis and interpretation of the standardized mean prediction error and the root mean squared error.

Results from the analysis show that maps created from the z-pattern sampling scheme using kriging had the lowest Normalized Residual Index (0.9751). All methods had a tendency to overestimate, with the exception of the z-pattern IDW of power 2 and IDW of power 4 which had a tendency to underestimate. None of the methods used in this study provided a weed map with the accuracy needed to serve as the basis for a herbicide application map.

DIFFERENTIATING WEED SPECIES FROM BACKGROUND COMPONENTS USING HYPERSPECTRAL REMOTE SENSING. D.M. Dodds, D.R. Shaw, L.M. Bruce, J.D. Byrd Jr., J.H. Massey, D.B. Reynolds, L.T. Barber, J.W. Barnett, N.W. Buehring, K.D. Burnell, C.J. Gray, W.B. Henry, K.C. Hutto, F.S. Kelley, C.T. Leon, C.T. Koger, D.B. Mask, W.G. Powell, and J.C. Sanders; Mississippi State University, Mississippi State, MS.

ABSTRACT

Weeds are typically absent in many portions of fields; however, until recently entire fields required treatment when any portion was infested. 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. This has the potential to reduce herbicide inputs, providing environmental and economic benefits. Previous research has shown accuracies ranging from 81 to 98% for differentiating common cocklebur (*Xanthium strumarium* L.), pitted morningglory (*Ipomoea lacunosa* L.), entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula* Gray), and sicklepod [*Senna obtusifolia* (L.) Irwin and Barnaby] from soybean [*Glycine max* (L.) Merr.] using stepwise discriminant analysis. However, accuracies of 25 to 28% have been shown when classifying eclipta (*Eclipta prostrata* L.) and Virginia buttonweed (*Diodia virginiana* L.) from multiple turfgrass and weed species using multiclass analysis techniques. Although an extensive dataset of individual hyperspectral measurements of many plant species, perennial tree species and soil types exists and has been previously evaluated, a dataset combining all data historically collected has not been compiled and evaluated. This study will combine all previously collected data (>30 species) into a large dataset and examine classification accuracies with newly developed feature extraction techniques.

Hyperspectral measurements were collected using a hand-held spectroradiometer that recorded data from 350-2500 nm. Feature extraction techniques using customized software (Hyperspec) developed at MSU were employed for species differentiation. Although large amounts of ancillary data exist for each reading, classification was attempted in steps to determine the level of ancillary data needed to correctly classify each weed species.

When species were analyzed as a whole (no ancillary data included) overall classification accuracy was 42%. However, Hyperspec was successful at classifying hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. ex. A.W. Hill] 95% correctly, kudzu [*Pueraria lobata* (Willd.) Ohwi] 75% correctly, and Dubbs soil 86% of the time. However, classification accuracies were generally inadequate. Species were then aggregated into groups commonly observed together in the natural environment. Classification accuracies for Dubbs, Marietta, Dundee, and Leeper soils were greater than 99%. Also classification accuracies for field crop residue were more than 95%. Classification for selected turfgrass and turfgrass weed species were more than 93%. Results indicate that hyperspectral remote sensing may be a viable option for detection of selected species and soil types. However, more research is needed to determine the level of ancillary data needed to correctly classify all species and soil types.

USING HYPERSPECTRAL RADIOMETRY TO IDENTIFY VARIATIONS AMONG PALMER AMARANTH (*Amaranthus palmeri*) AND PITTED MORNINGGLORY (*Ipomoea lacunosa*). C.J. Gray[1], D.R. Shaw[1], D.M. Dodds[1], K.R. Reddy[1], J.A. Bond[2], D.O. Stephenson, IV[3], L.R. Oliver[4], and L.M. Bruce[1]; [1]Mississippi State University, Mississippi State, MS; [2]Louisiana State University, Rayne, LA; [3]University of Florida, Jay, FL; [4]University of Arkansas, Fayetteville, AR.

ABSTRACT

Palmer amaranth and pitted morningglory are two weeds commonly found in production fields in the southern United States. Recent advances in remote sensing technology have improved weed detection capabilities. An experiment was implemented to compare reflectance characteristics of Palmer amaranth (*Amaranthus palmeri* S. Wats.) and pitted morningglory (*Ipomoea lacunosa* L.) accessions originating from across the species' indigenous range. Single-plant seed sources were collected from 24 and 16 locations for Palmer amaranth and pitted morningglory, respectively. Hyperspectral reflectance data were obtained from greenhouse-grown plants at 24 and 27 days after emergence. Leaves selected for observation were the two newest fully mature leaves. Reflectance data were subjected to maximum likelihood best spectral band classification analysis in the attempt to differentiate the accessions. This analysis technique selects individual wavelengths that provide the best differentiation between variables. The value of the spectral regions (blue, green, red, and near-infrared) and various vegetation indices were calculated and used as features. Wavelengths, spectral regions, and vegetation indices were utilized using stepwise discriminant analysis with cross-validation procedures. Classification analyses were completed for each observation date and then also pooled over both dates for each respective species.

Using best spectral band combination analysis pooled over both observation dates, Palmer amaranth and pitted morningglory overall classification accuracies were 25 and 19%, respectively. Stepwise discriminant analysis resulted in Palmer amaranth and pitted morningglory classification accuracies predominantly < 50%. Although some classification accuracies were higher, there were no predictable trends in accession collection origin for either species.

These results suggest there are only slight reflectance characteristic differences between Palmer amaranth and pitted morningglory accessions. These differences may not be predictable based upon accession origin due to the great diversity of Palmer amaranth and pitted morningglory.

IDENTIFICATION OF UNIQUE SPECTRAL CHARACTERISTICS OF COMMON WARM SEASON TURFGRASS WEEDS. K.C. Hutto*, D.R. Shaw, J.D. Byrd, Jr., C.J. Gray and L.M. Bruce; Mississippi State University, Mississippi State, MS.

ABSTRACT

Hand-held hyperspectral reflectance data were collected in the summers of 2002, 2003 and 2004 to identify unique spectral characteristics of common turfgrass and weed species. The turfgrass species evaluated were: 'Tifway 419' bermudagrass [*Cynodon dactylon* (L.) Pers. x. *C. transvaalensis* Burtt-Davy], 'Meyer' zoysiagrass, (*Zoysia japonica* Steud.), 'Raleigh' St. Augustinegrass [*Stenotaphrum secundatum* (Walt.) Kuntze] and common centipedegrass [*Eremochloa ophiuroides* (Munro) Hack]. 'Crenshaw' creeping bentgrass (*Agrostis stolonifera* L.) was also evaluated. The weed species evaluated were: dallisgrass (*Paspalum dilatatum* Poir.), southern crabgrass [*Digitaria ciliaris* (Retz.) Koel.], eclipta (*Eclipta prostrata* L.) and Virginia buttonweed (*Diodia virginiana* L.). Data were collected from greenhouse and field experiments. Reflectance data were subjected to stepwise discriminant analysis to identify specific spectral wavelengths that could be used to distinguish the individual species. An overall classification accuracy of 85% was achieved for all field species. Spectral bands that were consistent over the three data collection periods ranged from 378 to 1000 nm. Only centipedegrass, zoysiagrass and dallisgrass were classified 77% or lower. All other species were classified at least 80%. Turfgrass species were analyzed as a group, where an overall accuracy of 95% was achieved. All turfgrass species were correctly classified at least 87% with the exception of centipedegrass, which was classified correctly 77% of the time. Spectral bands used for this analysis ranged from 412 to 1000 nm. Weed species were analyzed as a group. An overall classification accuracy of 92% was achieved. All weed species were correctly classified at 88% with the exception of eclipta, which was classified correctly 75%. Spectral bands used for weed species identification ranged from 379 to 621 nm.

An overall classification accuracy of 69% was achieved for the greenhouse species. Spectral bands used in this analysis ranged from 353 to 799 nm. Creeping bentgrass and Virginia buttonweed were classified best among greenhouse species (96 and 92%, respectively). All other species were classified correctly 67% or less. Turfgrass species in the greenhouse were classified correctly 74%. Creeping bentgrass was classified the highest at 96%, while all other species were classified correctly 75% or lower using wavelengths from 353 to 799 nm. Greenhouse weed species were classified correctly 84% with Virginia buttonweed and southern crabgrass being classified the best (95 and 90%, respectively). All other species were below 67%. The same wavelengths used for the turfgrass species analysis were selected by discriminant analysis to identify the weed species.

THE USE OF AERIAL IMAGERY AS A TOOL TO ASSESS COTTON GROWTH FOR PLANT GROWTH REGULATOR APPLICATIONS. M.T. Kirkpatrick, D.B. Reynolds, J.J. Walton, C.G. O'Hara, and J.L. Willers. Mississippi State University Mississippi State, MS 39762 and USDA, ARS Starkville, MS 39759.

ABSTRACT

Plant growth regulators, such as mepiquat chloride, are essential growth management tools in cotton production. Because of the irregularity of cotton growth rates, it is often difficult to determine areas and rates of growth regulators for entire fields. Furthermore, current monitoring techniques are time consuming and require intensive field sampling. Although the crop may exhibit considerable spatial variability within a field, these techniques use an average of samples taken to determine a treatment scenario for an entire field. Remote sensing technology, and aerial imagery in particular, involves the spatial monitoring of plant growth within a field. Remote sensing applications can be used 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 to apply plant growth regulators to specific sites to compensate for variability and increase production economy. Potential implications to a producer can be more efficient data as well as more intensive sampling in a shorter time interval. These factors may result in increased efficacy while minimizing chemical cost and environmental impact.

The study was designed to examine whether NDVI (Normalized Difference Vegetative Index) could accurately depict cotton growth and enhance growth regulator applications based on aerial images. A study was conducted over 2 years 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 applications to conventional broadcast applications. These data show that plant heights and top 5 node elongation rates can be correlated to their respective NDVI value within the field (R2=0.73 and 0.65 in 2003 and 0.94 and 0.86 in 2004, respectively). In 2003, aerial imagery based recommendations were correlated to recommendations based on the MEPRT program and the Pix® stick methods of PGR rate selection (R2=0.77 and 0.58, respectively). However, in 2004 these methods correlated poorly with aerial image recommendations. The results further indicate that site-specific applications based on NDVI resulted in a reduction in the total amount of mepiquat chloride applied when compared to broadcast methods. Although the site-specific application resulted in less total mepiquat chloride use, areas of intense vegetative growth received higher application rates than the broadcast zones. Seed cotton yield did not differ between the site-specific and broadcast application methods.

TEXTURE ANALYSIS OF REMOTELY-SENSED IMAGES FOR WEED PATCH DETECTION IN ROW CROPS. W.A. Givens, D.R. Shaw, L.M. Bruce, A. Mathur, and D.M. Dodds; 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 homogeneous areas versus non-homogeneous areas in the image, for example with the use of image texture analysis.

The objective of this research was to test the ability of multiresolutional texture analysis methods for the detection of aggregated weed patches in a soybean production setting. This study was conducted on a soybean field at the Black Belt Branch Experiment Station during the 2004 growing season. The soybeans were planted in rows with a north-south orientation. A 70 x 70 meter area located in this field was divided into 1m quadrants. At each quadrant, weed species present and density of weed was recorded. The remote sensing data collected was multispectral imagery acquired the same day as the ground truth data collection.

Discrete wavelet transforms were used for feature detection. Results of the discrete wavelet transforms were combined with the ground truth data. Specifically, features extracted from the discrete wavelet transform of the image were compared to ground truth data collected the day of image acquisition. These features were tested for their ability to discriminate between non-weedy and weedy areas of a soybean field. The method was tested on the SAVI (Soil Adjusted Vegetative Index) of the multispectral image. The weeds were separated into grass and broadleaf categories based on physical characteristics of each weed, and Pearson's correlations were computed to evaluate the accuracies of the discrete wavelet transforms calculated from the imagery.

Results of the analyses showed significant correlations in the vertical decompositions for both grass and broadleaf weed categories. Of these correlations, the highest were found between the grass category and the vertical decomposition. These results suggest that discrete wavelet transforms show some promise as an alternative method for weed detection with spectral remote sensing.

SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

AMINOPYRALID: A NEW HERBICIDE FOR SELECTIVE BROADLEAF WEED CONTROL; AN INTRODUCTION AND EFFICACY SUMMARY. P. L. Burch, V. F. Carrithers, W. N. Kline, R. A. Masters, J. A. Nelson, M. E. Halstvedt; Dow AgroSciences, Christiansburg, VA

ABSTRACT

Aminopyralid is a new systemic herbicide developed by Dow AgroSciences specifically for use on rangeland, pasture, rights-of-way, such as roadsides for vegetation management, Conservation Reserve Program acres, non-cropland, and natural areas. The herbicide is formulated as a liquid containing, 240 g ae/liter of aminopyralid as a salt. The herbicide has postemergence activity on established broadleaf plants and provides residual control of germinating seeds of susceptible plants. Field research has shown aminopyralid to be effective at rates between 52.5 and 120 g ae/ha, which is about 1/4 to 1/20 less than use rates of currently registered rangeland and pasture herbicides with the same mode of action including, clopyralid, 2,4-D, dicamba, picloram, and triclopyr. Aminopyralid controls over 40 species of annual, biennial, and perennial broadleaf weeds including *Acroptilon repens, Artemisia absinthium*, *Carduus acanthoides*, *Carduus nutans*, *Centaurea diffusa*, *Centaurea maculosa*, *Centaurea solstitialis*, *Chrysanthemum leucantheum*, *Cirsium arvense*, *Cirsium vulgare*, *Lamium amplexicaule*, *Matricaria inodora*, *Ranunculus bulbosus*, *Rumex crispus*, *Solanum carolinense*, *Solanum viarum*, and *Xanthium strumarium.* Most warm- and cool-season rangeland and pasture grasses are tolerant of aminopyralid applications at proposed rates. Research continues to determine the efficacy of aminopyralid on other key invasive weeds and on the role of aminopyralid in facilitating plant community improvement in land management programs.

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NEW DEVELOPMENTS IN INDUSTRY

AMINOPYRALID: TOXICOLOGY, ECOTOXICOLOGY AND ENVIRONMENTAL FATE PROFILE

J.J. Jachetta*, P.L. Havens, J.A. Dybowski, J.A. Kranzfelder, C. Tiu, Dow AgroSciences LLC, Indianapolis, IN 46077

ABSTRACT

Aminopyralid is a new systemic low rate post-emergence herbicide in the pyridine carboxylic acid class for the selective control of noxious/invasive and agronomic broadleaf weeds in range and pasture, industrial vegetation management and wheat. As its formulated product (GF-871), aminopyralid exhibits low acute toxicity (Category III/IV). Overall, aminopyralid has a very favorable toxicity profile, with no evidence of teratogenicity, mutagenicity, carcinogenicity, endocrine or adverse reproductive effects.

Because of aminopyralid's low toxicity, risks to workers handling aminopyralid soluble liquid formulations are extremely low. Aminopyralid produces no significant soil or water metabolites except CO_2 and exhibits very low acute and chronic toxicity (practically nontoxic) to mammals, birds, fish, and aquatic invertebrates. Aminopyralid is slightly toxicity to algae and aquatic vascular plants and is substantially below all of EPA's levels of concern for adverse effects to these organisms. The route of degradation in soils is aerobic biodegradation with a median field soil half-life at North American locations of 32 days and an average K_{oc} of 10.8 L/kg. Field experiments showed limited movement in the soil profile and aminopyralid demonstrates a low potential for groundwater concentration in EPA groundwater contamination models. In aquatic systems, the main route of aminopyralid degradation is photolysis with a half-life of 0.6-d. Aminopyralid does not have the physical/chemical properties similar to bioaccumulative compounds (K_{ow} <3). Aminopyralid was granted Reduced Risk status by US EPA in October, 2004.

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NEW DEVELOPMENTS IN INDUSTRY

AMINOPYRALID: FIT IN MID-ATLANTIC US PASTURE MANAGEMENT. S.R. King, E.S. Hagood, and P.L. Burch; VPI & SU, Blacksburg, Va. and Dow AgroSciences, Christiansburg, Va.

ABSTRACT

DE-750 is an experimental herbicide from Dow Agrosciences that is projected to be registered by the Environmental Protection Agency in the third quarter of 2005. DE-750 is a new molecule in the pyridine herbicide family with the common name aminopyralid. Aminopyralid can be utilized for selective broadleaf weed control in range, pasture, industrial vegetation management, roadsides, natural areas, and conservation reserve program acres. Experiments were conducted from 2002 to 2004 to evaluate various rates and timings of aminopyralid alone or in combination with 2,4-D for the control of troublesome common broadleaf weeds in Virginia pastures and hayfields. These treatments were compared to other currently registered compounds including 2,4-D, dicamba, picloram, triclopyr, metsulfuron, and fluroxypyr, which were applied alone or in various combinations. Treatments were applied either postemergence (POST) to actively growing weeds or preemergence (PRE) to evaluate residual weed control. Weed species that were evaluated included horsenettle (*Solanum carolinense*), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), and cocklebur (*Xanthium strumarium*). An additional experiment evaluated the effect of various mowing timings (14 and 7 days before application, and 7, 14, and 21 days after application) on the efficacy of DE-750 applied at two rates for the control of Canada thistle. POST control of horsenettle with DE-750 applied alone or in combination with 2,4-D was greater than 97% and was equivalent to control provided by picloram plus 2,4-D at 2 months after treatment (MAT). Horsenettle control was only 76, 86, and 76% with triclopyr plus clopyralid, 2,4-D plus dicamba, and metsulfuron plus 2,4-D plus dicamba, respectively. POST musk thistle control with all rates of DE-750 applied alone or in combination with 2,4-D was 99% or greater at 7 weeks after treatment (WAT). At 16 WAT, PRE horsenettle control was 85% or greater when 0.063 to 0.078 lb ai/A of DE-750 was applied either alone or in combination with 0.75 lb ai/A of 2,4-D. PRE cocklebur control at 16 WAT was 90% or greater with DE-750 regardless of rate or the addition of 2,4-D. Canada thistle control in August was 88% or greater and neither rate nor mowing timing had any effect on the efficacy of DE-750 when treatments were applied in May and June. Bull thistle control at 7 WAT was 100% when DE-750 was applied either alone or in combination with 2,4-D. Forage in these plots contained 100% fescue and was uniformly grazed by cattle. Forage composition in the control plot was 58, 25, 17% fescue, white clover, and bull thistle, respectively, and fescue utilization in these plots was only 49%. Results from these experiments indicate that DE-750 alone or in combination with 2,4-D is an effective herbicide for the control of many problematic weeds and has the potential to be rapidly adopted by Virginia farmers.

SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

AMINOPYRALID*: A NEW HERBICIDE FROM DOW AGROSCIENCES FOR SELECTIVE BROADLEAF WEED CONTROL IN ROADSIDE VEGETATION MANAGEMENT. W.N. Kline and T.R. Murphy; Dow AgroSciences, Duluth, GA; and University of Georgia, Griffin, GA.

ABSTRACT

Aminopyralid is a new pyridine carboxylic acid herbicide from Dow AgroSciences LLC that was designed and developed specifically for selective broadleaf weed control in rights-of-way, natural land management areas, range & pastures, and on many industrial vegetation management non-crop sites. Aminopyralid is a systemic herbicide that was accepted for evaluation under the US EPA's Reduced Risk Pesticide program on October 19, 2004. Research throughout the world during the last 6 years has demonstrated that aminopyralid controls many broadleaf weeds. Most grasses are tolerant to aminopyralid over the rate ranges that will be used in roadside vegetation management programs. Aminopyralid will be offered as a liquid 2 lb ae/gallon triisopropanol ammonium salt formulated commercial product. The maximum use rate for roadsides will be 120 g ae/ha or 7 fl oz per acre of this formulation.

Experiments were conducted from 1999 through 2004 to evaluate various rates and timings of aminopyralid alone or in combinations with other roadside weed control products. Treatments were applied either postemergence to actively growing weeds or preemergence to evaluate residual weed control. At 4 to 7 fl oz per acre, aminopyralid controlled horseweed (ERICA), annual sowthistle (SONOL), prickly lettuce (LACSE), annual fleabane (ERIBO), bedstraw (GALSS), Canada thistle (CIRAR), plumeless thistle (CRUAC), teasel (DIWSS), vetch (VICSS), spotted knapweed (CENMA), common ragweed (AMBEL), cudweed (GNAPU), curly dock (RUMCR), kudzu (PUELO), mile-a-minute (POLPF), and many other roadside weeds. Aminopyralid has been shown to control weeds in the Compositae, Leguminosae and Solanaceae families. Other weeds controlled when aminopyralid is applied in combination with triclopyr, triclopyr+fluroxypyr or 2,4-D include Japanese hops (HUMJA), Japanese honeysuckle (LONJA), wild carrot (DAUCA) and dandelion (TAROF).

Expected uses on roadsides will be in warm-season bermudagrass and bahiaigrass release programs and for broadleaf weed control in cool-season grasses. Aminopyralid applied in bermudagrass and bahiagrass release programs in late winter through early spring will provide postemergence control of winter annual broadleaf weeds and preemergence control of many tall growing summer annual broadleaf weeds. Broadleaf weed control in cool-season grasses with aminopyralid applied in the early spring through summer, will provide preemergence and postemergence control of a broad spectrum of broadleaf weeds. The use of aminopyralid should reduce the need for growing season MSMA applications.

Due to the activity of aminopyralid on key tall growing roadside broadleaf weeds, selectivity to nearly all desirable roadside grasses, and low per acre use rates, aminopyralid is expected to become a foundation herbicide in multiple mixes applied throughout the Southeast, Northeast, Midwest, and Pacific regions.

*Aminopyralid has not yet received federal registered; registration is pending. The technical information presented herein is not an offer for sale.

SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

WEED CONTROL SPECTRUM OF PENOXSULAM IN SOUTHERN U.S. RICE. J.S. Richburg, R.B. Lassiter, V.B. Langston, R.K. Mann and L.C. Walton; Dow AgroSciences, Indianapolis, IN.

ABSTRACT

Penoxsulam, trade name Grasp® SC, developed by Dow AgroSciences LLC, is a new postemergence broad-spectrum triazolopyrimidine sulfonamide herbicide for use in rice. In U.S. field trials in AR, LA, MO, MS and TX from 1998 to 2004, Grasp SC was evaluated as a preflood postemergence foliar application in drill-seeded rice and as a postemergence foliar application in water-seeded rice. The objective of this research was to characterize the activity of Grasp SC alone on key target weeds in these markets. Grasp SC provided control of *Echinochloa* species as well as many annual rice weeds including hemp sesbania (*Sesbania exaltata*), northern jointvetch (*Aeschynomene virginica*), ducksalad (*Heteranthera limosa*), alligatorweed *(Alternanthera philoxeroides*), Texas/Mexicanweed (*Caperonia* spp), smartweed (*Polygonum* spp) and annual sedge (*Cyperus* spp). The use rate of Grasp SC is 0.031 lb ai/acre (35 g ai/ha or 2 oz product/acre), formulated as a 2 lb ai/gallon. Grasp SC can be tankmixed with cyhalofop, triclopyr, propanil containing products (except for alligatorweed control), clomazone, pendimethalin, quinclorac, imazethapyr and halosulfuron to increase the weed control spectrum. Grasp SC can be applied from rice emergence up to 60 days prior to harvest in drill-seeded rice and from rice pegging with 1 leaf up to 60 days prior to harvest in water-seeded rice.

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SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

PENOXSULAM EUP AND CONCEPT RESULTS FROM 2004 IN SOUTHERN U.S. RICE. L.C. Walton, V.B. Langston, R.B. Lassiter, R.K. Mann and J.S. Richburg, Dow AgroSciences LLC, Indianapolis, IN.

ABSTRACT

Penoxsulam, trade name Grasp™ SC herbicide, is a new postemergence herbicide from Dow AgroSciences for use in rice. During 2004, Grasp SC was evaluated under an Experimental Use Permit (EUP) in rice at eight locations across TX, LA, MS, and AR. These experiments were established to define the activity for weed control and crop response when applied through commercial ground and aerial application equipment. Grasp SC at 0.031 lb ai/a (2 oz product/A) was applied as a foliar application pre-flood in drill-seeded rice at seven locations and as a postemergence foliar application in water-seeded rice at the remaining location. In five of the eight EUP experiments, applications were made with commercial aerial equipment. The remaining three experiments were applied with commercial ground equipment.

Grasp SC was also evaluated as a foliar application pre-flood at five locations in concept (large block demonstration) plots in TX, LA, MS, and AR. The objectives of these large demonstration plots were for technical training and to test product concepts for Grasp SC with external customers (dealers, consultants, and growers) for understanding appropriate product fit.

In general, Grasp SC in the EUP experiments controlled susceptible problem annual grass and broadleaf weeds in rice, including but not limited to barnyardgrass, (*Echinochloa spp*), hemp sesbania (*Sesbania exaltata*), northern jointvetch (*Aeschynome virginica*), smartweed (*Polygonium spp*), annual sedge (*Cyperus spp*), dayflower (*Commelina diffusa*) and alligatorweed (*Alternanthera philoxeroides*). Control with Grasp SC was comparable to standard commercial herbicide programs when applied under favorable environmental conditions. Crop tolerance was excellent at all locations except one location where recent land leveling had occurred prior to planting the rice.

Weed control efficacy and crop tolerance results observed in the concept plots with Grasp SC was excellent and demonstrated that Grasp SC can be utilized in several use patterns alone, in mixes, or as a sequential application. Grasp SC can be used in drill-seeded rice from emergence to sixty days prior to harvest, and in water-seeded rice from pegging with one leaf up to sixty days prior to harvest.

