Proceedings of the Southern Weed Science Society 70th Annual Meeting

Hyatt Regency- The Wynfrey Hotel
Birmingham, AL

January 23 – 26, 2017

Dedication Statement

Dr. Dennis Elmore was born April 3, 1940 in Clay County Mississippi to Clarence and Nadine (Berry) Elmore. Dennis graduated in 1958 from Cumberland High School in Webster County Mississippi. He continued his education at Mississippi State University earning his B.S. degree in 1962. After graduation, he served in the United States Army as a Lieutenant at Fort Polk, LA. After his discharge from the Army, Dennis continued his education and received a M.S. degree from the University of Arizona in 1966 and a Ph.D. from the University of Illinois Urbana-Champaign in 1970.

After completion of his Ph.D., Dennis moved to Leland, Mississippi where he began a 32-year career as a Plant Physiologist at the Jamie Whitten Delta States Research Center (USDA-ARS). Dr. Elmore's primary research focused on plant physiology, genetics, and weed and herbicide applications. His research culminated in several published books and field study guides on morningglories and other weeds. Dennis recognized the need for a comprehensive, high quality identification guide for weeds that occur in the southern states that could be used by anyone involved with crop production. His vision, commitment and dedication culminated in the publication of the Southern Weed Science Society's Weed Identification Guide. As editor of the SWSS Weed Identification Guide, he devoted countless hours growing seedling weeds in the greenhouse, assisting with photography, selecting the best images to print, creating distribution maps, writing taxonomic descriptions which contained unique features to help ensure accurate identification, and proofing camera-ready copies. This effort resulted in the development of a guide that contained high quality images and descriptions of 350 weeds. His effort toward this project was recognized by him receiving the highest honor bestowed by the SWSS, the Distinguished Service Award in 1993. Dennis' vision and tireless contribution to educate individuals on weed identification generated revenue for the SWSS, much of which was transferred into the Endowment Foundation. Interest from those funds continues to provide educational opportunities for graduate students in the Southern Weed Science Society today. Dennis retired from the USDA in 2003, and after his retirement was able to continue his love of learning and teaching by teaching botany and biology as an adjunct faculty at Mississippi Delta Community College at Moorhead and their satellite campus in Greenville from 2005 until his death.

Along with teaching, Dennis's passions were centered around family, friends, and church. He was a longtime member of Leland Presbyterian Church where he held many leadership and volunteer positions during his over 40-year membership, including leading his Sunday school class, the Good News. Besides tirelessly following his three children everywhere and supporting all of their pursuits plus his devotion to the Church, Dennis enjoyed researching his family genealogy, sharing his love of plants and especially flowers, and also spending time and effort helping his community.

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ORAL PRESENTATION ABSTRACTS:

SYMPOSIUM ABSTRACTS

Preface

The PROCEEDINGS of the 70th Southern Weed Science Society Annual Meeting held at the Hyatt Regency-The Wynfrey Hotel, Birmingham, AL (Jan 23-26, 2017) contain abstracts of presentations made at the meeting. Other information presented in this PROCEEDINGS include: biographical data of recipients of the SWSS Outstanding Educator Award, Outstanding Young Weed Scientist-Academia, Outstanding Young Weed Scientist-Industry, and Outstanding Graduate Student Awards; lists of officers and committee chairpersons; minutes of business meetings; abstracts of posters and oral papers; list of herbicide-resistant weeds in the southern region; list of registrants attending the annual meeting; and list of sustaining members.

This PROCEEDINGS only includes papers that were presented at the annual meeting and submitted to the Editor in the prescribed format for printing. Abstracts are limited to one page. Authors were required to submit an original abstract according to the instructions available in the Call for Papers and on the SWSS website (www.swss.ws). The use of commercial names in the PROCEEDINGS neither constitutes an endorsement, nor does the non-use of similar products constitute a criticism by the Southern Weed Science Society.

This document is available as a PDF at the SWSS web site (www.swss.ws).

Muthu Bagavathiannan
2017 Proceedings Editor
Southern Weed Science Society

Regulations and Instructions for Papers and Abstracts

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 website 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 the 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 nontreated check where 0 equals no weed control or crop injury and 100 equals complete weed control or crop death.

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 website (http://www.swss.ws/) at the time of title or abstract/paper submission.

Word templates will be available on the web to help ensure that proper format is followed. It is important that submission deadlines and instructions are carefully adhered to, as the abstracts are not edited for content.

Typing Instructions-Format

1. Margins, spacing, etc.: Use 8-1/2 x 11" paper. **Leave 1" margins on all sides.** Use 10 point type with a ragged right margin, **do not justify and do not use hard carriage returns** in the body of the text. Single space with double space between paragraphs and major divisions. **Do not indent paragraphs.**

2. Content:

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

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

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 lefthand 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: Competiiton and control of smellmelon (*Cucumis melo* var. *dudaim* Naud.) in cotton

C.H. Tingle, G.L. Steele and J.M. Chandler; Department of Soil and Crop Sciences, Texas A&M University, College Station, TX 77843.

ABSTRACT

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

Acknowledgements - 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.

Outstanding Young Weed Scientist- Academia

Wes Everman

Dr. Wesley Everman (Purdue ’00, ’02; NC State ’08) is currently an Assistant Professor and Extension Weed Specialist at the North Carolina State University. He has authored or co-authored 45 published manuscripts, 291 abstracts at professional meetings, 29 invited presentations, and 66 extension publications.

One of the greatest contributions Dr. Everman has made so far is from the North Carolina Feed Grains Initiative. As project director, Dr. Everman coordinated a team that conducted research and extension activities to increase feed grain production in North Carolina. This project nearly doubled feed grain production, reduced expenses, and increased farm revenue. Industry estimates of $333,000,000 in increased revenue to the state as well as $95,000,000 in reduced operating expenses to Murphy Brown farms have been calculated for this project. In addition, Dr. Everman has been PI or co-PI on over $8,000,000 in awarded grant funding, with $6,000,000 of that awarded since January 2014.

In addition to the contributions above, Dr. Everman has directed 6 completed or ongoing Ph.D. projects and 10 M.S. projects. He also has received outstanding classroom teaching evaluations and has a very active extension program to deliver his research results to growers.

Outstanding Young Weed Scientist- Industry

Hunter Perry

Hunter earned his B.S. and M.S from Mississippi State University in Golf and Sports Turf Management and Plant Pathology in 2005 and 2007, respectively. He earned his Ph.D in Weed Science from Auburn University in 2011, before joining Dow AgroSciences. Hunter is currently the Field Station Manager at Dow AgroSciences' Southern Research Center near Greenville, MS. His primary responsibilities include not only field station operations and personnel management, but research responsibilities including early-stage product and trait characterization and product concept investigation. In his previous role, Hunter served as the weed scientist and plant pathologist for the Southern Research Center.

Since joining the SWSS, Hunter has served as Chair and Vice Chair of the graduate student paper and poster contests multiple times. He was elected as an Endowment Trustee in 2015 where he works alongside others to ensure the Endowment accomplishes educational objectives. Hunter has been instrumental in raising money for the Endowment by organizing the SWSS Annual Golf Tournament from 2014-2017 which raised more than $30,000 to benefit the Endowment. Hunter regularly moderates paper sessions, volunteers for the annual weed contest and serves on several committees. He has published in plant pathology and weed science peer-reviewed journals and remains an active reviewer. Hunter is married to Audra Perry and they reside in Leland, MS.

Previous Winners of the Outstanding Young Weed Scientist Award

Year	Name	University / Company
1980	John R. Abernathy	Texas A & M University
1981	Harold D. Coble	North Carolina State
1982	Lawrence R. Oliver	University of Arkansas
1983	Ford L. Baldwin	University of Arkansas
1984	Don S. Murray	Oklahoma State University
1985	William W. Witt	University of Kentucky
1986	Philip A. Banks	University of Georgia
1987	Kriton K. Hatzios	VPI & SU
1988	Joe E. Street	Mississippi State University
1989	C. Michael French	University of Georgia
1990	Ted Whitwell	Clemson University
1991	Alan C. York	North Carolina State
1992	E. Scott Hagood, Jr.	VPI & SU
1993	James L. Griffin	Louisiana State University
1994	David R. Shaw	Mississippi State University
1995	John C. Wilcut	North Carolina State
1996	David C. Bridges	University of Georgia
1997	L.B. McCarty	Clemson University
1998	Thomas C. Mueller	University of Tennessee
1999	Daniel B. Reynolds	Mississippi State University
2000	Fred Yelverton	North Carolina State
2001	John D. Byrd, Jr.	Mississippi State University
2002	Peter A. Dotray	Texas Tech. University
2003	Scott A. Senseman	Texas A & M University
2004	David L. Jordan	North Carolina State
2004	James C. Holloway	Syngenta
2005	Eric Prostko	University of Georgia
2005	no nomination	
2006	Todd A. Baughman	Texas A & M University
2006	John V. Altom	Valent USA Corporation
2007	Clifford "Trey" Koger	Mississippi State University
2007	no nomination	
2008	Stanley Culpepper	University of Georgia
2008	no nomination	
2009	Jason K. Norsworthy	University of Arkansas
2009	no nomination	
2010	Bob Scott	University of Arkansas
2010	no nomination	

2011	J. Scott McElroy	Auburn University
2011	Eric Palmer	Syngenta Crop Protection
2012	Jason Bond	Mississippi State University
2012	Cody Gray	United Phosphorus Inc.
2013	Greg Armel	BASF Company
2013	Shawn Askew	Virginia Tech
2014	Jason Ferrell	University of Florida
2014	Vinod Shivrain	Syngenta
2015	Jim Brosnan	University of Tennessee
2015	no nomination	
2016	Daniel Stephenson, IV	LSU-Ag Center
2016	Drew Ellis	Dow AgroSciences