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SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

ROUNDUP READY FLEX COTTON TECHNOLOGY. J.A. Burns, K.A. Croon, M. Edge, R.A. Ihrig, A.M. Kirk, J.W. Mullins, M.E. Oppenhuizen and R.D. Voth, Monsanto Company, St. Louis MO.

ABSTRACT

Since Roundup Ready cotton was introduced in 1997, it has redefined weed management in cotton production. Now, research and development has set the stage for a new weed management standard – the Roundup Ready Flex cotton system. Tested across the U.S. Cotton Belt since 2001, Roundup Ready Flex cotton offers an increased margin of crop safety due to its increased tolerance to glyphosate during cotton fruiting. This allows for a more flexible window of over-the-top applications of Roundup agricultural herbicides, extending from cotton emergence though layby, the key timing for the control of economically damaging weeds.

Benefits of Roundup Ready Flex Cotton. Research shows that the Roundup Ready Flex cotton system would be expected to provide additional grower benefits and efficiencies gains including: (1) Enhanced flexibility and convenience due to season-long application options, (2) Increased production efficiency as Roundup agricultural herbicide applications are combined with other crop chemical products, (3) Less dependence upon selective spray equipment, (4) Potential for greater weed control efficacy (due to current label restrictions and weather/equipment limitations), (5) Enhanced crop safety during sensitive cotton reproductive stages, and (6) Ability to tailor herbicide applications to weed height/stage instead of to the cotton stage of development.

Technical Description of Roundup Ready Flex Cotton. Roundup Ready Flex cotton is based upon a transformation event identified as MON 88913. Roundup Ready Flex cotton (Event MON 88913) utilizes a *cp4 epsps* gene sequence that encodes for the CP4 EPSPS protein. The CP4 EPSPS protein expressed in Roundup Ready Flex cotton is the same protein currently used in Roundup Ready cotton which has an extensive history of safe use. This protein provides the necessary tolerance to glyphosate, the active ingredient in Roundup brand agricultural herbicides. The increased level of glyphosate herbicide tolerance in Roundup Ready Flex cotton has been achieved through the use of improved promoter sequences that regulate the expression of the *cp4 epsps* coding sequence.

Testing of Roundup Ready Flex Cotton. Roundup Ready Flex cotton has been tested at field locations across the Cotton Belt. This field work includes agronomic and tolerance testing, regulatory studies and development of weed management recommendations by local University scientists. University and third party testing to date has accounted for three of every four Cotton Belt research locations. Ahead of the variety development step, extensive greenhouse and field trials were conducted to evaluate the agronomic characteristics and composition of cotton containing the Roundup Ready Flex cotton trait. In all, 458 comparisons of over 50 agronomic characteristics were made including seed germination and emergence, plant growth and development, and harvest quality. Further, an additional 69 different compositional components of the cottonseed were evaluated.

Varieties. Monsanto will broadly license the Roundup Ready Flex cotton trait through seed company licensees. It is expected that seed companies will incorporate Roundup Ready Flex technology alone and in combination with other technologies such as Bollgard II into their leading cotton varieties. As the length of the growing season and environmental conditions vary across the Cotton Belt, variety performance may also vary. Monsanto strongly encourages the grower to utilize seed company and local university resources in making variety decisions.

The targeted launch for Roundup Ready Flex cotton is 2006. This product launch depends on a variety of factors, including successful completion of the regulatory process. Roundup Ready Flex cotton is not currently approved for sale or distribution in the United States and Roundup agricultural herbicides are not yet approved for certain postemergence applications. It is a violation of federal law to promote any unregistered herbicide use.

SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

CHLORIMURON ETHYL PLUS TRIBENURON METHYL: A NEW HERBICIDE FOR WEED CONTROL IN SOYBEANS. K.H. Hahn, M.J. Martin, S. K. Rick and D.W. Saunders. DuPont Ag & Nutrition. Johnston, IA.

ABSTRACT

Field studies were conducted in the fall of 2003 and spring of 2004 to evaluate the control of emerged winter annual and perennial weeds as well as the residual control of summer annual weeds in soybeans (*Glycine max*) with a tank mix of chlorimuron ethyl and tribenuron methyl herbicides. Results from both university and in-house trials showed excellent control of a broad spectrum of weed species such as dandelion (*Taraxacum officinale*), common chickweed (*Stellaria media*), henbit (*Lamium amplexicaule* L.), cutleaf evening primrose (*Oenothera lacinata*) and marestail (*Erigeron canadensis* L.). The spectrum and level of weed control was similar with chlorimuron ethyl and tribenuron methyl tank mixes to Canopy XL® + Express® herbicide programs. Results for the chlorimuron ethyl and tribenuron methyl tank mixes showed better burndown and residual control of several weeds species compared to glyphosate.

Based on the results of these trials, a new blended herbicide consisting of 22.7% chlorimuron ethyl and 6.8% tribenuron methyl will be marketed for burndown and residual control of weeds prior to soybean planting. The new water-dispersible granular blend will be marketed under the trade name of Canopy® EX herbicide. Canopy® EX herbicide may be applied after the fall harvest up to 45 days prior to soybean planting. Use rates of Canopy® EX will range from 1.1 to 3.3 ounces product per acre. Applications with 2,4-D is recommended for a broader spectrum of weed control. The length of residual control of summer annuals is rate dependent. Work has been completed and submitted to the EPA to shorten the preplant interval to soybeans and corn.

SYMPOSIA

NEW DEVELOPMENTS FROM INDUSTRY

USE OF CARFENTRAZONE-ETHYL FOR AQUATIC WEED MANAGEMENT. R.D. Iverson and V.V. Vandiver, Jr.; FMC Corporation, Philadelphia, PA and Vandiver Consultants, Gainesville, FL

ABSTRACT

Carfentrazone-ethyl was approved by the EPA for use on aquatic sites in September, 2004 and will be marketed under the trade name STINGRAY®. Carfentrazone-ethyl is a PPO inhibitor herbicide (HRAC Group E) that represents a new mode of action for aquatic weed management. Carfentrazone-ethyl has also been classified by the EPA as a reduced risk pesticide. STINGRAY has a zero day water-holding period for drinking, fishing, swimming, livestock consumption and irrigation to commercial turf farms, residential turf and ornamentals when less than 20% of the surface of a water body is treated. It has a 1-day water holding period for irrigation to food crops when less than 20% of the surface of a water body is treated. STINGRAY has shown excellent activity on important floating aquatic weeds. Exploratory screening studies at the University of Florida with carfentrazone-ethyl showed excellent activity on water lettuce and water hyacinth with rates of 0.2 lb a.i./Acre. Efficacy evaluations are continuing via replicated field studies and in operational applications as part of a 2004 Florida Experimental Use Program. Weeds currently listed on the label include: water lettuce, water hyacinth, giant salvinia, water fern, mosquito fern, water spinach and watermeals. Alligatorweed and water primrose are suppressed. Field and mesocosm results on Eurasian watermilfoil have also been very encouraging with rates of 200 to 350 ppb. In addition, operational applications have demonstrated that STINGRAY will not negatively impact desirable grasses and that it may have less negative impact to other desirable plant species in comparison to other current treatment options.

SYMPOSIA

NEW DEVELOPMENTS FROM INDUSTRY

LEXAR: 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 D.E. Bruns; Syngenta Crop Protection, Inc., Greensboro, NC 27419.

LexarTM 3.7 SC herbicide is a pre-package mixture of mesotrione with S-metholachlor and atrazine from Syngenta Crop Protection, Inc. This new mixture was developed for preplant, preemergence, and early postemergence use in corn. Lexar herbicide applied prior to weed emergence provides excellent control of most important broadleaf and grass weeds in corn including velvetleaf, pigweed species, waterhemp species, common lambsquarters, common ragweed, jimsonweed, nightshade species, Pennsylvania smartweed, foxtail species, barnyardgrass, fall panicum, broadleaf signalgrass, and crabgrass. Corn shows excellent tolerance to Lexar herbicide.

SYMPOSIA

NEW DEVELOPMENTS FROM INDUSTRY

SEQUENCE™: THE FOUNDATION FOR COTTON WEED CONTROL. E.W. Palmer*, G.L. Cloud, J.C. Holloway, Jr., D. Porterfield, C.L. Foresman, and C.A. Sandoski; Syngenta Crop Protection, Greensboro, NC 27409.

ABSTRACT

Sequence™ is a new herbicide from Syngenta Crop Protection Inc. that combines the burndown activity of potassium glyphosate (Touchdown Total®) and the proven residual activity of s-metolachlor (Dual Magnum®). Sequence is formulated as a 5.25 EW (Emulsion in water) containing 2.25 lb ae/gallon glyphosate acid and 3.0 lb/gallon S-metolachlor. The signal word for Sequence is Caution. Sequence received Federal registration in 2004 for burndown in cotton, soybean, sorghum, pod crops, and peanuts. Sequence may be applied preemergence, pre-plant, or post-emergence over-the-top (POT) of glyphosate-tolerant cotton until the 4th leaf growth stage and over-the-top of glyphosate-tolerant soybean through the V3 (3rd trifoliate) growth stage. Preemergence applications are limited to AR, KS, LA, MS, NM, OK, TN, TX, and the MO boot heel. The Sequence application rates range from 2.5 to 4.0 pints/acre depending on weed species, weed size, and application type.

The maximum Sequence rate that can be applied over-the-top of glyphosate-tolerant cotton is 2.5 pints/ acre. Over-the-top applications can be made when cotton is 3 inches tall until the 5th true leaf is quarter-sized. Post-directed applications can be made until cotton is 12 inches tall. No additional surfactants are needed when applying Sequence. When observed, crop response was transient and did not impact cotton yield.

Sequence provides excellent postemergence and residual control of many tough weeds like redroot pigweed (*Amaranthus retroflexus* L.) and Palmer amaranth (*Amaranthus palmeri* S.Wats.) as well as annual grasses like barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], fall panicum (*Panicum dichotomiflorum* Michx.), and seedling johnsongrass [*Sorghum halepense* (L.) Pers.]. Sequence herbicide provides a solid weed control foundation when applied early postemergence and when followed by other Syngenta cotton herbicides like Envoke (postemergence or post-directed) and Suprend (post-directed) this will ensure a clean crop season-long.

SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

INNOVATIONS WITH CUTLESS 50W APPLICTIONS TO TURF. B. T. Bunnell* and R. B. Cooper. SePRO Corporation, Carmel, IN 46032 and TotalTurf Consulting LLC, Hilton Head Island, SC 29938

ABSTRACT

Plant growth regulators (PGR) such as Cutless 50W (flurprimidol) and Trimmit 2SC (paclobutrazol) are frequently used for *Poa annua* management in creeping bentgrass golf greens, fairways, and tees. These PGRs selectively suppress the growth of *Poa annua* to a greater degree compared to creeping bentgrass, hence shifting the competitive growth advantage away from *Poa annua* and towards creeping bentgrass. Therefore, over time, creeping bentgrass is able to grow laterally into the suppressed *Poa annua* stand, resulting in successful conversion. The objective of this study was to evaluate the lateral regrowth (RG) potential of creeping bentgrass golf course fairways and greens following applications of flurprimidol and paclobutrazol.

Two studies were performed for 8 wks from 15 June to 10 August, 2004 on an established creeping bentgrass golf green and fairway in Westfield, IN. In the golf green study, treatments included Cutless 50W and Trimmit 2SC at 0.125 and 0.25 lbs ai/A and Primo MAXX 1EC (trinexapac-ethyl) at 0.05 lbs ai/A. In the fairway study, treatments included Cutless 50W and Trimmit 2SC at 0.25 and 0.50 lbs ai/A and a tank mix containing Cutless 50W plus Primo MAXX 1EC at 0.125 plus 0.05 lbs ai/A, respectively. Applications were made on 15 June and 16 July, 2004.

In order to evaluate lateral RG of creeping bentgrass, soil cores were extracted from each replicate plot prior to PGR application and backfilled with topdressing sand. The diameters of the soil cores were 5 cm for the golf green study and 11 cm for the fairway study. Soil cores were approximately 10 cm deep. In order to measure lateral RG, a wire mesh grid was constructed equal to the dimension of the original extracted core. The grid contained 210 and 80 square holes (0.4 cm^2 in area) for the fairway and golf green study, respectively. A green shoot present in a 0.4 cm^2 square denoted a RG point. Digital images were taken every 2 weeks with the wire mesh grid overlaying the backfilled soil core and percent lateral RG was calculated with the equation: [green shoot RG points/total squares (210 or 80)]. In the golf green study, at 2 weeks after the initial application (WAIT) no differences in lateral RG occurred between treatments. However, by 4 WAIT, Trimmit 2SC at 0.25 lbs ai/A reduced lateral RG compared to all treatments by 9 to 13%. By 6 WAIT or 2 weeks after the second application, Trimmit 2SC at 0.25 lbs ai/A reduced lateral RG by 12% compared to untreated plots and Primo MAXX 1EC and 8 to 11% compared to both rates of Cutless 50W. Trimmit 2SC at 0.125 lbs ai/A maintained 8% greater lateral RG compared to the 0.25 lbs ai/A rate.