Outstanding Educator Award

Jason Norsworthy

Jason Norsworthy grew up on a vegetable farm in southern Arkansas, where he quickly learned the need for weed management in crops. He completed his B.S. in Plant Sciences – Agronomy from Louisiana Tech University in 1995 and then his M.S. in Plant Sciences – Weed Science at the University of Arkansas in 1997. After completing his Ph.D. in Plant Sciences – Weed Science in 2000 from the University of Arkansas, he spent six years on the faculty at Clemson University. He returned to the University of Arkansas in 2006 and currently holds the academic rank of Professor with tenure in the Crop, Soil, and Environmental Sciences Department, and he holds the University of Arkansas' endowed Chair of Weed Science. He teaches Principles of Weed Control and team teaches Integrated Pest Management, Advanced Crop Science, and Weed Science Practicum. He has directed 9 M.S. degrees, 4 Ph.D. degrees, 6 Postdoctoral Associates, and has served on several graduate student committees. Dr. Norsworthy is currently advising 12 M.S. students, 3 Ph.D. students, and 4 Postdoctoral Associates. Jason has authored or co-authored over 180 refereed journal publications and over 600 abstracts. He spends much of his time conducting research centered on developing strategies to manage herbicide-resistant weeds and reduce the risk of herbicide resistance. Dr. Norsworthy has documented eight new herbicide-resistant weeds in Arkansas. Dr. Norsworthy frequently travels across the U.S. speaking on the resistance issues confronted by growers throughout the South and elaborates on the strategies that can be used to reduce the risk of herbicide-resistant weeds evolving. Dr. Norsworthy has led an international team of scientists in preparing a position paper for the Weed Science Society of America outlining best management practices to mitigate the evolution of herbicide resistance. Jason was awarded the Southern Weed Science Societies= Outstanding Young Weed Scientist award in 2009, and he received the Early Career Weed Scientist award from the Weed Science Society of America in 2010. In 2011, the University of Arkansas awarded Dr. Norsworthy and three other weed scientists the John White Team Award for their efforts in education and promotion of herbicide resistance issues relevant to the midsouthern U.S. The Arkansas Association of Cooperative Extension Specialists recognized Dr. Norsworthy as Researcher of the Year in 2011 and he was presented the Outstanding Researcher Award by the Arkansas Chapter of Gamma Sigma Delta in 2015. Dr. Norsworthy provided a keynote address at the International Herbicide Resistance Challenge Conference and the subsequent Australian Weed Congress that met in Perth, Australia in February 2013. Dr. Norsworthy presently serves as Editor-in-Chief for *Weed Technology*.

Previous Winners of the Outstanding Educator Award

Year	Name	University
1998	David R. Shaw	Mississippi State University
1999	Ronald E. Talbert	University of Arkansas
2000	Lawrence R. Oliver	University of Arkansas
2001	James L. Griffin	Louisiana State University
2002	Thomas F. Peeper	Oklahoma State University
2003	Daniel B. Reynolds	Mississippi State University
2004	William Vencill	University of Georgia
2005	John W. Wilcut	North Carolina State
2006	Don S. Murray	Oklahoma State University
2007	Thomas C. Mueller	University of Tennessee
2008	James M. Chandler	Texas A&M University
2009	William W. Witt	University of Kentucky
2010	Peter Dotray	Texas Tech. University
2011	Eric Prostko	University of Georgia
	Gregory Mac Donald	University of Florida
	Tim Grey	University of Georgia
2014	Scott Senseman	University of Tennessee
2015	Nilda Roma-Burgos	University of Arkansas
2016	Katie Jennings	North Carolina State

Outstanding Graduate Student Award (MS)

John Buol

John Buol graduated from the University of Wisconsin-Madison with a B.S. in Biochemistry in December 2014. As an undergraduate, John conducted research on RNAi inheritance in nematodes and authored an article in a Wisconsin research series characterizing the spread of glyphosate-resistant horseweed. His Master's thesis under the direction of Dr. Dan Reynolds at Mississippi State University evaluates the effect of cotton growth stage on susceptibility to injury and yield effects from sub-lethal concentrations of 2,4-D and dicamba. During his time as a Master's student, John serves as teaching assistant for Dr. Reynold's Herbicide Technology course, and was a member of the 3rd place team at the 2016 SWSS Weed Contest. John's achievements have been recognized with awards such as the Will Carpenter Distinguished Field Scientist Monsanto Fellowship, induction into the Gamma Sigma Delta National Agriculture Honors Society, and the 2016 Future Leaders in Science Award at the Congressional Visits Days in Washington, D.C., where he met with Congressional leaders to advocate for the importance of agricultural research funding. John placed 2nd in both the oral and poster contests at the 2016 SWSS Annual Meeting, has placed first in local competitions including the MSU Future of Ag Competition, the MSU Graduate Student Research Symposium, and the MSU Three-Minute Thesis Competition; and has received awards for various other presentations. John has presented several MSU Extension talks and has authored 10 abstracts for professional meetings. He will continue working under the direction of Dr. Dan Reynolds at Mississippi State University, where his PhD research will investigate probabilistic models for gene flow in weed populations.

Previous Winners of the Outstanding Graduate Student Award (MS)

Year	Name	University
1998	Shawn Askew	Mississippi State University
1999	Patrick A Clay	Louisiana State University
2000	Wendy A. Pline	University of Kentucky
2001	George H. Scott	North Carolina State University
2002	Scott B. Clewis	North Carolina State University
2003	Shawn C. Troxler	North Carolina State University
2004	Walter E. Thomas	North Carolina State University
2005	Whitney Barker	North Carolina State University
2006	Christopher L. Main	University of Florida
2007	no nomination	
2008	no nomination	
2009	Ryan Pekarek	North Carolina State University
2010	Robin Bond	Mississippi State University
2011	George S. (Trey) Cutts, III	University of Georgia
2012	Josh Wilson	University of Arkansas
2013	Bob Cross	Clemson University
2014	Brent Johnson	University of Arkansas
2015	Garret Montgomery	University of Tennessee
2016	Chris Meyer	University of Arkansas

Outstanding Graduate Student Award (PhD)

Misha Manuchehri

Dr. Misha Manuchehri joined the faculty of Oklahoma State University in July 2016 as the new Wheat Extension Weed Specialist. She is in the Department of Plant and Soil Sciences. Dr. Manuchehri recently completed her Ph.D. at Texas Tech University with Dr. Peter Dotray. Her responsibilities in Oklahoma are split, with the majority of her assignment being a Wheat Extension Specialist. She also works with canola as a rotational crop and teaches the junior level weed science course. Misha is a native of Washington State where she earned her B.S. and M.S. degrees with Dr. Ian Burke.

Previous Winners of the Outstanding Graduate Student Award (PhD)

Year	Name	University
1998	Nilda Roma Burgos	University of Arkansas
1999	A. Stanley Culpepper	North Carolina State University
2000	Jason K. Norsworthy	University of Arkansas
2001	Matthew J. Fagerness	North Carolina State University
2002	William A. Bailey	North Carolina State University
2003	Shea W. Murdock	Oklahoma State University
2004	Eric Scherder	University of Arkansas
2005	Ian Burke	North Carolina State University
2006	Marcos J. Oliveria	Clemson University
2007	Wesley Everman	North Carolina State University
2008	Darrin Dodds	Mississippi State University
2009	Sarah Lancaster	Texas A & M University
2010	Tom Eubank	Mississippi State University
2011	Sanjeev Bangarwa	University of Arkansas
2012	Edinalvo (Edge) Camargo	Texas A&M University
2013	Kelly Barnett	University of Tennessee
2014	James McCurdy	Auburn University
2015	Sushila Chaudhari	North Carolina State University
2016	Reiofeli Algodon Salas	University of Arkansas

Fellow Award

James Holloway

James grew up in the Mississippi Delta and was involved in some aspect of agriculture all of his life. James received his BS in Weed Science from Mississippi State University in 1989, his Master's Degree in Weed Science under Dr. Wayne Cole in 1992 and his Ph.D. under the direction of Dr. David Shaw in 1995. James received an offer to work for Ciba Crop Protection at their Winterville, MS farm and started work with them on April 3rd, 1995. In 1997, following a merger with Sandoz, Novartis was born and James worked with them, as Station weed scientist, Field Rep for MS and LA, as well as interim station manager, until the merger with Zeneca, at which time Syngenta Crop Protection was born. James worked in MS as a field rep for Syngenta until December 2003, at which time he was moved to Jackson, TN to take on the responsibility of Field Rep for TN and the Boot Heel of MO. James was promoted to Senior Field Biology Expert in 2016 and continues to work the same geography. James has been a member of the Southern Weed Science Society since 1989. James has served the Society as a graduate student contest judge, has hosted the Southern Weed Contest in 1999, and assisted with multiple other contests. James currently serves as the President of Endowment committee and he is also a member of the Weed Science Society of America and TAPA as well as being a previous member and board member of the Mississippi Weed Science Society.