Similar results were found in the fairway study where rates of Cutless 50W and Trimmit 2SC were doubled compared to the rates used in the golf green study. At 2 WAIT, Cutless 50W at 0.5 lbs ai/A and untreated plots maintained ≥6% lateral RG compared to other treatments. By 4 WAIT, Trimmit 2SC at 0.5 lbs ai/A reduced lateral RG by 11 to 13% compared to Cutless 50W at 0.25 and 0.5 lbs ai/A. Therefore, after one application, Trimmit 2SC reduced lateral RG by 13% compared to Cutless 50W when both PGRs were applied at 0.5 lbs ai/A. Trends continued at 6 WAIT, with Trimmit 2SC at 0.5 lbs ai/A reducing lateral RG by 12 to 14% compared to treatments containing Cutless 50W and the untreated. At the final rating date, at 8 WAIT, plots receiving Trimmit 2SC at 0.5 lbs ai/A reached 82% total RG, whereas Cutless 50W at 0.5 lbs ai/A reached 98%. The tank mix containing Cutless 50W + Primo MAXX 1EC did not influence lateral RG at any rating date. Lateral RG differences occurred between Cutless 50W and Trimmit 2SC when applied to creeping bentgrass golf greens and fairways. At the final rating date, the high rates of Trimmit 2SC reduced creeping bentgrass lateral RG significantly by 11 and 16%, respectively, compared to plots receiving the same ai/A rate of Cutless 50W in the golf green and fairway study. The low rate of Trimmit 2SC did not reduce lateral RG in either study. Additionally, in both studies, the lateral RG of creeping bentgrass following Cutless 50W applications at 0.25 and 0.5 lbs ai/A did not differ from untreated plots at study's end. The Cutless 50W + Primo MAXX 1EC tank mix and Primo MAXX 1EC alone and did not significantly influence lateral RG of creeping bentgrass in either study. Future research will investigate the effects of various rates and timings of Cutless 50W and Trimmit 2SC on the lateral RG of creeping bentgrass and other perennial turf species such as Kentucky bluegrass and perennial ryegrass. Future studies will also evaluate lateral RG of creeping bentgrass with a yearly program consisting of 4 to 6 applications of Cutless 50W and Trimmit 2SC at various rates.

SYMPOSIA

NEW DEVELOPMENTS IN INDUSTRY

INVASIVE PLANT MANAGEMENT: TROPICAL SODA APPLE (SOLANUM VIARUM) CONTROL WITH AMINOPYRALID*. J.J. Mullahey and W.N. Kline; University of Florida, Milton, FL; and Dow AgroSciences, Duluth, GA.

ABSTRACT

Aminopyralid is a new pyridine carboxylic acid herbicide from Dow AgroSciences LLC that was designed and developed specifically for selective broadleaf weed control in rights-of-way, natural land management areas, range & pastures, and on many industrial vegetation management non-crop sites. Aminopyralid is a systemic herbicide that was accepted for evaluation under US EPA's Reduced Pesticide program on October 19, 2004. Research throughout the world during the last 6 years has demonstrated that aminopyralid controls many broadleaf weeds. Most grasses are tolerant to aminopyralid over the rate ranges that will be used in pasture vegetation management programs. Aminopyralid will be offered as a liquid 2 lb ae/gallon or as a premix of aminopyralid at 0.33 lbs ae/gallon + 2,4-D at 2.67 lbs ae/gallon. The maximum use rate on pastures will be 120 g ae/ha or 7 fl oz per acre of the aminopyralid only product and 2.6 pints/acre of the aminopyralid + 2,4-D product.

This project was a partnership between the University of Florida and Dow AgroSciences LLC. Experiments were conducted in Florida to evaluate various rates and application timings of aminopyralid for tropical soda apple (Solanum viarum) (TSA) control. Treatments were applied either postemergence to actively growing weeds or preemergence to evaluate residual weed control. Applications were made April 2003, January 2004, June 2004 and were with a fixed horizontal boom using TT11003 nozzles on 18 in spacing mounted on a 4 wheeler at approx 4 ft above the ground; applications were at 40 GPA total volume.

Tropical soda apple was controlled with preemergence or postemergence applications of aminopyralid. Over the range of rates evaluated some rate response was detected particularly with postemergence applications on large mature TSA plants at 200 or more days after treatment (DAT). Average control of mature TSA, over 10 field trials, at 100 DAT ranged from 95 to 98% with aminopyralid at 4 to 7 fl oz/acre . TSA control with Remedy[*] herbicide at 2 pints/acre in the same trials averaged 82% and was more variable than control with aminopyralid. At 200 or more days after treatment aminopyralid at 4 or 5 fl oz/acre provided 89% control and 97% control with 7 fl oz/acre, while control of TSA with Remedy averaged 83%. TSA control with aminopyralid at 4 or 5 fl oz/acre and Remedy was more variable than control provided by aminopyralid at 7 fl oz/acre at later rating dates.

TSA seedling germination and emergence was evaluated in 3 of the trials to assess aminopyralid preemergence control potential. At between 70 and 140 DAT, seedling control averaged 97% across all rates (4,5, or 7 fl oz/acre) of aminopyralid applied. In contrast, TSA seedlings that emerged after applications were not controlled by Remedy.

Aminopyralid at 4 to 7 fl oz/acre provided excellent postemergence control of mature TSA plants. Seasonal differences in plant morphology, vigor, fruiting stage, canopy density (presence or absence of foliage) did not appear to affect the performance of aminopyralid. This was not observed with Remedy . Optimum control of TSA with Remedy requires application to TSA regrowth sometime shortly after a mowing treatment. Aminopyralid provided excellent residual control of germinating TSA seeds. Current estimates are that aminopyralid will provide 6 months or more TSA seedling residual control. As part of a maintenance strategy, aminopyralid spot treatments will likely need to be applied after the first broadcast treatment to require control TSA patches. The TSA management strategy will likely vary according to stand density. High density TSA stands and sites suspected to have substantial TSA seed banks will need to be treated with aminopyralid at 7 fl oz/acre. Moderate to light density TSA stands will require aminopyralid at 4 to 5 fl oz/acre. Pastures, sod farms, seed fields, and hay fields where TSA is not apparent, but does occur in surrounding areas, may require a preventative or sanitation approach where aminopyralid may be applied at 2 to 4 fl oz/acre to kill emerged seedlings and small plants and provide short-term residual control of TSA seedlings that emerge after application.

*Aminopyralid has not yet received federal registered; registration is pending. The technical information presented herein is not an offer for sale.

[*] Trademark of Dow AgroSciences, LLC

INTEGRATED MANAGEMENT STRATEGY FOR THE DEVELOPMENT AND IMPLEMENTATION OF AN ATRAZINE TMDL FOR AQUILLA LAKE. M. Dozier, P. Baumann, S. Senseman, J. Bragg, and A. Spencer; Texas Cooperative Extension, College Station, TX; Texas Agricultural Experiment Station, College Station, TX; Texas State Soil and Water Conservation Board, Temple, TX; and USDA-NRCS, Hillsboro, TX.

ABSTRACT

Aquilla Reservoir was assessed as not supporting its designated use when samples of finished drinking water violated the Maximum Contaminant Level (MCL) for atrazine. The MCL requires a running annual average of 0.003 mg/L or lower. The annual running average for the second quarter of 1997 through the first quarter of 1998 was 0.004 mg/L. This led to the listing of Aquilla Reservoir on the 1998 Texas 303(d) list and the subsequent development of a Total Maximum Daily Load (TMDL) for atrazine in the Aquilla Reservoir watershed. After the development of the TMDL, an implementation plan was prepared. Working with area farmers, state and federal agency personnel combined expertise and resources in order to more effectively deal with the atrazine issue. A major component of the implementation plan was the placement of best management practices (BMPs) designed to reduce off-target losses of atrazine in surface runoff. These BMPs included preplant incorporation of atrazine, use of grass filter strips, vegetated waterways, sediment control structures, and others. Cost-share programs of the USDA-Natural Resources Conservation Service (NRCS) and the Texas State Soil and Water Conservation Board (TSSWCB) helped fund installation of BMPs in the watershed. Texas Cooperative Extension (TCE) led the way in producer education on BMP effectiveness to enhance adoption by farmers. TCE and the Texas Agricultural Experiment Station (TAES) established and maintained a network of automatic and passive samplers in several locations of the watershed to collect runoff water generated by storm events. TCE and TAES also collected routine stream water samples and lake and stream sediment samples for analysis. The TAES pesticide fate research lab analyzed all samples for atrazine concentrations. This monitoring effort along with reservoir sampling by the Texas Commission of Environmental Quality (TCEQ) has been used to validate the effectiveness of BMP and educational efforts in reducing atrazine concentrations. Through this team effort, ambient atrazine concentrations have been reduced by over 60% compared to 1997 – 98 levels and current running annual average concentrations for atrazine in finished drinking water are well below the MCL. Based on these reductions, the TCEQ and TSSWCB have recommended the removal of Aquilla Reservoir from the 2004 Texas 303(d) list for atrazine.

FACTORS INFLUENCING RUNOFF OF PESTICIDES FROM WARM-SEASON TURFGRASSES. P.A. Ampim*[1], J.H. Massey[1], B.A. Stewart[1], M.C. Smith[1], A.B. Johnson[2], and A.A. Andrews[1]. [1]Mississippi State University, Mississippi State, MS; [2] Alcorn State University, Lorman, MS.

ABSTRACT

Accurate estimation of turf pesticide runoff using models requires critical data inputs that are lacking. This study is part of an on-going project designed to address some of these data needs. We are investigating the effects of grass species, mowing height, and plot size on pesticide runoff from warm season turfgrasses. In this preliminary study, we applied 2,4-D (2,4-dichlorophenoxy acetic acid), flutolanil (trifluoro-3`-isopropoxy-o-toluanilide) and chlorpyrifos (O,O-diethyl hexahydro-4,7-methanoindene) at maximum label rates to two turfgrasses maintained as golf course fairways on a Brookville silty clay (fine montmorillonitic, thermic Aquic Chromudert). The turf species used were Mississippi Pride bermudagrass (*Cynodon dactylon* [L] Pers. X *Cynodon transvalensis* Burtt-Davy) and Meyer zoysia grass (*Zoysia japonica*). Twenty four h after pesticide application, simulated rainfall was applied at 2.2 ± 0.2 cm/h to the plots to generate runoff. On average, 22 ± 6.7% of applied 2,4-D, 1.8 ± 0.7% of applied flutolanil and 0.2 ± 0.8% of applied chlorpyrifos were measured in runoff. Maximum concentrations observed in runoff were 823 ± 126 ppb for 2,4-D, 1386 ± 60 ppb for flutolanil and 21 ± 7 ppb for chlorpyrifos. Soil organic carbon coefficients were 73 ml/g for 2,4-D, 576 ml/g for flutolanil and 3551 ml/g for chlorpyrifos, indicating weak adsorption potential for 2,4-D, moderate to strong adsorption for flutolanil and high adsorption for chlorpyrifos. Runoff results were well correlated to the soil-water distribution coefficient for the Brooksville silty clay.

A DECISION SUPPORT SYSTEM FOR SEDIMENT AND PESTICIDE TMDL IMPLEMENTATION. M.L. Tagert, J.H. Massey, D.R. Shaw, R.L. Bingner, and J.M. Prince; Mississippi State University, Mississippi State, MS; USDA-ARS National Sedimentation Laboratory, Oxford, MS.

ABSTRACT

The USDA Agricultural Nonpoint Source (AGNPS) runoff model is being used as a decision support system (DSS), in combination with geographical information systems (GIS) and remote sensing, to predict water, sediment, and pesticide nonpoint source runoff in the uppermost portion of the Pearl River Basin in east central Mississippi. The AGNPS model includes a GIS interface that processes a soils layer, digital elevation models (DEM), land cover from Landsat satellite imagery, climate stations, and other inputs. AGNPS, using the DEM as the main input, performed a topographic evaluation of the watershed, drainage area identification, watershed segmentation and created synthetic channel networks and subcatchment parameters. Two National Weather Service (NWS) rain gauges were located within the drainage area, and one additional gauge was just outside the drainage area. Measured precipitation data were obtained from January 1994 through December 2003 for all gauges. Once the watershed segmentation was performed and subwatershed cells were delineated, the AGNPS GIS interface intersected the soils, land use, and climate information with the subwatershed cells. The AGNPS Input Editor was then used to combine all necessary information, such as climate data, watershed cell and reach data, management information, into an input file that was utilized by the pollutant loading portion of the model. For the ten-year period that was modeled, AGNPS predicted the average annual rainfall for the watershed to be 1450 mm, with a watershed average annual loading of 463 mm. Sediment loading (clay, silt, and sand combined) at the outlet was predicted to be 27 mg/ha/yr, and nitrogen loading (dissolved and attached) was predicted at 19 kg/ha/yr. Average annual loading was predicted to be 284 and 67 kg/ha/yr for organic carbon and phosphorus, respectively. Results of the AGNPS DSS are also being analyzed for pesticide runoff, as well as specific rainfall events, and compared to measured results for validation.