Previous Winners of the Distinguished Service Award

(Renamed Fellow Award in 2015)

Year	Name	University/Company
1976	Don E. Davis	Auburn University
1976	V. Shorty Searcy	Ciba-Geigy
1977	Allen F. Wiese	Texas Agric. Expt. Station
1977	Russel F. Richards	Ciba-Geigy
1978	Robert E. Frans	University of Arkansas
1978	George H. Sistrunck	Valley Chemical Company
1979	Ellis W. Hauser	USDA, ARS Georgia
1979	John E. Gallagher	Union Carbide
1980	Gale A. Buchanan	Auburn University
1980	W. G. Westmoreland	Ciba-Geigy
1981	Paul W. Santelmann	Oklahoma State University
1981	Turney Hernandez	E.I. DuPont
1982	Morris G. Merkle	Texas A & M University
1982	Cleston G. Parris	Tennessee Farmers COOP
1983	A Doug Worsham	North Carolina State University
1983	Charles E. Moore	Elanco
1984	John B. Baker	Louisiana State University
1984	Homer LeBaron	Ciba-Geigy
1985	James F. Miller	University of Georgia
1985	Arlyn W. Evans	E.I. DuPont
1986	Chester G. McWhorter	USDA, ARS Stoneville
1986	Bryan Truelove	Auburn University
1987	W. Sheron McIntire	Uniroyal Chemical Company
1987	no nomination	
1988	Howard A.L. Greer	Oklahoma State University

1988	Raymond B. Cooper	Elanco
1989	Gene D. Wills	Mississippi State University
1989	Claude W. Derting	Monsanto
1990	Ronald E. Talbert	University of Arkansas
1990	Thomas R. Dill	Ciba-Geigy
1991	Jerome B. Weber	North Carolina State University
1991	Larry B. Gillham	E.I. DuPont
1992	R. Larry Rogers	Louisiana State University
1992	Henry A. Collins	Ciba-Geigy
1993	C. Dennis Elmore	USDA, ARS Stoneville
1993	James R. Bone	Griffin Corporation
1994	Lawrence R. Oliver	University of Arkansas
1994	no nomination	--
1995	James M. Chandler	Texas A & M University
1995	James L. Barrentine	DowElanco
1996	Roy J. Smith, Jr.	USDA, ARS Stuttgart
1996	David J. Prochaska	R & D Sprayers
1997	Harold D. Coble	North Carolina State University
1997	Aithel McMahon	McMahon Bioconsulting, Inc.
1998	Stephen O. Duke	USDA, ARS Stoneville
1998	Phillip A. Banks	Marathon-Agri/Consulting
1999	Thomas J. Monaco	North Carolina State University
1999	Laura L. Whatley	American Cyanamid Company
2000	William W. Witt	University of Kentucky
2000	Tom N. Hunt	American Cyanamid Company
2001	Robert M. Hayes	University of Tennessee
2001	Randall L. Ratliff	Syngenta Crop Protection
2002	Alan C. York	North Carolina State University

2002	Bobby Watkins	BASF Corporation
2003	James L. Griffin	Louisiana State University
2003	Susan K. Rick	E.I. DuPont
2004	Don S. Murray	Oklahoma State University
2004	Michael S. DeFelice	Pioneer Hi-Bred
2005	Joe E. Street	Mississippi State University
2005	Harold Ray Smith	Biological Research Service
2006	Charles T. Bryson	USDA, ARS, Stoneville
2006	no nomination	--
2007	Barry J. Brecke	University of Florida
2007	David Black	Syngenta Crop Protection
2008	Thomas C. Mueller	University of Tennessee
2008	Gregory Stapleton	BASF Corporation
2009	Tim R. Murphy	University of Georgia
2009	Bradford W. Minton	Syngenta Crop Protection
2010	no nomination	--
2010	Jacquelyn "Jackie" Driver	Syngenta Crop Protection
2011	no nomination	--
2011	no nomination	--
2012	Robert Nichols	Cotton Incorporated
2012	David Shaw	Mississippi State University
2013	Renee Keese	BASF Company
2013	Donn Shilling	University of Georgia
2014	Tom Holt	BASF Company
2014	Dan Reynolds	Mississippi State Univ.
2015	Bobby Walls	FMC Corporation
2015	John Harden	BASF Corporation
2016	No award	

Previous Winners of the Weed Scientist of the Year Award

(Renamed Fellow Award in 2015)

Year	Name	University
1984	Chester L. Foy	VPI & SU
1985	Jerome B. Weber	North Carolina State University
1986	no nominations	--
1987	Robert E. Frans	University of Arkansas
1988	Donald E. Moreland	USDA, ARS, North Carolina
1989	Roy J. Smith, Jr.	USDA, ARS, North Arkansas
1990	Chester McWhorter	USDA, ARS, Mississippi
1991	Ronald E. Talbert	University of Arkansas
1992	Thomas J. Monaco	North Carolina State University
1993	A. Douglas Worsham	North Carolina State University
1994	Stephen O. Duke	USDA, ARS, Mississippi
1995	Lawrence R. Oliver	University of Arkansas
1996	William L. Barrentine	Mississippi State University
1997	Kriton K. Hatzios	VPI & SU
1998	G. Euel Coats	Mississippi State University
1998	Robert E. Hoagland	USDA, ARS, Mississippi
1999	James H. Miller	U.S. Forest Service
2000	David R. Shaw	Mississippi State University
2001	Harold D. Coble	North Carolina State University
2002	no nominations	--
2003	John W. Wilcut	North Carolina State University
2004	Gene D. Wills	Mississippi State University
2005	R. M. Hayes	University of Tennessee

2006	James L. Griffin	Louisiana State University
2007	Alan C. York	North Carolina State University
2008	Wayne Keeling	Texas A&M University
2009	W. Carroll Johnson, III	USDA, ARS, Tifton
2010	Don S. Murray	Oklahoma State University
2011	Krishna Reddy	USDA, ARS, Mississippi
2012	Daniel Reynolds	Mississippi State University
2013	Barry Brecke	University of Florida
2014	no nominations	-

Excellence in Regulatory Stewardship Award

A. Stanley Culpepper

Stanley Culpepper is a Professor in the Crop and Soil Science Department at The University of Georgia. A native of North Carolina, he grew up on a bicentennial family farm producing cotton, peanut, soybean, and wheat. He received his BS in Agronomy from N. C. State University. His MS and PhD were also obtained at N. C. State in weed science under the direction of Dr. Alan York. Stanley began his professional career at The University of Georgia as a cotton, vegetable, and small grain weed scientist in 1999, and continues with those same responsibilities today. Stanley's ultimate goal is to assist family farms with long-term sustainability by helping growers make wise production decisions using information generated from unbiased research.

Because of Stanley's efforts, he has been an invited speaker at 261 functions across 24 states and several countries. In Georgia, he has presented timely information to growers at 546 county meetings and 115 field days while also training extension agents during 103 in-service meetings. He has authored or co-authored 92 refereed journal articles, 4 book chapters, 353 abstracts for presentations at professional meetings, 211 extension publications and 171 newsletters/blogs. Additionally, Stanley has authored 16 successful Section 18 packages and critical use nomination packages as well as co-authoring 33 Section 24(c) state herbicide labels bringing new weed management tools to Georgia growers. His greatest award accomplishments were winning the EPA's Montreal Protocol International Award for assisting in the preservation of the ozone layer and receiving the Southern Region Excellence in Extension Award provided by the Extension Committee on Organization and Policy and the USDA National Institute of Food and Agriculture. Stanley's greatest professional honor was being invited to serve as a member of the Agricultural Science Committee of the U.S. Environmental Protection Agency's Science Advisory Board.

Past Presidents of the Southern Weed Science Society

1948-49 C.A. Brown
1949-50 E.C. Tullis
1950-51 O.E. Sell
1951-52 G.M. Shear
1952-53 D.A. Hinkle
1953-54 W.B. Ennis, Jr.
1954-55 W.C. Shaw
1955-56 G.C. Klingman
1956-57 W.B. Albert
1957-58 E.G. Rogers
1958-59 R. Behrens
1959-60 V.S. Searcy
1960-61 R.A. Darrow
1961-62 W.K. Porter, Jr.
1962-63 J.T. Holstun, Jr.
1963-64 R.F. Richards
1964-65 R.E. Frans
1965-66 D.E. Wolf
1966-67 D.E. Davis
1967-68 R.A. Mann
1968-69 W.L. Lett, Jr.
1969-70 J.B. Baker
1970-71 D.D. Boatright
1971-72 J.R. Orsenigo
1972-73 T.J. Hernandez
1973-74 A.F. Wiese
1974-75 W.G. Westmoreland
1975-76 P.W. Santlemann
1976-77 A.J. Becon
1977-78 G.A. Buchanan
1978-79 C.G. Parris
1979-80 M.G. Merkle
1981-82 J.B. Weber
1982-83 J.E. Gallagher
1983-84 C.G. McWhorter
1984-85 W.S. McIntire
1985-86 R.E. Talbert
1986-87 H.M. LeBaron
1987-88 R.L. Rogers
1988-89 L.B. Gillham
1989-90 L.R. Oliver
1990-91 J.R. Bone
1991-92 J.M. Chandler
1992-93 J.L. Barrentine
1993-94 A.D. Worsham
1994-95 P.A. Banks
1995-96 S.O. Duke
1996-97 B.D. Sims
1997-98 R.M. Hayes
1998-99 R.L. Ratliff
1999-00 D.S. Murray
2000-01 L.L. Whatley
2001-02 J.E. Street
2002-03 J.W. Wells
2003-04 W.W. Witt
2004-05 J.S. Harden
2005-06 D.R. Shaw
2006-07 J.A. Driver
2007-08 D.W. Monks
2008-09 A.M. Thurston
2009-10 D.B. Reynolds
2010-11 T.J. Holt
2011-12 B.J. Brecke
2012-13 T.C. Mueller
2014-15 S.A. Senseman
2015-16 B. Minton
2016-17 P. Dotray

Dedication of the Proceedings of the SWSS

Year	Name	University or Company
1973	William L. Lett, Jr.	Colloidal Products Corporation
1975	Hoyt A. Nation	Dow Chemical Company
1978	John T. Holstun, Jr.	USDA, ARS
1988	V. Shorty Searcy	Ciba-Geigy
1995	Arlen W. Evans	DuPont
1997	Michael & Karen DeFelice	Information Design
1999	Glenn C. Klingman	Eli Lilly and Company
1999	Allen F. Wiese	Texas A&M University
2004	Chester G. McWhorter	USDA-ARS
2004	Charles E. Moore	Lilly Research Laboratories
2008	John Wilcut	North Carolina State University
2008	Larry Nelson	Clemson University
2012	Jacquelin Edwards Driver	Syngenta Crop Protection
2015	Paul Santelmann	Oklahoma State University
2016	Tedd Webster	USDA-ARS
2017	Dennis Elmore	USDA-ARS

List of SWSS Committee Members

January 31, 2016 - January 31, 2017

Note: Duties of each Committee are detailed in the Manual of Operating Procedures, which is posted on the SWSS web site at http://www.swss.ws

100. SOUTHERN WEED SCIENCE SOCIETY OFFICERS AND EXECUTIVE BOARD

100a. OFFICERS

President	Gary Schwarzlose	2018
President Elect	Bob Scott	2019
Vice-President	James Holloway	2020
Secretary-Treasurer	Jim Brosnan	2020
Editor	Muthu Bagavathiannan	2020
Immediate Past President	Peter Dotray	2018

100b. ADDITIONAL EXECUTIVE BOARD MEMBERS

Member-at-Large - Academia	Angela Post	2018
Member-at-Large - Academia	Jason Bond	2019
Member-at-Large- Industry	Matt Goddard	2018
Member-at-Large - Industry	Greg Stapleton	2019
Representative to WSSA	John Byrd	2019

100c. EX-OFFICIO BOARD MEMBERS

Constitution and Operating Procedures	Carroll Johnson	2019
SWSS Business Manager	Tara Steinke	
Student Representative	John Brewer	2018
Web Master	David Kruger	
Newsletter Editor	Bob Scott	

101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

President	Brent Sellers	2018
Secretary	Darrin Dodds	2019

	Donnie Miller	2020
	Hunter Perry	2021
	Gary Schwarzlose	2022
Graduate Student Rep	Zachary Lancaster	2018

101b. BOARD OF TRUSTEES - EX-OFFICIO

James Holloway	Past President of Endowment Foundation Board of Trustees
Tara Steinke	SWSS Business Manager

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

Peter Dotray*	2018	Robert Nichols	2018	Tim Grey	2018
Bob Hayes	2018	Wayne Keeling	2018	David Shaw	2019

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

102a. SWSS Fellow Award Subcommittee

John Byrd	2018	Doug Worsham	2019	Barry Brecke	2020
Robert Nichols *	2018	Ken Smith	2019	Renee Keese	2020

102b. Outstanding Educator Award Subcommittee

Tim Grey *	2018	Jim Brosnan	2019	Jason Norsworthy	2020
Greg MacDonald	2018	Charlie Cahoon	2019	Tom Mueller	2020

102c. Outstanding Young Weed Scientist Award Subcommittee

Eric Prostko	2018	Jay Ferrell	2019	Drew Ellis	2020
Bob Hayes *	2018	Todd Baughman	2019	Daniel Stephenson	2020

102d. Outstanding Graduate Student Award Subcommittee

Wayne Keeling *	2018	Matt Goddard	2019	Stanley Culpepper	2020
David Jordan	2018	Joyce Tredaway	2019	Jay McCurdy	2020

102e. Excellence in Regulatory Stewardship Award Subcommittee

David Shaw *	2019	J. D. Green	2020	David Jordan	2021
Matt Goddard	2019	Larry Walton	2020		

103. COMPUTER APPLICATION COMMITTEE (STANDING)

Shawn Askew *	2020
Dan Reynolds *	2020

104. CONSTITUTION AND OPERATING PROCEDURES COMMITTEE (STANDING)

W. Carroll Johnson *	2019

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

James Holloway *	2019
Bob Scott	2018
Jim Brosnan	2020
John Richburg	2018
Muthu Bagavathiannan	2020
Tara Steinke – SWSS Business Manager	
Phil Banks	2020

106. GRADUATE STUDENT ORGANIZATION

President	John Brewer	Virginia Tech
Vice President	Zachary Lancaster	Arkansas
Secretary	John Buol	MS. State
Weed Resistance & Technology Committee Rep	Savana Davis	MS. State
Student Program Committee Rep.	Brad Wilson	MS. State

Endowment Committee Rep.	Zachary Lancaster	Arkansas

107. WEED RESISTANCE AND TECHNOLOGY STEWARDSHIP (STANDING)

Alabama	J. Tredaway		North Carolina	D. Spak
Arkansas	N. French J. Norsworthy		Oklahoma	T. Baughman
Florida			South Carolina	
Georgia	E. Prostko C. Johnson		Tennessee	J. Holloway L. Steckel A. Mills
Kentucky			Texas	P. Dotray
Louisiana	D. Stephenson		Virginia	
Mississippi	H. Perry ** F. Carey * J. Bond		Commonwealth of Puerto Rico	
Missouri	M. Horak A. Kendig		Student Representative	Savana Davis

108. HISTORICAL COMMITTEE (STANDING)

John Byrd *	2018
Andy Kendig	2019

109. LEGISLATIVE AND REGULATORY COMMITTEE (STANDING)

Angela Post *	Chair & Member-at-Large - Academia	2020
Lee Van Wychen	(ad hoc) WSSA Science Policy Director	2018
Donn Shilling	(ad hoc) Chair of the WSSA Science Policy Committee	2018
Mike Barrett	(ad hoc), EPA liaison	2018
Jason Bond	Member-at-Large - Academia	2019
Matt Goddard	Member-at-Large - Industry	2018
Greg Stapleton	Member-at-Large - Industry	2019
Peter Dotray	Past President	2018

110. LOCAL ARRANGEMENTS COMMITTEE - (STANDING)

Henry McLean *	2018	Atlanta (SE)
Todd Baughman	2019	Oklahoma City (SW)

111. LONG-RANGE PLANNING COMMITTEE (STANDING) –
Shall consist of the Past-Past President (chair), Past-President, President, and President-Elect.

Brad Minton *	2018
Peter Dotray	2019
Gary Schwarzlose	2020
Bob Scott	2021

112. MEETING SITE SELECTION COMMITTEE (STANDING) - Shall consist of six members and the SWSS Business Manager. The members will be appointed by the President on a rotating basis with one member appointed each year and members shall serve six-year terms. The Chairmanship will rotate to the senior committee member from the geographical area where the meeting will be held.

Tim Grey (SE) *	2018	Eric Webster (SW)	2019	James Holloway (MS)	2020
Angela Post (SE)	2021	Luke Etheredge (SW)	2022	Andrew Price (MS)	2023
Tara Steinke – SWSS Business Manager					

113. NOMINATING COMMITTEE (STANDING) - Shall be composed of the Past President as Chair.

Peter Dotray *	2018

114. PROGRAM COMMITTEE - 2018 MEETING (STANDING)

Bob Scott *	2018

115. PROGRAM COMMITTEE - 2019 MEETING (STANDING)

James Holloway *	2019

116. RESEARCH COMMITTEE (STANDING)

James Holloway *	2018			
Alabama	J. Tredaway		North Carolina	W. Everman
Arkansas	N. Burgos		Oklahoma	T. Baughman

Florida			South Carolina	M. Marshall
Georgia	E. Prostko		Tennessee	L. Steckel
Kentucky			Texas	P. Dotray
Louisiana	D. Miller		Virginia	S. Askew
Mississippi	J. Byrd		Commonwealth of Puerto Rico	
Missouri	K. Bradley			

117. RESOLUTIONS AND NECROLOGY COMMITTEE (STANDING)

David Black *	2018	Michael Flessner	2019	Ryan Edwards	2020

118. SOUTHERN WEED CONTEST COMMITTEE (STANDING) open to all SWSS members

Mississippi	D. Dodd **		North Carolina	W. Everman
Alabama	J. Tredaway		Missouri	
Arkansas	N. Burgos		Oklahoma	T. Baughman
Florida	G. MacDonald		South Carolina	
Georgia	W. Vencill		Tennessee	T. Mueller D. Ellis *
Kentucky			Texas	P. Dotray
Louisiana	E. Webster		Virginia	S. Askew
Mississippi	D. Reynolds		Commonwealth of Puerto Rico	

119. STUDENT PROGRAM COMMITTEE (STANDING)

Darrin Dodds *	2018	
Brad Wilson	2018	Graduate Student Organization Rep. – Ex-officio member
Charlie Cahoon	2019	

120. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

John Richburg *	2018	Larry Steckel	2018	Peter Eure	2019
Jacob Reed	2019	Kelly Barnett	2020	Tom Barber	2020

121. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

AL - Steve Li	2018		NC - Bobby Walls	2018
AR - Tom Barber	2018		NC - Katie Jennings	2018
FL - Calvin Odero	2018		OK - Todd Baughman	2018

GA - Scott Tubbs	2018		SC - Alan Estes *	2018
KY - Mike Harrell	2018		TN - Drew Ellis	2018
LA - Jeff Ellis	2018		TX - Jacob Reed	2018
MS -Te-Ming Paul Tseng	2018		VA - Charlie Cahoon	2018

Minutes
SWSS Executive Board Meeting

Sunday, January 22, 2017

Hyatt Regency – The Wynfrey Hotel – Birmingham, AL

Essex Room

5:00 pm to 7:00 pm

Dr. PeterDotray called the meeting to order at 5:00 pm and then made introductions.

Attending: Peter Dotray, President; Gary Schwarzlose, President-Elect and Program Chair; Bob Scott, Vice President; Daniel Stephenson, Secretary/Treasurer; Brad Minton, Past President; Joyce Tredaway, Member-at-large-Academia; Angela Post, Member-at-large-Academia; James Holloway, Member-at-large-Industry; Matt Goddard, Member-at-large-Industry, Carroll Johnson, Constitution and By-Laws; Nilda Burgos, Proceedings Editor; Eric Palmer, WSSA Representative; Drake Copeland, Graduate Student Organization-President; John Brewer, Graduate Student Organization, Vice President; Phil Banks, Business Manager; Lee Van Wychen; Director of Science Policy; Greg Stapleton, incoming Member-at-large-Industry

Absent: None

Meeting agenda, Peter Dotray:

Agenda was passed out to BOD and they were allowed to read it.

Motion to accept agenda; James Holloway; Daniel Stephenson second; PASSED UNANIMOUSLY

Secretary report, Daniel Stephenson:

Copy of minutes from summer board of directors (BOD) meeting held June 22-23, 2016 and email minutes from April 9, 2016 through November 4, 2016 provided via email to BOD members on January 18-20, 2017.

Motion to accept minutes; Matt Goddard; Angela Post second; PASSED UNANIMOUSLY

Financial Overview and Report, Phil Banks:

See the following report from Phil Banks

Minutes

SWSS Executive Board Meeting

Monday, January 23, 2017

Hyatt Regency – The Wynfrey Hotel – Birmingham, AL

Essex Room

11:00 am to 12:00 pm

Dr. Peter Dotray called the meeting to order at 11:00 am.