PESTICIDE MONITORING IN THE AQUILLA WATERSHED. S.R. Lancaster[1], M.C. Dozier[2], K.H. Carson[1], and S.A. Senseman[1], [1]Texas Agricultural Experiment Station and [2]Texas Cooperative Extension, Texas A&M University System, College Station, TX 77843.

ABSTRACT

Recent detections of pesticides in Texas surface waters, including Lake Aquilla have resulted in a need for the monitoring of the movement of several preemergence herbicides transported by surface runoff in the Aquilla watershed. For this reason, a project was initiated with the purpose of monitoring the levels of the herbicides atrazine, simazine, alachlor, and metolachlor at selected locations within the Aquilla watershed. All major stream inlets into Lake Aquilla were studied and appropriate sampling locations were selected. Sampling sites were established at the selected locations to provide a clearer picture of herbicide movement through the watershed. Water samples were collected monthly between November 2002 and August 2004 at each of these sites. In addition, sediment samples were collected semi-annually in 2003 and 2004 at each of the sampling sites as well as Lake Aquilla. All samples were analyzed by the Texas A&M Pesticide Fate Research Laboratory using gas chromatography and mass spectrometry. Of the 79 water samples, atrazine was detected at concentrations of 0.3 - 95.3 $\mu g\ L^{-1}$, alachlor at 0.8 - 1.3 $\mu g\ L^{-1}$, and metolachlor at 0.3 - 4.9 $\mu g\ L^{-1}$ in 55, 3, and 10 samples, respectively. Simazine was not detected in any of the samples. Herbicide detection in the watershed generally coincided with herbicide application times. Atrazine was only detected in one of 20 sediment samples, indicating that sediments are not a likely source of contamination.

HALOSULFURON DISSIPATION AT SELECTED PH VALUES IN SPRAY TANK WATER. M.A. Matocha and S.A. Senseman, Texas A& M University, College Station, TX.

ABSTRACT

Laboratory and growth chamber experiments were conducted in 2004 to evaluate the dissipation of halosulfuron in spray tank water at varying pH. Halosulfuron was added to deionized water and adjusted to pH levels of 5, 7, and 9 and stored for 0 to 24 days. Palmer amaranth plants were sprayed with treatments and harvested 14 d after application. On day of application aliquots of spray solutions were removed and analyzed by HPLC-PDA. Results showed the least degradation of herbicide at pH 5. However, plant bioassay data indicates less efficacy at acidic spray tank pH.

IMAZETHAPYR PHOTODEGRADATION IN RICE PADDY WATER. L.A. Avila, J.H. Massey, S.A. Senseman, K.L. Armbrust, S.R. Lancaster, G.N. McCauley, and J.M. Chandler. Texas A&M University, College Station, TX; Mississippi State University; Texas A&M University, College Station, TX; Mississippi State Chemical Laboratory, Mississippi State University; Texas Agricultural Experiment Station, Eagle Lake, TX; and Texas A&M University, College Station, TX.

ABSTRACT

With the introduction of imidazolinone tolerant rice varieties, imazethapyr has become a potential herbicide for red rice control in cultivated rice. Little is known about the behavior of this herbicide in the aquatic rice environment, particularly due to the effects of water quality. Since changes in turbidity, nutrients, and other water quality parameters may affect the persistence of chemicals in an aquatic environment, data about imazethapyr dissipation in a rice field warrants further study. A laboratory experiment was conducted in 2004 to evaluate the photodegradation of imazethapyr in three rice paddy waters. Paddy water samples were collected from three locations, including Beaumont, TX (BM), Clarksdale, MS (CD) and Eagle Lake, TX (EL). Deionized water (DW) buffered at pH 7.0 was also included in the study as a control. All water samples were fortified with imazethapyr at 15 µg/ml and subjected to irradiation with UV lamps (100 W) for 0, 1, 2, 6, 12, 24, 48, 72 and 96 hours at 25°C in a growth chamber. The experiment was conducted as a randomized block design with four replications. To calculate half-life for each water, the logarithm of the remaining herbicide concentration was plotted against time in hours. The slope of the line k (rate constant) was calculated using least square regression. Rate constants were compared between water samples using the Fisher's Protected LSD test at $p \leq 0.05$. The results showed that the half-life of imazethapyr was different among water sources. The order of imazethapyr photodegradation was DW = EL > BM = CD. Differences in degradation rates correlate well with the relative light attenuation of the water samples, showing that turbidity is the main factor in slowing photolysis rates in field water.

SYMPOSIA

EMERGING ISSUES IN ENVIRONMENTAL IMPACT OF WEED SCIENCE

ATRAZINE OCCURRENCE IN THE MIDWEST AND ITS POTENTIAL AFFECT ON NATIVE FROGS.
W.A. Battaglin; U.S. Geological Survey, Box 25046 MS 415, Lakewood, CO 80225; T.B. Hayes, University of California, Berkeley, CA 94720

ABSTRACT

Recent studies suggest atrazine can induce hermaphroditism in amphibians at concentrations commonly occurring in surface waters of the Midwest. Atrazine is a triazine herbicide used predominantly on corn, sorghum, and sugar cane farms but also in some places on ornamental plants, sod, pasture, golf courses, and road and railroad rights-of-way. Atrazine was first registered for use in the U.S. in 1958, and annual applications currently exceed 75 million pounds. Atrazine is one of the most commonly detected herbicides in U.S. rivers, groundwater, precipitation, and air. The occurrence of atrazine is closely related to its pattern of use, but it can also be transported hundreds of miles from its point of use on windborne dust, then deposited with precipitation. Atrazine has relatively low toxicity to humans and other non-target organisms and is not likely to be a carcinogen at the concentrations commonly observed in the environment. However, atrazine has the potential to affect hormonal processes. In 2002-04, at sites in 6 Midwest States (CO, ND, NE, MT, SD, and WY), water samples were collected by the U.S. Geological Survey and analyzed for atrazine and selected other herbicides and herbicide transformation products. Many sites were paired with a small pond habitat adjacent to a larger river. Atrazine occurrence and concentrations at the sampling sites were strongly correlated with 1999 atrazine use estimates. In most cases, herbicide concentrations at pond sites were similar to those in near-by large rivers. Approximately 100 frogs (newly metamorphosed Rana pipiens) where collected from each site and submitted for histological analysis of gonads. Frogs with gonadal abnormalities occurred at sites in with atrazine detections in ND, NE, and SD, but were not found at sites in CO, WY, and MT when atrazine was not detected.

SYMPOSIA

EMERGING ISSUES IN ENVIRONMENTAL IMPACT OF WEED SCIENCE

EFFECTS OF ATRAZINE IN THE AQUATIC ENVIRONMENT: USING THE CASM MODEL TO DETERMINE LEVELS OF CONCERN (LOCS). K.R. Solomon[1], J. Gonzalez-Valero[2], S.R. Mortensen[2]. [1]Environmental Biology, University of Guelph, Guelph, ON, N1G 2W1. [2]Syngenta Crop Protection, Greensboro, NC, 27419

ABSTRACT

The potential risks of atrazine to aquatic organisms have been extensively studied and reviewed (Giddings et al. 2004). Among many other ecological studies, an exceptional number of aquatic micro- and mesocosm studies have been conducted with atrazine. The Comprehensive Aquatic Systems Model (CASM) is a bioenergetics-based compartment model that describes the daily production of biomass (carbon) by populations of aquatic plants and animals for an annual cycle (Bartell et al. 2000). The CASM has been applied to generic assessments for rivers, lakes and reservoirs and for site-specific assessments of ecological risk posed by chemicals. The CASM also was recommended for determining aquatic life criteria for atrazine by EPA's Office of Water (USEPA 2003). This presentation describes the use of CASM for determinations of aquatic ecosystem levels of concern (LOCs) for atrazine. The parameterized model was validated against field and micro/meso-cosm study results. The modeled toxicity profile included twenty-six producer species (10 plankton, 10 periphyton, 6 macrophytes), and 17 consumer species, showing the same species sensitivity distribution as for the total toxicity data set for atrazine (Giddings et al. 2004). The model was used to define duration-specific levels of concern that matched with the No- to Low/Reversible effects observed in the field studies. The most appropriate simulation result for comparison with the field data was the simulated primary producer community structure (Steinhaus similarity). It was found that freshwater aquatic life and their uses should not be directly affected unacceptably if the average primary producer Steinhaus similarity deviation for a site is less than 5% as determined using CASM. This is suggested as criterion and method for determining scenario-specific LOCs.

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SYMPOSIA

EMERGING ISSUES IN ENVIRONMENTAL IMPACT OF WEED SCIENCE

THE APPLICATION OF ENVIRONMENTAL AND ECOLOGICAL MODELING TOOLS IN THE DESIGN AND INTERPRETATION OF AN ATRAZINE ECOLOGICAL EXPOSURE MONITORING PROGRAM. P. Hendley, P. Hertl, J. Gonzalez-Valero, G. Burnett, A. Hosmer, S. Mortensen, J. McFarland, C. Harbourt, M. Ball, and M. Matella; Syngenta Crop Protection, Greensboro, NC; and Waterborne Environmental, Inc., Leesburg, VA.

ABSTRACT

In 2003, the US Environmental Protection Agency (EPA) completed a 9-year review of hundreds of new studies on the safety of atrazine. The conclusions are that atrazine can be used safely and is not likely to cause cancer in humans. Throughout the review, scientific methodology advances were made in atrazine toxicology, exposure studies, benefits analyses, ecological and human risk assessments and environmental stewardship. These new studies on atrazine have improved safety testing options and risk assessment methods applicable to all classes of agrochemicals.

Additional monitoring studies for atrazine in water are required as part of the reregistration of atrazine. Water intended for human consumption in a well defined fraction of potentially exposed community water systems will continue to be frequently monitored and the results compared with triggers for site-specific mitigation. EPA also required a monitoring program to evaluate the potential magnitude and duration of exposure to atrazine residues experienced by aquatic ecosystems in headwater streams. In order to identify a pool of potentially vulnerable watersheds, the US Geological Survey (USGS) WAtershed Regression for Pesticides (WARP) model was applied using GIS to around 6000 approximately HUC10-scale watersheds intersecting with the upper 45th percentile of atrazine use counties. These watersheds were ranked by the WARP predictions of 95th percentile annual atrazine concentrations and the upper 20th centile of watersheds was selected as a pool of vulnerable watersheds (1172) to examine further. The validity of this approach was demonstrated by comparing the WARP predictions with available atrazine ambient monitoring data. The Generalized Random Tessellation Stratified (GRTS) survey design approach (EPA Corvallis) was used to spatially select a subset of 50 watersheds (including 10 "spare" sites) for the selection of monitoring sites in a way that ensured that the selected watersheds exhibited a spatial density pattern that closely mimicked the spatial density pattern of the original 1172 (with a focus on atrazine use). This resulted in a set of 40 headwater sub-watersheds ranging in area between 20 and 250 sq. km.. Water monitoring commenced at 20 of these sites in 2004 and included continuous flow monitoring, grab samples collected every four days as well as flow driven sampling at 5 of the sites. Analysis for atrazine was performed by immunoassay (IA) with GC/MS confirmation where IA results indicated results exceed approximately 5 ppb; total suspended solids levels were also measured.

Results from the first year of monitoring have been collected and the resulting chemographs have been examined using the Comprehensive Aquatic Systems Model (CASM) to determine compliance according to the October 2003 draft Aquatic Life Criteria (EPA Office of Water/Office of Pesticide Programs). Despite intense runoff events experienced at a few locations, no sites exceeded the criteria of a 5% deviation in annual average primary producer Steinhaus Similarity Index. These results will be discussed and, in addition, we will present examples of CASM output indicating how an ecosystem will respond to various illustrative examples of atrazine chemographs.

In 2005, water monitoring will continue for these 20 sub-watersheds and work will start at the additional 20 sites. Monitoring will also commence at sites in Louisiana and Florida in waterways draining areas dominated by sugarcane agriculture.

SYMPOSIA

EMERGING ISSUES IN ENVIRONMENTAL IMPACT OF WEED SCIENCE

PESTICIDE USE IN TURF: TRENDS AND EMERGING ISSUES. J.H. Massey. Mississippi State University, Mississippi State, MS.