Attending: Peter Dotray, President; Gary Schwarzlose, President-Elect and Program Chair; Bob Scott, Vice President; Daniel Stephenson, Secretary/Treasurer; Brad Minton, Past President; Joyce Tredaway, Member-at-large-Academa; Angela Post, Member-at-large-Acedemia; James Holloway, Member-at-large-Industry; Matt Goddard, Member-at-large-Industry, Carroll Johnson, Constitution and By-Laws; Nilda Burgos, Proceedings Editor; Eric Palmer, WSSA Representative; Drake Copeland, Graduate Student Organization-President; John Brewer, Graduate Student Organization, Vice President; Phil Banks, Business Manager; Greg Stapleton, incoming Member-at-large-Industry; Tara Steinke, incoming Business Manager; Darrin Dodds, Chairman, Weed Contest Committee

Absent: None

Review of Sunday evening meeting, Peter Dotray:

Peter Dotray provided agenda to BOD.

Motion to accept agenda; Bob Scott; James Holloway second; PASSED UNANIMOUSLY

Committee Reports: see in the following pages

Minutes

SWSS Executive Board Meeting

Monday, January 23, 2017

Hyatt Regency – The Wynfrey Hotel – Birmingham, AL

Wynfrey Ballroom C

5:00 pm to 6:00 pm

The annual business meeting called to order by President Peter Dotray at 5:00 pm.

Business Manager's Report for the 2017 SWSS Meeting

Birmingham, AL

All tax forms and bills were paid on time during the past year. The attached financial statements show that SWSS is in good financial order and posted an increase in net worth ($878.71) during the last fiscal year (ended May 31, 2016). Our current (January 19, 2017) financial status is attached. We have a total of $377,093.93 on hand (this includes $4,236.00 in Weed ID DVD inventory). The cash flow since the beginning of this fiscal year (April 1, 2016) is also attached. I will send the Finance Committee the entire transaction report for the year and provide detailed investment information for when I meet with them during the meeting.

Currently, 332 SWSS members have registered for the meeting (98 are students). There are 5 spouse/friend registrations. It appears that most members had few or no problems with registration. The hotel did fill up, and some members had to find other hotels. I handled the registration of the SWSS Golf Tournament (17 golfers). Award plaques and the Awards Program were printed well ahead of the meeting. The total number of paid members of SWSS is currently 584.

I have been working with Tara Steinke of IMI to have an orderly transition of the Business Manager duties to her by the end of February. I visited the IMI facility in Denver and met with her and IMI owner, Gary Leeper, on January 11 and 12. We will have all bank accounts, merchant accounts and investment accounts transferred soon. I think they will do a good job for SWSS.

Tara and I will work with Site Selection Chair, John Byrd, to choose a location for our 2020 meeting. It should be in the middle part of our region. They will have a recommendation at our summer Board meeting. Our next annual meeting will be in Atlanta, GA.

Submitted by Phil Banks, Business Manager

Summary of Financial Status:

The society has total assets of $332,579.92 as of 5/31/2016 with no liabilities. The distribution of funds are as follows: Five individual CD's = $20,000 initial deposit; with one maturing either 1, 2, 3, 4, or 5 years after initial deposit; current value of each is approximately $20,000; Money Market = $36,678.24; RBC Account = $109,450.20; SWSS Checking = $50,472.69; Wells Fargo Savings = $35,156.55.

Item	Net worth	Net change from previous year
Total Assets on May 31, 2008	242,242.37	-10,079.63
Total Assets on May 31, 2009	239,102.58	-3,139.79
Total Assets on May 31, 2010	247,056.17	7,953.59

Total Assets on May 31, 2011	264,386.91	17,330.74
Total Assets on May 31, 2012	283,708.14	19,321.23
Total Assets on May 31, 2013	303,001.03	19,292.89
Total Assets on May 31, 2014	328,166.57	25,165.54
Total Assets on May 31, 2015	331,701.22	3,534.65
Total Assets on May 31, 2016	332,579.93	878.71

The society showed cash inflows last year of $70,518.46, primarily from annual meeting registration, sustaining membership dues, golf tournament, and annual meeting support. The society also showed income from DVD and book sales of $1039.70 and $2,545.76. Cash outflows last year were $69,639.75 primarily from management fee, weed contest, and director of science policy. Other significant outflows include website host, travel to summer BOD meeting, and awards. Overall the society showed a net gain of $878.71 in 2016.

-End of report

Phil Banks presented his report to the BOD. He stated that all bills have been paid and taxes have been filed. He stated that income was less for the past fiscal year than in the past for reasons written in the report. Phil mentioned the Interaction Encyclopedia of North American Weeds DVD sales have been strong and that the profit margin is high with a profit of approximately $45 per copy. They are available for sale on the SWSS website and the WSSA offers it on their website when individuals register for the WSSA meeting and pay their annual dues. Phil Banks stated that there has been additional people who registered for the SWSS meeting since he sent his report. He expects more individual registering as walk-ins. The hotel room block was filled, which is very positive. Currently there are 584 members of the SWSS. Phil discussed his experience with the new business manager. He worked with them at the North Central Weed Science Society annual meeting with no issues. He feels the transition will be smooth. He said he would continue to be a member of the SWSS and was willing to serve on the Finance Committee for 3 years to help ensure the success of the transition from his management to IMI.

Brad Minton asked why the change in net worth has declined over the past few years.

Phil stated that we have had a negative change in security value even though we had a positive dividend income. Our investment manager has provided some suggested changes in our investment structure, which Phil will discuss with the Finance Committee. In addition, we paid Ohio State University for the Weed Olympics in 2015 and we did not seek extramural funding to offset that expense. Also, deals with hotels for our annual meetings are becoming more expensive. Phil suggested that we be very careful in our future negotiations with hotels.

Nilda Burgos asked if the spouse’s program has been discontinued indefinitely.

Phil said that BASF has been the sole supporter of the spouse's program. The last annual meeting the spouse's program was offered was in Savannah. Unfortunately, no one has offered to sponsor the spouse's program.

Peter Dotray pointed out that the net worth trend has decreased in recent years, but there has been a very positive trend over the pasts nine years.

Carroll Johnson asked if the SWSS lost money by having last year's joint meeting with the WSSA.

Phil Banks stated that the WSSA wrote the SWSS a check for $28,000. The expenses applied solely to the SWSS at the joint meeting was for our reception and the SWSS covered the cost of the audio/visual equipment in the student contest room, which amounted to approximately $20,000. Therefore, the SWSS left the joint meeting without losing money.

Carroll Johnson asked Phil Banks if he foresees any warning signs in our future concerning money.

Phil Banks stated that he felt the SWSS was on a good path. However, a downturn in attendance to the SWSS annual meeting would be problematic. Furthermore, the potential mergers of agricultural companies could lead to less sustaining member donations.

Carroll Johnson asked if we needed to seek greater donations from outside entities for the weed contest.

Phil Banks stated that he, Gary Schwarzlose, and the Sustaining Member Committee chairman developed a letter to be sent to agricultural companies listing all the things they could donate money to under the SWSS umbrella. The company dictated where their donation was placed and some feel the weed contest is very important, so they donate to it. Others do not.

Peter Dotray thanked the ad hoc committee who worked in the hiring of our new business manager.

Phil Banks told the entire BOD that the transition to the new business manager would go smooth if the SWSS manual of operating procedures was read and followed.

Motion to accept business manager report; Bob Scott; Eric Palmer second; PASSED UNANIMOUSLY

Local Arrangements Committee Report

Report submitted by: Joyce Tredaway

Joyce Tredaway stated that the food, audio/visual equipment, and meeting rooms are in order and ready for the conference to begin. She mentioned the individuals who helped her in the arrangement of the meeting.

Motion to accept Local Arrangements Committee Report; Matt Goddard; Carroll Johnson; PASSED UNANIMOUSLY

Program Committee Update

Report submitted by: Gary Schwarzlose

See report given by Gary Schwarzlose in the minutes of the SWSS Business Meeting on Monday, January 23 (next section).

Gary Schwarzlose stated that we have 276 total title entries, comprised of 158 oral presentations and 118 poster presentations. He is beginning to receive cancellations since the email was sent stating the abstract deadline date. He mentioned there were numerous changes to the program and that an addendum would be provided to the membership. He discussed that the majority of missing abstracts as of this meeting were from the symposium speakers.

Bob Scott stated that there is some confusion as to whether a symposium is an actual presentation to be listed in the proceedings.

Gary Schwarzlose stated that the SWSS needs to be more specific concerning the abstract requirements in the future.

Eric Palmer reminded the group of the issue we had in the past of individuals submitted a title and never actually coming to the meeting or submitting an abstract. He then asked Gary Schwarzlose if he foresees that issue this year.

Gary Schwarzlose stated that he does not foresee the number being as high as it was last year. He also suggested that the Vice President be chairman of the posters so they can get experience with the system.

Bob Scott stated that he asked Tom Barber to act as chairman of the posters at this annual meeting.

Peter Dotray suggested the SWSS send emails to section chairs and moderators as reminders of their duties. He then asked about the student contest.

Gary Schwarzlose stated that there are currently 19 Ph.D. and 16 M.S. oral presentations in the contest and 12 Ph.D. and 25 M.S. poster presentations in the contest. Therefore, a total of 72 students are competing.

Motion to accept Program Committee report; James Holloway; Bob Scott second; PASSED UNANIMOUSLY

Director of Science Policy Report

Report submitted by: Lee Van Wychen

See report given by Lee Van Wychen in the minutes of the SWSS Business Meeting on Monday, January 23 (next section).

Lee Van Wychen discussed his report to the BOD. He mentioned issues pertaining to regulation over the past year. He is unsure as to what the new administration will do, but he feels it will be less regulation accompanied by less funding. His main concern are the auxinic herbicides BMP's. Specifically, what is the societies' role? He stated that the triazine review was complicated and that the EPA is using a model that isn't applicable to the real world. He stated that a research exemption for backpack application of paraquat was requested by the Weed Science Society of America and that it was granted. The mentioned that the U.S. and Canada survey of weeds is available on the WSSA website. He also requested that the SWSS continue our annual weed survey.

Bob Scott asked that with the change in administration, will the Pria Dates concerning the new herbicide labels or the restrictions associated with labels be lessened? Does the SWSS and/or the WSSA have any influence?

Lee Van Wychen stated that the Endangered Species Act (ESA) is the primary issue, but politicians are hesitant to attempt to change the ESA. Essentially, integration of the ESA with FIFRA is grinding the whole FIFRA process to a halt.

Bob Scott stated that calling a tree line or a ditch a restricted area and the number of regulations on the new labels will essentially make farmers criminals.

Lee Van Wychen announced that Peter Dotray has been appointed to the Agriculture Advisory Board for the EPA. Stanley Culpepper and Andrew Kniss have also been appointed, so there are three weed scientists on the board.

Motion to accept Director of Science Policy report; Bob Scott; Joyce Tredaway second; PASSED UNANIMOUSLY

WSSA Representative Report

Report submitted by: Eric Palmer

See report given by Eric Palmer in the minutes of the SWSS Business Meeting on Monday, January 23.

The upcoming WSSA meeting is in 2 weeks. In 2018, the WSSA annual meeting is scheduled to be held in Washington DC and in New Orleans in 2019. Hawaii or Tampa are being considered for the 2020 annual meeting. Also, the WSSA BOD voted to hire IMI as their business manager. The WSSA BOD voted to raise their sustaining member fee. They also decided to have a student oral presentation contest at this year's annual meeting for the first time.

James Holloway asked if the SWSS is considering another joint meeting with the WSSA.

Eric Palmer stated that the WSSA BOD is discussing that possibility. There is interest from the other regional societies, but there are currently differing opinions among WSSA BOD members about joint meetings.

Peter Dotray mentioned that the 2018 and 2019 annual meetings of the SWSS and WSSA will be held in back-to-back weeks.

Bob Scott noted that that scenario would make it difficult for extension weed scientists to attend both due producer meetings.

Motion to accept WSSA Representative report; James Holloway; Bob Scott second; PASSED UNANIMOUSLY

Old Business, Peter Dotray:

Stewardship Award, Brad Minton:

This is the first year for this award. Discussions for this award began in 2013. It was supposed to be awarded last year, but it was just missed. Monsanto agreed to sponsor the award for 5 years with 2016 being the first year of their sponsorship.

New Business, Peter Dotray:

Lee Van Wychen mentioned that he has heard about the possibility of another Weed Olympics in 2019.

Motion to adjourn; James Holloway; Joyce Tredaway second; PASSED UNANIMOUSLY

Sunday January 22, 2017 5:00 – 7:00 PM Essex	Agenda Item	Discussion Leader
	Introductions and Approval of Agenda	Peter Dotray
	Secretary's Report	Daniel Stephenson
	Financial Overview and Report	Phil Banks
	Local Arrangements Committee Report	Joyce Tredaway
	Program Committee Update	Gary Schwarzlose
	Director of Science Policy Report	Lee Van Wychen
	WSSA Representative	Eric Palmer
	Old Business Stewardship Award	Board of Directors
	New Business	Peter Dotray
	Adjourn	

Endowment Committee Report

Report submitted by: James Holloway

See report given by James Holloway in the minutes of the SWSS Business Meeting on Monday, January 23.

James Holloway reported that the Endowment Foundation Committee met early in the day and that the Endowment Scholarship winners would make presentations at the General Session later today.

Nilda Burgos asked if the number of scholarships given will be increased.

James Holloway said the number would remain at three until there is increased interest by graduate students.

Carroll Johnson asked if there was a mechanism for an individual’s estate to make a memorial gift to the Endowment Foundation.

James Holloway said he didn’t know and then asked if there is any procedure for that scenario written in the SWSS MOP.

Carroll Johnson stated that he would work with Brent Sellers, incoming Endowment Foundation Committee chairman, on including that into the MOP.

Motion to accept Endowment Foundation Committee Update; Bob Scott, Brad Minton; PASSED UNANIMOUSLY

Legislative Committee Report

Report submitted by: Bob Nichols

See report given by Bob Nichols in the minutes of the SWSS Business Meeting on Monday, January 23.

Bob Nichols discussed the claim that glyphosate was a carcinogen and pointed out that the claim has been denounced by many entities, including the EPA. However, media and other individuals with no training in science continue to voice the claim. Therefore, we have to deal with public perception. He stated that individuals who argue against science, specifically those that claim glyphosate is a carcinogen, are activists and not environmentalists. Bob stated that he and others have questioned the transparence of the EPA concerning glyphosate and that a letter was sent to the EPA pointing out the lack of data supporting the claim. In the former administration, there was a movement within the EPA to implement precautionary standards without scientific basis. He also discussed the new labels for XtendiMax with VaporGrip, Engenia, and Enlist Duo and the fact that they are very restrictive. The label is the law, thus has to be adhered to. Therefore, it is our job to advise/explain the restrictions to our clientele. Also, states may provide additional restrictions. Bob finished and asked for questions.

Joyce Tredaway asked when the atrazine review would be completed.

Bob Nichols stated that he did not know.

Angela Post stated that atrazine had yet to go through a human health review and that we haven't accepted the environmental review.

Bob Nichols stated that the report proposes to reduce the atrazine rate or number of acres where it can be used.

Bob Scott reminded the BOD that we voted to support a letter from the WSSA to the EPA discussing BMP's for resistant weeds, but, in light of the restrictive labels, it's as if the letter did no good. Also, if a company refuses the restrictive label from EPA, they could very likely not get their product registered.

Bob Nichols stated that if the WSSA publically came out against the labels, it would create chaos. Therefore, we are now in the implementation phase and he will support extension to the best of his ability.

Eric Palmer stated that as long as the endangered species act, we will have to deal with buffers.

Bob Nichols stated that the endangered species law, as written, is a mistake. However, if someone tries to rewrite it, then it will be a disaster. As written, it can possible wreck the US economy. It needs to be rewritten using common sense.

Bob Nichols stated that he will resign from his post at the end of this week. Angela Post will replace him as chairman of the Legislative Committee.

Motion to accept the Legislative Committee report; James Holloway; Eric Palmer second; PASSED UNANIMOUSLY

SWSS Weed Contest Update

Report submitted by: Darrin Dodds

Darrin Dodds told the group that Monsanto hosted in 2016 at their Scott Learning Center in Scott, MS and did a great job. Syngenta will host in 2017 in Vero Beach, FL on August 1 and 2. The 2018 contest is scheduled for the AgriCenter in Memphis, TN. He also mentioned that discussions have begun to have a Weed Olympics like the one held at Ohio State University in 2015 in 2019, but no specifics have been determined yet. Also, the Weed Contest Committee decided to request the Program Planning Committee to move the Weed Contest Committee meeting from Monday morning to Monday afternoon following the business meeting to encourage more participation from membership. He stated that the Weed Contest Committee would work to develop a database of participants, farmer problems, weed species, calibration test, etc. from past contest so future host would have information to draw from. Darrin stated that he told Syngenta (host of the 2017 contest) that funds from the SWSS would be available for the weed contest.

Bob Scott asked if the committee has made any progress is securing outside funding for the contest.

Darrin stated that Syngenta agreed to fund some of the expenses; however, they have not developed a budget for the 2017 contest yet. Once that budget is developed, the committee would work to secure outside funding if needed. He pointed out that the AgriCenter in Memphis solicited funds when they hosted in the past and that is not proper. The SWSS Weed Contest Committee should be the ones seeking that funding.

Gary Schwarzlose said the letter to Sustaining Membership list the Weed Contest as something that can be donated to if the Sustaining Member chooses too.

Darrin Dodds finished by saying that he appreciated Syngenta hosting in 2017.

Motion to approve SWSS Weed Contest Committee Update; James Holloway; Joyce Tredaway second; PASSED UNANIMOUSLY

Old Business, Peter Dotray:

None

New Business, Peter Dotray:

Peter Dotray asked Tara Steinke (incoming business manager) to step outside. He began a discussion concerning Phil Banks. Peter said it is important to recognize Phil at the banquet and that a plague will be given. He asked if the SWSS BOD has an issue giving Phil a monetary award as well. The North Central Weed Science Society (NCWSS) gave him a plaque and monetary award. Peter asked Phil's wife what she suggested and she suggested giving him a gift card to one of his favorite stores.

Gary Schwarzlose said the NCWSS and Western Weed Science Society are giving the same gift.

Peter Dotray said the SWSS President has discretionary funds totaling $5000 to use as the President desires.

Gary Schwarzlose stated that it was not a matter of giving a monetary gift, it was a question of how much the gift should be.

Motion to use the SWSS President's discretionary funds to give Phil Banks a monetary gift; Gary Schwarzlose; Carroll Johnson second; PASSED UNANIMOUSLY

Discussion among SWSS BOD about the amount of the monetary gift.

Motion made amending the previous motion to set the monetary gift at $1500; Bob Scott, Nilda Burgos second; PASSED UNANIMOUSLY

Carroll Johnson stated that the SWSS President does not have to seek SWSS BOD input concerning the discretionary funds. He commended Peter Dotray for asking for input from the BOD.

Motion to adjourn; James Holloway; Joyce Tredaway second; PASSED UNANIMOUSLY

Monday January 23, 2017 11:00A – 12:00P Essex	Agenda Item	Discussion Leader
	Review of Sunday Evening	Peter Dotray
	Endowment Committee Update	James Holloway
	Legislative Committee Report	Bob Nichols
	SWSS Contest Update	Darrin Dodds
	Old Business	Board of Directors
	New Business	Peter Dotray
	Adjourn	

Secretary-Treasurer's Report

Report submitted by: Daniel Stephenson

Minutes are included in the 2016 proceedings posted on the website and no changes were noted.

The society has total assets of $332,579.92 as of 5/31/2016 with no liabilities. The distribution of funds are as follows: Five individual CD's = $20,000 initial deposit; with one maturing either 1, 2, 3, 4, or 5 years after initial deposit; current value of each is approximately $20,000; Money Market = $36,678.24; RBC Account = $109,450.20; SWSS Checking = $50,472.69; Wells Fargo Savings = $35,156.55.