ABSTRACT

An estimated 50 million acres of managed turf exist in the U.S. This land area rivals that of wheat and surpasses both cotton and rice acreages. Some 700,000 athletic fields, 15,000 golf courses, and tens of millions of home lawns nationwide help to make turfgrass the number one or two “crop” in rapidly urbanizing states such as FL, MD, NC, NJ, PA, and VA. Nearly 50% of all lawns receive at least one pesticide and/or fertilizer application per year, resulting in a total of ca. 102 million lbs. pesticides being applied to U.S. lawns and gardens in 2001. The lawn and garden ‘consumables’ market, which includes fertilizers, pesticides, mulch, seeds, etc., is expected to increase by ca. 5% per yr as increasing numbers of baby-boomers retire over the coming decade. It has been estimated that nearly 90% of all Americans contact turf on a daily basis. As a result, concerns exist as to the level and significance of non-dietary exposures resulting from contact with pesticide-treated turfgrass. Recent ‘aesthetic’ pesticide bans in Canada prohibiting certain private and public uses of lawn and garden pesticides may add to the concerns of some citizens. Moreover, the U.S. Geological Survey’s National Water Quality Assessment program has found higher concentrations of certain pesticides in urban streams than typically found in agricultural settings. As a result of these issues and the rapid expansion of turf acreages across the U.S., demand for information on the health and environmental aspects of turf management will likely increase with time. Four areas related to turf pesticide use will be identified as requiring additional outreach and/or investigation. First, improved education of the public in ways to reduce their exposure to pesticides and potential environmental impacts is needed. The contamination of municipal compost in WA that resulted in a 2002 ban on clopyralid herbicide for home lawns indicates that homeowners do not always follow pesticide label instructions. Educational efforts are needed that stress basic aspects of pesticide use (e.g., following product labels and prior measurement of the actual turf area to be treated) and other key aspects of environmental turf management (e.g., reducing soil compaction to increase infiltration rates). Region-specific (e.g., cool-season vs. warm-season vs. transition zones) best management practices and integrated pest management programs for turf should be further developed as citizens are made more aware of their potential impacts on water quality. Unlike for most agronomic crops, standardized field procedures and exposure modeling scenarios used to evaluate pesticide runoff from turf are needed. Lastly, we need to better understand how thatch impacts turf hydrology and pesticide fate. As turf acreages steadily increase, research addressing these and other issues involving pesticide use in turfgrass is required.

SYMPOSIA

REGULATORY FUNDAMENTALS WORKSHOP

HERBICIDE USE AND STATE REGISTRATION UNDER FIFRA SECTIONS 2(EE), 24(C) AND 18. L.L. Whatley; BASF Corporation, Research Triangle Park, NC 27709

ABSTRACT

State pesticide regulatory agencies register herbicides after EPA has registered them under Section 3 of FIFRA. Many states regulate herbicide applications under FIFRA Section 2(ee), which defines “to use any registered pesticide in a manner inconsistent with its labeling,” a prohibition seen on all herbicide labels. States also have authority under FIFRA Section 24(c) to register additional herbicide uses, within limits. An Emergency Exemption under Section 18 of FIFRA allows unregistered herbicide use.

Section 2(ee) permits herbicide applications at lower doses, concentrations, or frequency than the label prescribes; it also allows applications to a labeled crop or site to control an unlabeled pest. In addition, using an unlabeled application method or mixing the herbicide with fertilizer is permitted under Section 2(ee) unless the label specifically prohibits it. Herbicide applications can be made under Section 2(ee) without written permission. However, a written document is needed for a third party to recommend a use under Section 2(ee). These may take the form of a technical information bulletin or something similar.

Registration under FIFRA Section 24(c) provides state authority to approve supplemental labeling, which takes special local needs into account. However, states cannot use Section 24(c) to add new food or feed crops, change preharvest intervals, increase application rates, or change restrictions on the main label. A chemical company or grower group typically prepares the 24(c) application; the application usually includes a written justification of the need, letters of support from Extension personnel or university researchers, a draft label, and data supporting the use. Once a state issues a 24(c) registration, EPA is notified. EPA then has 90 days to request that the state withdraw the approval if the use is deemed beyond the state’s authority. However, the 24(c) label is valid from the day the state approves it until it is withdrawn.

State agencies typically apply to EPA for a Section 18, which permits the unregistered use of a herbicide. Before the EPA grants the exemption from registration, the state must document the urgency of the situation and the economic hardship the uncontrolled weed(s) will create. For food or feed crops, EPA must also issue a temporary tolerance so crops containing exempted herbicide residues can enter normal channels of trade. Emergency Exemptions are usually issued for one year or less, but may be reapplied for in succeeding years. Progress toward a FIFRA Section 3 registration must be demonstrated for EPA to issue a repeat Section 18.

SYMPOSIA

REGULATORY FUNDAMENTALS WORKSHOP

THE ROLE OF IR-4 IN HERBICIDE LABELING. D.W. Monks, and R.B.Batts; North Carolina State University, Raleigh, NC 27695-7609. (248)

ABSTRACT

IR-4 (Interregional Project Number 4) has cooperated with researchers, producers, agricultural chemical companies, and federal agencies to secure clearances for pesticides for specialty (minor) crops since 1963. The goal of IR-4 is to provide pest management solutions to growers of fruits and vegetables and other specialty crops for the benefit of consumers, growers and food processors. Agriculture in the southern states is heavily dependent on specialty crops with value of specialty crops ranging from 5 (Arkansas) to 90% (Florida) of all crops grown in each state. In the U.S., specialty crop value makes up over 50% of total crop value in 26 states. Specialty crops make up over $40 billion in sales annually and are approximately 40% of total crop sales in the U.S. Though the primary goal of IR-4 is to achieve national labels for products, IR-4 data is often used to secure Section 18 registrations. In a recent 6 year span, the estimated savings to growers from IR-4 data supported Section 18's was approximately $853,000,000. Since 1963, 7300 food crop tolerances have been established. Over 10,600 ornamental tolerances have been established since this portion of the program began in 1977. Over 50% of tolerances established by EPA since 2001 have come from IR-4 petitions. Information on how the process works can be found on the following web site http://rutgers.edu/.

SYMPOSIA

REGULATORY FUNDAMENTALS WORKSHOP

PEST RESISTANCE MANAGEMENT AND THE HERBICIDE LABEL. Sharlene R. Matten, US Environmental Protection Agency, Office of Pesticide Programs, Biopesticides and Pollution Prevention Division (7511C), 1200 Pennsylvania Ave., NW, Washington DC, 20460.

ABSTRACT

In 2001, the U. S. Environmental Protection Agency published voluntary resistance management labeling guidelines based on rotation of mode of action for agricultural uses of pesticides. Similar guidelines were published in 1999 by the Pest Management Regulatory Agency in Canada. These voluntary guidelines focus on two aspects: 1) classification of pesticides according to their modes/sites of action and 2) recommendations for resistance management strategies in the use directions. These guidelines establish a harmonized North America approach in pesticide resistance management labeling. The management of pesticide resistance development is an important part of sustainable pest management and this, in conjunction with alternative pest management strategies and integrated pest management programs, can make significant contributions to reducing risks to humans and the environment.

SYMPOSIA

REGULATORY FUNDAMENTALS WORKSHOP

REGISTERING A NEW HERBICIDE ACTIVE INGREDIENT IN THE U.S. J.W. Wells, Syngenta Crop Protection, Greensboro, NC.

ABSTRACT

This presentation provided a brief review of the data requirements for registering a new herbicide active ingredient in the U.S. The data review process that the U.S. Environmental Protection Agency undertakes was also covered, with emphasis on the area of risk assessment. Examples were given on how tolerances are determined and human health and environmental risk assessments are done.

WEED SURVEY – SOUTHERN STATES

2005

Broadleaf Crops Subsection

(Cotton, Peanut, Soybean, Tobacco, and Forestry)

Theodore M. Webster
Chairperson

Information in this report is provided by the following individuals:

Alabama	Mike Patterson	John Everest
Florida	Jay Ferrell	Barry Brecke
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Mississippi	John Byrd	
Missouri	Andy Kendig	
North Carolina	Alan York Loren Fisher	David Jordan
Oklahoma	Case Medlin	Don Murray
South Carolina	Jason Norsworthy Larry Nelson	Jay Chapin
Tennessee	Larry Steckel	

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton.

	States		
Ranking	Alabama	Florida	Georgia
Ten Most Common Weeds			
1	crabgrass spp.	crabgrass spp.	Texas panicum
2	morningglory spp.	pigweed spp.	Palmer amaranth
3	prickly sida	sicklepod	smallflower morningglory
4	sicklepod	Florida pusley	*Ipomoea* morningglory spp.
5	pigweed spp.	Florida beggarweed	Florida pusley
6	nutsedge spp.	morningglory spp.	Florida beggarweed
7	Florida pusley	nutsedge spp.	nutsedge spp.
8	spurge spp.	common cocklebur	Sicklepod
9	goosegrass	Texas panicum	crabgrass spp.
10	bristly starbur	redweed	bristly starbur
Ten Most Troublesome Weeds			
1	bermudagrass	tropical spiderwort	tropical spiderwort
2	morningglory spp.	morningglory spp.	Palmer amaranth
3	nutsedge spp.	nutsedge spp.	*Ipomoea* morningglory spp.
4	sicklepod	Florida pusley	Florida pusley
5	coffee senna	smallflower morningglory	nutsedge spp.
6	tropic croton	bermudagrass	spreading/Asiatic dayflower
7	velvetleaf	sicklepod	smallflower morningglory
8	spurge spp.	wild poinsettia	Texas panicum
9	Florida pusley	groundcherry spp.	wild poinsettia
10	smartweed spp.	Palmer amaranth	Bermudagrass

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton (continued).

	States		
Ranking	Louisiana	Missouri	Mississippi
Ten Most Common Weeds			
1	morningglory spp.	crabgrass spp.	pitted morningglory
2	pigweed spp.	pigweed spp.	ivyleaf/entireleaf morningglory
3	nutsedge spp.	morningglory spp.	spotted spurge
4	Johnsongrass	common cocklebur	purple nutsedge
5	redvine	goosegrass	Bermudagrass
6	hemp sesbania	prickly sida	yellow nutsedge
7	broadleaf signalgrass	velvetleaf	hemp sesbania
8	prickly sida	spurge spp.	prickly sida
9	bermudagrass	Johnsongrass	southern crabgrass
10	Pennsylvania smartweed	spurred anoda	broadleaf signalgrass
Ten Most Troublesome Weeds			
1	morningglory spp.	Palmer amaranth	spotted spurge
2	nutsedge spp.	morningglory spp.	hemp sesbania
3	pigweed spp.	common cocklebur	Redvine
4	bermudagrass	velvetleaf	pigweed spp.
5	hemp sesbania	prickly sida	Bermudagrass
6	redvine	Johnsongrass	prickly sida
7	broadleaf signalgrass	spurge spp.	morningglory spp.
8	prickly sida	perennial vines	Trumpetcreeper
9	Pennsylvania smartweed	bermudagrass	southern crabgrass
10	wild okra	goosegrass	honeyvine milkweed

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton (continued).

	States		
Ranking	North Carolina	Oklahoma	South Carolina
Ten Most Common Weeds			
1	pigweed spp.	pigweed spp.	Palmer amaranth
2	large crabgrass	morningglory spp.	large crabgrass
3	broadleaf signalgrass	red sprangletop	morningglory spp.
4	morningglory spp.	large crabgrass	goosegrass
5	sicklepod	Texas panicum	nutsedge spp.
6	prickly sida	silverleaf nightshade	sicklepod
7	common lambsquarters	Johnsongrass	tropic croton
8	nutsedge spp.	common cocklebur	prickly sida
9	smartweed spp.	yellow nutsedge	arrowleaf sida
10	common cocklebur	devil’s claw	common cocklebur
Ten Most Troublesome Weeds			
1	Palmer amaranth	morningglory spp.	Palmer amaranth
2	morningglory spp.	silverleaf nightshade	morningglory spp.
3	nutsedge spp.	pigweed spp.	sicklepod
4	dayflower spp.	red sprangletop	nutsedge spp.
5	Florida pusley	yellow nutsedge	Florida pusley
6	goosegrass	common cocklebur	coffee senna
7	smartweed spp.	devil’s claw	bermudagrass
8	bermudagrass	field bindweed	spurred anoda
9	spurred anoda	Johnsongrass	common cocklebur
10	tropic croton	Texas panicum	velvetleaf

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton (continued).

Ranking	State Tennessee
Ten Most Common Weeds	
1	Horseweed
2	Palmer amaranth
3	morningglory spp.
4	broadleaf signalgrass
5	large crabgrass
6	spotted spurge
7	yellow nutsedge
8	Johnsongrass
9	velvetleaf
10	smooth pigweed
Ten Most Troublesome Weeds	
1	Horseweed
2	Palmer amaranth
3	morningglory spp.
4	smooth pigweed
5	broadleaf signalgrass
6	spotted spurge
7	yellow nutsedge
8	prickly sida
9	velvetleaf
10	common cocklebur

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Peanut.

	States		
Ranking	Alabama	Florida	Georgia
Ten Most Common Weeds			
1	Florida beggarweed	crabgrass spp.	Florida beggarweed
2	nutsedge spp.	Florida beggarweed	Texas panicum
3	morningglory spp.	sicklepod	sicklepod
4	sicklepod	Florida pusley	Florida pusley
5	crabgrass spp.	pigweed spp.	nutsedge spp.
6	common cocklebur	morningglory spp.	morningglory spp.
7	bristly starbur	nutsedge spp.	Palmer amaranth
8	prickly sida	Texas panicum	bristly starbur
9	ragweed spp.	tropic croton	crabgrass spp.
10	Texas panicum	bristly starbur	tropic croton
Ten Most Troublesome Weeds			
1	Florida beggarweed	Florida beggarweed	Palmer amaranth
2	nutsedge spp.	tropical spiderwort	Florida pusley
3	horsenettle	bristly starbur	tropical spiderwort
4	bristly starbur	morningglory spp.	Florida beggarweed
5	tropic croton	cowpea	nutsedge spp.
6	dayflower spp.	Palmer amaranth	tropic croton
7	sicklepod	tropic croton	sicklepod
8	maypop passionflower	hairy indigo	Texas panicum
9	groundcherry spp.	cutleaf groundcherry	morningglory spp.
10	wild poinsettia	Texas panicum	common bermudagrass

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Peanut (continued).

	States		
Ranking	Mississippi	North Carolina	Oklahoma
Ten Most Common Weeds			
1	broadleaf signalgrass	large crabgrass	pigweed spp.
2	Palmer amaranth	broadleaf signalgrass	crownbeard
3	eclipta	nutsedge spp.	prickly sida
4	cutleaf groundcherry	morningglory spp.	eclipta
5	horsenettle	prickly sida	yellow nutsedge
6	Johnsongrass	goosegrass	morningglory spp.
7	pitted morningglory	common ragweed	Johnsongrass
8	pigweed spp.	common lambsquarters	large crabgrass
9	prickly sida	common cocklebur	Texas panicum
10	spotted spurge	pigweed spp.	spurge spp.
Ten Most Troublesome Weeds			
1	eclipta	nutsedge spp.	yellow nutsedge
2	horsenettle	eclipta	eclipta
3	spotted spurge	common ragweed	ALS-resistant Palmer amaranth
4	purple nutsedge	prickly sida	hophornbeam copperleaf
5	prickly sida	sicklepod	horsenettle
6	cutleaf groundcherry	Carolina horsenettle	pigweed spp.
7	goosegrass	common bermudagrass	crownbeard
8	southern crabgrass	Texas panicum	spurge spp.
9	Johnsongrass	Florida beggarweed	silverleaf nightshade
10	morningglory spp.	nightshade spp.	Texas panicum

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Peanut (continued).

	State
Ranking	South Carolina
Ten Most Common Weeds	
1	Palmer amaranth
2	sicklepod
3	morningglory spp.
4	large crabgrass
5	goosegrass
6	Texas panicum
7	yellow nutsedge
8	tropic croton
9	bermudagrass
10	Florida beggarweed
Ten Most Troublesome Weeds	
1	Palmer amaranth
2	sicklepod
3	morningglory spp.
4	yellow nutsedge
5	Texas panicum
6	large crabgrass
7	tropic croton
8	Florida beggarweed
9	goosegrass
10	bermudagrass

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean.

	States		
Ranking	Alabama	Florida	Georgia
Ten Most Common Weeds			
1	sicklepod	crabgrass spp.	sicklepod
2	morningglory spp.	Florida beggarweed	Palmer amaranth
3	pigweed spp.	sicklepod	crabgrass spp.
4	crabgrass spp.	Florida pusley	morningglory spp.
5	Johnsongrass	pigweed spp.	Texas panicum
6	prickly sida	morningglory spp.	common cocklebur
7	common cocklebur	nutsedge spp.	nutsedge spp.
8	nutsedge spp.	Texas panicum	Florida beggarweed
9	ragweed spp.	tropic croton	Florida pusley
10	Florida pusley	bristly starbur	common ragweed
Ten Most Troublesome Weeds			
1	sicklepod	Florida beggarweed	sicklepod
2	morningglory spp.	Palmer amaranth	morningglory spp.
3	nutsedge spp.	cowpea	Palmer amaranth
4	bermudagrass	dayflower spp.	nutsedge spp.
5	tropic croton	bristly starbur	Florida pusely
6	pigweed spp.	morningglory spp.	tropical spiderwort
7	horsenettle	cutleaf eveningprimrose	Texas panicum
8	balloonvine	hairy indigo	common cocklebur
9	Florida pusley	tropic croton	Florida beggarweed
10	coffee senna	Texas panicum	roundup ready cotton

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean (continued).

	States		
Ranking	Kentucky	Louisianna	Mississippi
Ten Most Common Weeds			
1	horseweed/marestail	morningglory spp.	prickly sida
2	smooth pigweed	pigweed spp.	pitted morningglory
3	Johnsongrass	barnyardgrass	entireleaf morningglory
4	common pokeweed	hemp sesbania	broadleaf signalgrass
5	prickly sida	prickly sida	nodding/hyssop spurge
6	dandelion	sicklepod	barnyardgrass
7	fall panicum	red rice	yellow nutsedge
8	honeyvine milkweed	broadleaf signalgrass	hemp sesbania
9	pitted morningglory	wild poinsettia	Johnsongrass
10	eastern black nightshade	Johnsongrass	prostrate spurge
Ten Most Troublesome Weeds			
1	honeyvine milkweed	wild poinsettia	prickly sida
2	trumpetcreeper	groundcherry spp.	pitted morningglory
3	common pokeweed	spreading dayflower	entireleaf morningglory
4	burcucumber	Texasweed	nodding/hyssop spurge
5	horseweed/marestail	morningglory spp.	yellow nutsedge
6	eastern black nightshade	red rice	Johnsongrass
7	ivyleaf morningglory	jointvetch spp.	trumpetcreeper
8	giant ragweed	sicklepod	redvine
9	Johnsongrass	redvine/trumpetcrepper	bermudagrass
10	yellow nutsedge	itchgrass	horsenettle

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean (continued).

	States		
Ranking	Missouri	North Carolina	Oklahoma
Ten Most Common Weeds			
1	common waterhemp	pigweed spp.	pigweed spp.
2	giant foxtail	large crabgrass	morningglory spp.
3	velvetleaf	broadleaf signalgrass	common cocklebur
4	morningglory spp.	morningglory spp.	large crabgrass
5	common cocklebur	sicklepod	Johnsongrass
6	sunflower spp.	common ragweed	common lambsquarters
7	shattercane	common lambsquarters	velvetleaf
8	crabgrass spp.	Johnsongrass	prickly sida
9	smartweed spp.	fall panicum	Texas panicum
10	common ragweed	common cocklebur	hemp sesbania
Ten Most Troublesome Weeds			
1	common waterhemp	morningglory spp.	morningglory spp.
2	velvetleaf	pigweed spp.	pigweed spp.
3	common cocklebur	eastern black nightshade	common cocklebur
4	morningglory spp.	broadleaf signalgrass	velvetleaf
5	sunflower spp.	sicklepod	spurge spp.
6	shattercane	common ragweed	hemp sesbania
7	hemp dogbane	Johnsongrass	prickly sida
8	common ragweed	hemp dogbane	johsnongrass
9	Palmer amaranth	common milkweed	yellow nutsedge
10	giant foxtail	bermudagrass	Texas panicum

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean (continued).

	States	
Ranking	South Carolina	Tennessee
Ten Most Common Weeds		
1	Palmer amaranth	Johnsongrass
2	sicklepod	horseweed
3	Large crabgrass	Palmer amaranth
4	goosegrass	broadleaf signalgrass
5	morningglory spp.	smooth pigweed
6	nutsedge spp.	morningglory spp.
7	Florida pusley	large crabgrass
8	prickly sida	sicklepod
9	common cocklebur	hophornbeam copperleaf
10	arrowleaf sida	prickly sida
Ten Most Troublesome Weeds		
1	sicklepod	Palmer amaranth
2	Palmer amaranth	horseweed
3	morningglory spp.	morningglory spp.
4	Florida pusley	prickly sida
5	nutsedge spp.	hophornbeam copperleaf
6	Texas panicum	giant ragweed
7	common cocklebur	sicklepod
8	coffee senna	trumpetcreeper
9	arrowleaf sida	smooth pigweed
10	prickly sida	Johnsongrass

Table 4. The Southern States 10 Most Common and Troublesome Weeds in Tobacco.

	States		
Ranking	Florida	Kentucky	North Carolina
Ten Most Common Weeds			
1	crabgrass spp.	foxtail spp.	nutsedge spp.
2	Florida pusley	smooth pigweed	large crabgrass
3	nutsedge spp.	large crabgrass	pigweed spp.
4	sicklepod	ivyleaf morningglory	sicklepod
5	Florida beggarweed	common lambsquarters	broadleaf signalgrass
6	bermudagrass	Johnsongrass	common ragweed
7	morningglory spp.	common ragweed	common lambsquarters
8	bristly starbur	hairy galinsoga	morningglory spp.
9	Texas panicum	yellow nutsedge	goosegrass
10	pigweed spp.	horsenettle	bermudagrass
Ten Most Troublesome Weeds			
1	nutsedge spp.	honeyvine milkweed	morningglory spp.
2	bermudagrass	hairy galinsoga	nutsedge spp.
3	morningglory spp.	ivyleaf morningglory	large crabgrass
4	tropical spiderwort	yellow nutsedge	sicklepod
5	sicklepod	johnonsgrass	common ragweed
6	Florida beggarweed	horsenettle	pigweed spp.
7	bristly starbur	smooth pigweed	common cocklebur
8	pigweed spp.	common lambsquarters	carolina horsenettle
9	hairy indigo	common ragweed	common lambsquarters
10	wild poinsettia	jimsonweed	broadleaf signalgrass

Table 4. The Southern States 10 Most Common and Troublesome Weeds in Tobacco (continued).

Ranking	State Tennessee
Ten Most Common Weeds	
1	large crabgrass
2	smooth pigweed
3	morningglory spp.
4	common ragweed
5	common lambsquarters
6	common purslane
7	carpetweed
8	carolina horsenettle
9	yellow nutsedge
10	hairy galinsoga
Ten Most Troublesome Weeds	
1	common ragweed
2	hairy galinsoga
3	carolina horsenettle
4	yellow nutsedge
5	morningglory spp.
6	Johnsongrass
7	bermudagrass
8	large crabgrass
9	groundcherry spp.
10	common cocklebur

Table 5. The Southern States 10 Most Common and Troublesome Weeds in Forestry.

	States		
Ranking	Alabama	Florida	Louisiana
Ten Most Common Weeds			
1	dogfennel	dogfennel	*Rubus* spp.
2	common ragweed	pigweed spp.	Chinese privet
3	horseweed	saw palmetto	Johnsongrass
4	crabgrass spp.	sandbur spp.	horseweed
5	broomsedge	Johnsongrass	dogfennel
6	blackberry spp.	Chinese tallow	giant ragweed
7	goldenrod spp.	cogongrass	sweetgum
8	Johnsongrass	Chinese privet	red oak
9	kudzu	tickberry spp.	blackgum
10	camphorweed	Japanese climbing fern	hickory
Ten Most Troublesome Weeds			
1	kudzu	cogongrass	sweetgum
2	cogongrass	saw palmetto	red oak
3	broomsedge	bamboo	winged elm
4	gallberry spp.	Chinese privet	Chinese tallow
5	honeysuckle spp.	Japanese climbing fern	broomsedge
6	dogfennel	broomsedge	hickory
7	greenbriar spp.	Chinese tallow	red maple
8	goldenrod spp.	dogfennel	boxelder
9	camphorweed	blackberry spp.	*Rubus* spp.
10	sweetgum	goldenrod spp.	giant ragweed

Table 5. The Southern States 10 Most Common and Troublesome Weeds in Forestry (continued).