Item	Net worth	Net change from previous year
Total Assets on May 31, 2015	331,701.22	3,534.65
Total Assets on May 31, 2016	332,579.93	878.71

The society showed cash inflows last year of $70,518.46, primarily from annual meeting registration, sustaining membership dues, golf tournament, and annual meeting support. The society also showed income from DVD and book sales of $1,039.70 and $2,545.76, respectively. Cash outflows last year were $69,639.75 primarily from management fee, weed contest, and director of science policy. Other significant outflows include website host, travel to summer BOD meeting, and awards. Overall the society showed a net gain of $878.71 in 2016.

Program Committee Report

2017 SWSS Program Report

Hyatt Regency-Wynfrey Hotel, Birmingham, AL

Gary Schwarzlose, Program Chair

The theme for the program this year was "Opportunities, Challenges, and Communicating Solutions". The General Session included a presentation from the Honorable David Sessions. He represents Alabama House District 105 and serves as the Chairman of the Agriculture and Forestry Committee for the Alabama House of Representatives. There were also presentations by the three students receiving the SWSS 2016 Endowment Enrichment Scholarships highlighting activities of their enrichment experiences. The session also included an update on Washington Policy by Lee Van Wychen, Science Policy Director.

A symposium was held on "Launching New Technology Systems: Roundup Ready® Xtend Crop System". Dr. Randy Ratliff presented at the Graduate Student Symposium about how companies use and implicate the Target Selection Interview process, and ways to better prepare the graduate students for various interview styles.

The program consisted of the following sections this year:

- General Session
- Graduate Student Oral Papers (MS Only)
- Graduate Student Oral Papers (PhD only)
- Graduate Student Posters (MS only)
- Graduate Student Posters (PhD only)
- New Technologies in Weed Science / Educational Aspects of Weed Control
- Physiological & Biological Aspects of Weed Control
- Poster Section
- Soil and Environmental Aspects of Weed Science / Weed Management in Aquatics
- Symposium - Launching New Technology Systems: Roundup Ready® Xtend Crop System
- Weed Biology and Ecology
- Weed Management in Agronomic Crops
- Weed Management in Horticultural Crops
- Weed Management in Pastures, Rangeland, Utilities, and Forestry
- Weed Management in Turf

There were 276 total presentations that included 118 posters and 158 oral presentations.

Special thanks goes to Phil Banks for all he does and has done for this organization; to Joyce Tredaway and her Local Arrangements Committee; Andrew Price, Wykle Green, Scott McElroy, Steve Li, Jacob Williams, and William Greer for all their hard work behind the scenes, and to all Session Chairs and Moderators; Hunter Perry, Darrin Dodds, Charles Cahoon, Michael Flessner, Matt Inman, Peter Eure, Drake Copeland, Chase Samples, Garrett Montgomery, Jay McGurdy, Gerald Henry, Paul Tseng, Stephen Enloe, Peter Dittmar, Angela Post, Nilda Burgos, Tom Mueller, Tom Barber, and Dr. John Willis.

Respectfully Submitted,

Gary Schwarzlose

2017 SWSS Program Chair

Local Arrangements Committee Report

Report submitted by: Joyce Tredaway

Joyce Tredaway stated that most everything went smoothly. She thanked her graduate students and Andrew Price for help. Thanks to Gary and Matt Goddard for help too.

Student Contest Committee Report

Report produced by: Hunter Perry

Hunter Perry stated that as of now this report, the SWSS student contest consist of 16 MS papers divided into two sections, 18 PhD papers divided into two sections, 25 MS posters divided into 3 sections, and 12 PhD posters, all in a single section. This brings the total number of titles in the competition to 72. He stated that 40 judges were needed and they had 62 volunteers. In 2016, 58 poster titles submitted which is greater than this year; however, the poster contest last year was combined with the WSSA. Non-SWSS students were allowed to compete.

Graduate Student Organization

Report submitted by: Drake Copeland

Drake Copeland announced that the Graduate Student Luncheon will be Wednesday from 12-2 with Randy Ratliff presenting on behavioral interviews.

Nominating Committee Report

Report produced by: Brad Minton

2017 SWSS Meeting - Nominating Committee Report

January 23, 2017

Brad Minton - Past President

Nominations for Member-at-Large for Industry, Member-at-Large for Academia, Editor, Representative to WSSA, Secretary-Treasurer, Vice President, and Board Member for the SWSS Endowment Foundation were accepted in the fall of 2016. Elections were held by electronic vote in the fall of 2016 and the newly elected officers were determined to be:

Member-at-Large for Industry – Greg Stapleton - BASF

Member-at-Large for Academia – Jason Bond – Mississippi State University

Editor - Muthu Bagavathiannan - Texas A&M University

Representative to WSSA - John Byrd – Mississippi State University

Secretary-Treasurer - Jim Brosnan – University of Tennessee

Vice President – James Holloway – Syngenta Crop Protection

Board Member Endowment Foundation - Gary Schwarzlose – Bayer Crop Sciences

All nominees have accepted the duties and the office and will begin their service on Thursday, January 26, 2017.

End of report

Meeting Site Selection Committee Report

Report submitted by: John Byrd

Johy Byrd stated that Phil Banks sent the request for proposals (RFP) for 2019 annual meeting to 20 properties. After receiving those RFP's, the committee recommended Oklahoma City for 2019 meeting. The Committee met this morning to discuss the 2020 annual meeting location and they recommend properties in New Orleans, Memphis, and Lexington be given priority.

Awards Committee Report

Report submitted by: Brad Minton

Brad Minton stated that the Awards Committee received 20 nominations for this year's awards. Winners will be announced at the banquet.

SWSS Weed Contest Committee Report

Report submitted by: Darrin Dodds

Darrin Dodds announced the team and individual winners from the 2016 SWSS Weed Contest that was held at the Monsanto Scott Learning Center in Scott, MS. In 2017, Syngenta will host the SWSS weed contest at their facility in Vero Beach, FL. It will be at the AgriCenter in Memphis, TN in 2018. 2019 is still being investigated.

WSSA Representative Report

Report submitted by: Eric Palmer

See report from Eric Palmer below.

2017 SWSS Meeting - WSSA Representative's Report

Hyatt Regency/Wynfrey Hotel Birmingham, AL

January 23-26, 2017

The upcoming WSSA meeting will be held February 6-9 at the Hilton El Conquistador Golf and Tennis Resort in Tucson, AZ.

Future meeting sites for WSSA

2018 January 29- February 1, Crystal Gateway Marriott, Arlington, VA

2019 February 11-14, Sheraton, New Orleans, LA

President's Report – Kevin Bradley

Business Manager Proposals were presented from two companies ASG and IMI. BOD voted to pursue negotiations with IMI as business manager.

Executive Secretary Report – Joyce Lancaster

2016 Joint Meeting Final attendance figures were as follows:

Annual Meeting Registrants: 652; Guests: 72 for a total of 724.

Joyce thought this is our highest attendance since she has been involved with the meetings. The next highest attendance would have been Waikoloa, HI in 2012 at 657 and the last WSSA/SWSS joint meeting in Orlando, FL at 656.

Finance Committee Report – Rick Boydston

BOD voted on meeting registration dues for the 2017 meeting and on membership dues for the next year. Meeting registration fees for 2017 - $400 early, $500 late, and $600 at the meeting.

Sustaining Membership levels were increased and approved by BOD. Associates level was not changed.

The levels of membership are as follows: (bold is the new level amount)

Presidential $5,000 - $6,000

Leaders $2,500 - $3,000

Patrons $1,500 - $2,000

Contributors $750 - $1,000

Associates $500

Director of Science Policy Report – Lee Van Wychen

Dicamba is a hot topic in Washington. WSSA position is the label is the law.

Mike Barrett will pull a subcommittee together for a public comment around atrazine SAP.

BOD discussed options for Science Policy Internship to help Lee Van Wychen.

Program Chair – Janis McFarland

Symposia plans - Reviewed seven proposals that were submitted. BOD ranked 1-7. Budgeted for 4 symposia if enough hotel space.

Potential Tours at 2017 meeting - Sonoran desert museum, Pina air and space museum, Biosphere II, Titan missile museum.

Herbicide MOA -Scott Senseman Clarification of issues regarding Herbicide mechanism of action classification-mission of ad-hoc committee. EPA wants clarification between WSSA system and HRAC. Scott Senseman to organize relevant chairs to address this issue.

Potential recording of sessions – Mark Bernards

Proposal to record one of the symposia at the upcoming meeting and recording would be posted on the WSSA website.

Survey monkey may be sent out to the membership to gauge interest in recording the oral presentations.

Publication Report – Sarah Ward

Cambridge University Press transition is going well for WSSA journals.

Graduate Student Report – Nick Basinger

Grad. Student organization is planning a luncheon at the 2017 meeting.

Darrin Dodds presented a proposal for an oral presentation contest at the 2017 meeting and this was approved by the BOD. There will be a student poster and oral presentation contest at the 2017 WSSA meeting.

Respectfully Submitted,

Eric Palmer

End of report

Endowment Foundation Committee Report

Report submitted by: James Holloway

2017 ENDOWMENT BOARD MEETING

Monday January 23, 2017

Hyatt Regency-The Wynfrey Hotel; Avon Room, Birmingham, Alabama

Present: James Holloway, Brent Sellers, Darrin Dodds, Donnie Miller, Hunter Perry, Gary Schwarzlose, and Zach Lancaster

Absent: Renee Keese

ENDOWMENT BOARD:

James Holloway (2017), President

Brent Sellers (2018), Secretary

Darrin Dodds (2019)

Donnie Miller (2020)

Hunter Perry (2021)

Gary Schwarzlose (2022); newly elected

Zach Lancaster (student rep 2017-2018)

Ex Officio: Tara Steinke and Renee Keese (2016)

Meeting called to order by James Holloway at 8:06 am. Introductions were done around the table by all attendees.

2016 Minutes were circulated by James via email. Motion to approve by Darrin and 2nd by Gary; passed. Will be sent to Nilda Burgos (editor).

Old Business

1. **2016 SWSS Student Enrichment Scholarship**

   Discussion covering 2016 awards with Darrin and Hunter providing positive feedback with student/sponsor interactions. Students will be giving presentations covering their experience (10 min./student) during the opening session. Some discussion of making sure all students know of opportunity as at least one student was unaware (may be due to their non-participation in graduate student luncheon meeting).