	States	
Ranking	Mississippi	South Carolina*
Ten Most Common Weeds		
1	baccharis	fireweed
2	eastern red cedar	common ragweed
3	privet	dogfennel
4	yaupon	horseweed
5	dogwood	aster spp.
6	green sawbriar	poorjoe
7	sweetgum	sunflower spp.
8	red oak	boneset
9	blackgum	tall lettuce
10	hickory	lespedeza spp.
Ten Most Troublesome Weeds		
1	sweetgum	coffeeweed
2	red oak	white snakeroot
3	winged elm	pigweed spp.
4	yaupon	bitter sneezeweed
5	hickory	morningglory spp.
6	blue vervain	common cocklebur
7	*Rubus* spp.	sicklepod
8	green sawbriar	lespedeza spp.
9	privet	trumpetcreeper
10	kudzu	tropic croton

* Weeds are not listed in any particular order

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-1691	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-2080	Pasture Weed and Brush Control
FSA-2109	Home Lawn Weed Control
FSA-2145	Spot Spraying Pasture Brush

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-0044 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-87-63 Application Procedure for Use of Grass Carp for Control of Aquatic Weeds
A-87-73 Biology and Chemical Control of Algae
A-87-103 Biology and Chemical Control of Duckweed
A-87-113 Chemical Control of Hydrilla
A-87-123 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-1881 Weed Management in Commercial Citrus
HS-1891 Weed Control in Cole or Brassica Leafy Vegetables
HS-1901 Weed Control in Cucurbit Crops
HS-1911 Weed Control in Eggplant
HS-1921 Weed Control in Okra
HS-1931 Weed Control in Bulb Crops
HS-1941 Weed Control in Potato
HS-1951 Potato Vine Dessicants
HS-1961 Weed Control in Strawberry
HS-1971 Weed Control in Sweet Corn
HS-1981 Weed Control in Sweet Potato
HS-1991 Weed Control in Pepper
HS-2001 Weed Control in Tomato
HS-2011 Weed Control in Carrots and Parsley
HS-2021 Weed Control in Celery
HS-2031 Weed Control in Lettuce, Endive, and Spinach
HS-7061 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
2805	Families, Mode of Action and Characteristics of Agronomic, Non-Crop and Turf Herbicides
4592	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
8524	Weed Control in Sod Production
1114	Weed Management for Florida Golf Courses
-----5	Florida Weed Control Guide ($8.00)
DH-88-054	Turfgrass Weed Control Guide for Lawn Care Professionals
DH-88-074	Commercial Bermudagrass Weed Control Guide
SM-445	Aquatic and Wetland Plants of Florida ($11.00)
SP-355	Identification Manual for Wetland Plant Species of Florida ($18.00)
SP-375	Weeds in Florida ($7.00)
	Florida Weeds Part II ($1.00)
SP-795	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

281	Georgia Pest Control Handbook ($15.00)*

MISCELLANEOUS

Pub. 46	2005 Georgia Peach Spray and Production Guide
Pub. 377	2005 Georgia Tobacco Growers Guide
Pub. 380	2005 Cotton Production Package
Hdbk. No. 11	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)
7611	Weeds of the Southern United States ($3.00)
8391	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, Plant and Soil Sciences Department, 413 Plant Science Building, University of Kentucky, Lexington, KY 40546-0312 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. Nathan Buehring, 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	
6731	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
10251	Aquatic Weed Identification and Control--Bushy Pondweed and Coontail
10261	Aquatic Weed Identification and Control--Willows and Arrowhead
10271	Aquatic Weed Identification and Control--Cattail and Spikerush
10281	Aquatic Weed Identification and Control--Pondweed and Bladderwort
10291	Aquatic Weed Identification and Control--Fanwort and Parrotfeather
10301	Aquatic Weed Identification and Control--Frogbit and Watershield
10311	Aquatic Weed Identification and Control--Burreed and Bulrush
10321	Aquatic Weed Identification and Control--White Waterlily and American Lotus
10331	Aquatic Weed Identification and Control--Duckweed and Water Hyacinth
10341	Aquatic Weed Identification and Control--Hydrilla and Alligatorweed
10351	Aquatic Weed Identification and Control--Algae
10361	Aquatic Weed Identification and Control--Methods of Aquatic Weed Control
10371	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
10053	Christmas Tree Production in Mississippi
10064	Calibration of Ground Spray Equipment
1091	Garden Tabloid

1100	Soybeans Postemergence Weed Control
12175	Rice Weed Control
12773	Forest Management Alternatives for Private Landowners
1322	Establish and Manage Your Home Lawn
1344	Weed Control in Small Grain Crops
1532	2005 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
21662	Poisonous Plants of the Southeastern United States

TECHNICAL NOTES

MTN-SG3	Weed Control in Christmas Tree Plantations
MTN-7F3	An Overview of Herbicide Alternatives for the Private Forest Landowner
MTN-8F3	Tree Injection: Equipment, Methods, Effective Herbicides, Productivity, and Costs
MTN-11F3	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
MP171	Missouri Pest Management Guide: Corn, Soybean, Wheat
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)
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/
http://www.turffiles.ncsu.edu/AllPublications.aspx

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-371	Agricultural Chemicals for North Carolina Apples
AG-1461	Peach and Nectarine Spray Schedule
AG-187	Tobacco Information - 2005
AG-208	Identifying Seedling and Mature Weeds in Southeastern United States ($7.00)
AG-331	2005 Peanut Information
AG-348	Turfgrass Pest Management Manual ($7.00)
AG-408	Pest Control for Professional Turfgrass Managers 2005
AG-417	2005 Cotton Information
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-5722	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	
HIL205B1	Weed Control Options for Strawberries on Plastic
HIL3251	Peach Orchard Weed Management
HIL380	Orchard Floor Management in Pecans
HIL449	Weed Management in Conifer Seedbeds
HIL570	Greenhouse Weed Management
HIL6431	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
HIL81011	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	2005 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

Herbicide Names and Manufacturers

Common or Code Name	Trade Name	Manufacturer
A		
acetochlor	Harness	Monsanto
	Surpass	Dow AgroSciences
acifluorfen	Ultra Blazer	BASF
acifluorfen + bentazon	Conclude Xact	BASF
alachlor	Lasso, Partner, Micro-Tech	Monsanto
ametryn	Evik	Syngenta
asulam	Asulox	Bayer
atrazine	AAtrex / others	Syngenta / others
azafenidin	Milestone	DuPont Ag Products
AEF 130060		Dow AgroSciences
B		
BAS 625H	Aura	BASF
BAY FOE5043	Axiom	Bayer
BAY MKH 6561		Bayer Crop Science
benefin	Balan	Dow AgroSciences
bensulfuron	Londax	DuPont Ag Products
bentazon	Basagran	BASF, Micro Flo
bispyribac-sodium	Regiment	Valent USA
bromacil	Hyvar X	DuPont Ag Products
bromoxynil	Buctril, Bronate	Bayer Crop Science
butroxydim	Falcon	
C		
carfentrazone	Aim, Shark	FMC
CGA-362622	Envoke	Syngenta
chlorimuron	Classic	DuPont Ag Products
chlorimuron + sulfentrazone	Canopy XL	DuPont Ag Products
chlorimuron + thifensulfuron	Synchrony STS	DuPont Ag Products
chlorsulfuron	Glean, Telar	DuPont Ag Products
chlorsulfuron + metsulfuron	Finesse	DuPont Ag Products
clethodium	Select, Envoy, Prism	Valent USA
clomazone	Command	FMC
clopyralid	Lontrel Stinger	Dow AgroSciences

cloransulam	FirstRate Amplify Gangster	Dow AgroSciences Monsanto Valent
cyhalofop	Clincher	Dow AgroSciences
D		
2,4-D	Several	Several
2,4-D + MCPP + dicamba	Trimec Classic	PBI Gordon
2,4-DB	Butoxone Butyrac	Bayer Crop Science
DCPA	Dacthal	Amvac
dicamba	Banvel Clarity Vanquish	Micro Flo BASF Syngenta
dicamba + diflufenzopyr	Distinct	BASF
dicamba + diflufenzopyr + nicosulfuron	Celebrity Plus	BASF
dicamba + 2,4-D	Weedmaster	BASF
dichlobenil	Casoron	Uniroyal
dichlorprop (2,4-DP)	Several	Bayer Crop Science
diclofop	Hoelon	Bayer Crop Science
diclosulam	Strongarm	Dow AgroSciences
dimethenamid	Frontier	BASF
dimethenamid-P	Outlook	BASF
diquat	Reglone, Reward	Syngenta
dithiopyr	Dimension	Rohm & Haas
diuron	Karmex Direx	Griffin Griffin
E		
endothall	Endothal	Pennwalt
ethalfluralin	Sonalan, Curbit	Dow AgroSciences
ethofumesate	Prograss	Bayer Crop Science
F		
fenoxaprop	Puma, Ricestar, Whip	Bayer Crop Science
fluazifop-P	Fusilade DX	Syngenta
fluazifop + fenoxaprop	Fusion	Syngenta
flufenacet	Define	Bayer
flufenacet + metribuzin + atrazine	Axiom, Domain	Bayer Crop Science
flumetsulam	Python	Dow AgroSciences
flumetsulam + clorpyralid	Hornet	Dow AgroSciences
flumetsulam + clopyralid +2,4-D	Scorpion III	Dow AgroSciences
flumiclorac	Resource	Valent USA
flumioxazin	Valor	Valent USA
fluometuron	Cotoran, Meturon	Griffin Griffin

fluoroxypyr	Vista	Dow AgroSciences
fluthiacet methyl	Action	Syngenta
	Appeal	KI USA
fomesafen	Reflex	Syngenta
fosamine	Krenite	DuPont Ag Products
G		
glufosinate	Liberty	Bayer Crop Science
	Rely	Bayer Crop Science Bayer
	Ignite	Crop Science
glyphosate	Many	many
H		
halosulfuron	Permit, Sempra	Monsanto
hexazinone	Velpar	DuPont Ag Products
I		
imazamethabenz	Assert	BASF
imazamox	Beyond, Raptor	BASF
imazapic	Cadre, Plateau	BASF
imazapyr	Arsenal,	BASF
	Chopper,	BASF
	Stalker, Habitat	BASF
imazaquin	Scepter	BASF
	Image	BASF
imazethapyr	Pursuit	BASF
	NewPath	BASF
imazethapyr + imazapyr	Lightning	BASF
	Event	
isoxaben	Gallery	Dow AgroSciences
isoxaben + oryzalin	Snapshot DF	Dow AgroSciences
isoxoben + trifluralin	Snapshot TG	Dow AgroSciences
isoxaflutole	Balance	Bayer Crop Science
J-L		
lactofen	Cobra	Valent USA
M		
MCPA	Several	Several
mecoprop	Several	Several
mesosulfuron	Osprey	Bayer
mesotrione	Callisto	Syngenta
mesotrione + metolachlor	Camix	Syngenta
mesotrione + metolachlor + atrazine	Lumax	Syngenta
metham	Vapam	Amvac
methyl bromide	Bromo-gas	Great Lakes
metolachlor	Dual Magnum	Syngenta
	Pennant	Syngenta
metolachlor + atrazine	Bicep	Syngenta
metribuzin	Sencor	Bayer Crop Science
metribuzin + metolachlor	Turbo	Bayer Crop Science

metribuzin + trifluralin	Salute	Bayer Crop Science
metsulfuron	Ally, Escort	DuPont Ag Products
molinate	Ordram	Syngenta
MSMA	Several	Several
N		
napropamide	Devrinol	Syngenta
nicosulfuron	Accent	DuPont Ag Products
nicosulfuron + rimsulfuron + atrazine	Basis Gold	DuPont Ag Products
nicosulfuron + rimsulfuron	Steadfast	DuPont Ag Products
norflurazon	Zorial, Solicam, Evital	Syngenta Syngenta
O		
oryzalin	Surflan	Dow AgroSciences
oxadiazon	Ronstar	Bayer Crop Science
oxadiazon + prodiamine	Regalstar	Regal Chemical Company
oxasulfuron	Expert	Syngenta
oxyfluorfen	Goal	Dow
oxyfluorfen + oryzalin	Rout	The Scotts Company
oxyfluorfen + oxadiazon	Regal	Regal Chemical Company
oxyfluorfen + pendimethalin	Ornamental Herbicide II	The Scotts Company
P		
paraquat	Gramoxone Max, Gramoxone Extra, Starfire, Cyclone	Syngenta
pelargonic acid	Scythe	Mycogen
pendimethalin	Prowl, Prowl H2O Pendulum Pentagon Lesco PRE-M Corral	BASF BASF BASF Lesco The Scotts Company
picloram	Tordon	Dow
picloram + 2,4-D	Grazon P+D	Dow
primisulfuron	Beacon	Syngenta
primisulforon + dicamba	NorthStar	Syngenta
prodiamine	Barricade, Factor	Syngenta
prohexadione	Apogee	BASF
prometryn	Caparol Cotton Pro	Syngenta Griffin
propanil	Stam, Stampede	Dow
prosulfuron	Peak	Syngenta
prosulfuron + primisulfuron	Exceed Spirit	Syngenta Syngenta

pyridate	Tough	Syngenta
pyrithiobac	Staple	DuPont
pyrithiobac + glyphosate	Staple Plus	DuPont
Q		
quinclorac	Facet, Drive Paramount	BASF BASF
quizalofop	Assure II	DuPont
R		
rimsulfuron	Titus, Matrix	DuPont
rimsulfuron + thifensulfuron	Basis	DuPont
S		
sethoxydim	Poast, Poast Plus, Vantage	BASF
simazine	Princep	Syngenta
sulfentrazone	Authority, Spartan	FMC
sulfentrazone + clomazone	Authority One-Pass	FMC
sulfometuron	Oust	DuPont
sulfosulfuron	Monitor, Maverick, Outrider	Monsanto
T-Z		
tebuthiuron	Spike	Dow
terbacil	Sinbar	DuPont
thiafluamide +		

70

metribuzin	Axiom	Bayer
thiazopyr	Dimension Spindle, Visor	Dow
thifensulfuron	Harmony GT	DuPont
thifensulfuron + tribenuron	Harmony Extra	DuPont
triasulfuron	Amber	Syngenta
triasulfuron + dicamba	Rave	Syngenta
tribenuron	Express	DuPont
triclopyr	Garlon Grandstand	Dow
triclopyr +clopyralid	Redeem R&P	Dow
trifloxysulfuron	Envoke	Syngenta
trifluralin	Treflan Trifluralin	Dow Dow /
trinexapac-ethyl	Primo Palisade	Syngenta

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