2. Financials

Financial review: Brief notes from Phil Banks: total assets are $382,335.90; total available for distribution are $75,040.40 as of 9/30/2016.

INFLOWS		
Uncategorized	0	
Capital Gains	186.01	
Div Income	5,927.02	
Donations	13,185.00	Golf tournament and donations from members
Interest Inc	3,309.12	
Security Value Change	1,443.75	
TOTAL INFLOWS	24,050.90	
OUTFLOWS		
Account Fee	1,495.15	RBC fees
Annual Fee	10.00	
Expense For Golf Tournament	5,703.31	
Scholarship	4,500.00	three $1500 scholarships
Student Paper Contest	2,400.00	Held at annual meeting
Supplies	0.00	
Tax Charge	15	
Tax Preparation	460.33	
TOTAL OUTFLOWS	14,583.79	
OVERALL TOTAL	9,467.11	

3. Golf tournament

Hunter Perry provided feedback on this year's golf tournament. Received donations of approximately $9,000 with expenses of approximately $1,500, ~$7,500 net on golf tournament this year.

New Business

1. **SWSS Student Enrichment Scholarship**

   Goal this year is to have applications due on April 7, 2017, with a target announcement date of May 1, 2017. Brent, and rest of board is to reach out to former sponsors and potentially get more sponsor locations for this year. Hunter asked to be added to sponsor list. Discussion of getting with Tara or Phil to see if applications could be handled electronically.

2. **Graduate students**

   Zach was asked to make general statement at the graduate student luncheon concerning the Enrichment Scholarship. James will attend Graduate student meeting to field any questions. New graduate student representative to be elected at the 2018 meeting.

3. **Nominees to the Endowment Board for election**

   Two names were motioned by Donnie and seconded by Darrin, Larry Steckel, UT and Josh Copes, LSU. Passed.

4. **Silent auction**

   Several have already donated for this year's meeting. Some discussion on how to increase donations for silent auction including reaching out to vendors at meeting locations for potential "regional" donations that would interest members.

   Discussion of sending letters to those who have donated for their records and tax reporting. Will reach out to Tara to see if she will send out letters on behalf of the Endowment Board.

Proceedings Editor Report

Report submitted by: Nilda Burgos

Nilda Burgos was not present at the Business meeting. See report from Nilda Burgos below.

Proceedings Editor's Report of the 2016 Meeting

The 2016 meeting was a joint meeting of SWSS and WSSA held in San Juan, Puerto Rico. The 2016 Proceedings of the Southern Weed Science Society contained 639 pages, including 505 abstracts. By comparison, the 2015 Proceedings of the Southern Weed Science Society contained 397 pages, including 253 abstracts (Savannah, GA); the 2014 Proceedings had 398 pages, including 259 abstracts (Birmingham, AL); the 2013 Proceedings had 387 pages, including 274 abstracts (Houston, TX); the 2012 Proceedings had 277 abstracts and 375 pages (Charleston, SC); the 2011 Proceedings had 342 abstracts and 515 pages (San Juan, Puerto Rico); the 2010 Proceedings had 245 abstracts and 365 pages; the 2009 WSSA/SWSS joint meeting, contained 588 pages; the 2008 Proceedings had 315 pages; 2006 Proceedings contained 325; and the 2005 Proceedings contained 363 pages.

A total of 505 titles (224 posters and 281 oral presentations) were submitted.

The 2016 Proceedings was dedicated to Dr. Theodore "Ted" M. Webster who passed away on Tuesday, February 16, 2016. Ted was a Research Agronomist with USDA-ARS in Tifton, GA and was Research Leader of the Crop Protection and Management Research Unit. The Proceedings contained the Presidential Address, list of committees and their members, Executive Board minutes from the January and summer board meetings, committee reports (including reports from: Program Chair, Editor, Business Manager, Legislative & Regulatory Committee, Director of Science Policy, Graduate Student Contest, Weed Resistance & Technology Stewardship, Endowment, WSSA Representative, Nominating, Site Selection, Manual of Operations Procedures, and Necrology), award winners, as well as abstracts. The Proceedings were complete and uploaded to the SWSS website in July 2016, after the summer Board meeting.

Section	Number of Pages
SWSS 2016 Awardees	14
Past Presidents	1
List of Committees and Committee Members Jan 31, 2015 – Jan 31, 2016	4
Minutes of Executive Board, Committee Reports, etc	46
Posters	224
Weed Management in Agronomic Crops	52
Physiology	17

Soil and Environ. Aspects	2
Integrated Weed Management	14
Horticultural Crops	11
Turf and Ornamental Crops	6
Pasture, Rangeland, Forest and Rights of Way	6
Wildland and Aquatic Invasive Plants	2
Regulatory Aspects	1
Education and Extension	5
Formulation, Adjuvant, and Application Technology	10
Weed Biology and Ecology	19
WSSA MS Poster Contest	39
WSSA PhD Poster Contest	40
Symposium: New Technologies	25
Agronomic Crops I and II	67
Biocontrol of Weeds	4
Physiology	23
Integrated Weed Management	16
Horticultural Crops	14
Turf and Ornamental Crops	15
Pasture, Rangeland, Forest, and Rights of Way	12
Wildlife and Aquatic Invasive Plants	8
Education and Extension	12
Formulation, Adjuvant, and Application Technology	9
Weed Biology and Ecology	20
SWSS MS Oral Contest	28
SWSS PhD Oral Contest	28
Survey of Herbicide-Resistant Weeds	4
Registrants of 2016 Annual Meeting	22

Objectives for Next Year: Help the new Proceedings Editor during the transition period

Finances (if any) Requested: None

Respectively submitted,

Nilda Roma-Burgos, Proceedings Editor

End of report

Sustaining Membership Committee

Report produced by: John Richburg

John Richburg stated that all sustaining members are listed in the program and on the poster out in the main hall of the meeting. He asked that if anyone knows of an entity that may donate, please give the name to a committee member. A reformatted letter soliciting funds from Sustaining Members was been developed by Gary Schwarzlose and others. This letter will be more efficient for the Sustaining Membership to seek funding within their company for the SWSS. The letter allows the Sustaining Member to choose which portion of the SWSS (weed contest, awards, etc.) they would like to have their donation put toward. John Richburg pointed out that the potential mergers of agricultural companies will lead the Sustaining Membership Committee to discuss the possibility of raising the Sustaining Membership levels. If they decide to raise the levels, that recommendation will be made to the SWSS BOD for a vote.

Director of Science Policy Report

Report submitted by: Lee Van Wychen

SWSS Annual Meeting - Birmingham, AL

Director of Science Policy Report

Lee Van Wychen - Jan. 12, 2017

Trump Administration Starting to Take Shape

Washington DC is abuzz with all the activities that come about with a change in the office of the President and leadership among all the federal government agencies. As I write this, President-elect Trump has nominated all of his cabinet members except for USDA. Here's a quick look at his cabinet nominees for EPA and Interior.

Scott Pruitt, Oklahoma Attorney General, has been nominated to lead EPA. The 49 year old Pruitt was born and raised in Kentucky where he graduated from Georgetown College in 1990. After that, he moved to Oklahoma where he earned his law degree at the University of Tulsa specializing in constitutional law. More info about Scott can be found at: https://en.wikipedia.org/wiki/Scott_Pruitt and http://scottpruitt.com/meet-scott/

Ryan Zinke, Montana's sole Representative in the U.S. House, was nominated for the position of Interior Secretary. The 55 year old former Navy Seal has a B.S. in Geology from Oregon and a Masters in Business Finance and Masters in Global Leadership from the University of San Diego. More info about Ryan can be found at: https://en.wikipedia.org/wiki/Ryan_Zinke and http://www.ryanzinke.com/

Less Federal Regulations Expected: The last couple of years have been daunting for the sheer number of rules and regulations that have required comments from the weed science societies. In addition, lawsuits from environmental groups over endangered species act (ESA) assessments are grinding the FIFRA registration process to a halt. There is a massive effort going on behind the scenes right now to educate new leadership at EPA, Interior and Commerce on how to implement existing FIFRA/ESA Counterpart Regulations to fix this situation without the need for new regulations or statutes. They need to abandon wasteful interim approaches that EPA recently has tested for ESA analysis.

Federal Government Funded on CR Through April 28.

Congress passed a continuing resolution (CR) just before midnight on Dec. 9, funding the government at FY 2016 levels through April 28, 2017. The new 115th Congress of the United States will have to deal with the remainder of FY 2017 funding as well as start on FY 2018 federal funding where sequestration will kick back in for discretionary spending. There will be much debate over how those recessions will be distributed between defense and non-defense programs or if there will be another budget deal to "raise the caps". Most federal research dollars depend on non-defense discretionary funding.

Senate Ag Committee Members Set

There will be 11 Republicans and 10 Democrats on the Senate Committee on Agriculture, Nutrition and Forestry in the 115th Congress. The chairman of the Senate Ag Committee, Pat Roberts from Kansas, and ranking member, Debbie Stabenow from Michigan, will remain in their same roles as the 114th Congress. Members, in order of seniority (SWSS states bolded):

Republicans (11)	
Pat Roberts	KS
Thad Cochran	MS
Mitch McConnell	KY
John Boozman	AR
John Hoeven	ND
Joni Ernst	IA
Charles E. Grassley	IA
Jeff Sessions	AL
John Thune	SD
Steve Daines	MT
David Perdue	GA

Democrats (10)	
Debbie Stabenow	MI
Patrick Leahy	VT
Sherrod Brown	OH
Amy Klobuchar	MN
Michael Bennett	CO
Kirsten Gillibrand	NY
Joe Donnelly	IN
Heidi Heitkamp	ND
Bob Casey	PA
Chris Van Hollen	MD

House Ag Committee Members Set

There will be 26 Republicans and 20 Democrats on the House Agriculture Committee in the 115th Congress. Mike Conaway, Texas, will remain chair and Collin Peterson, Minnesota, will remain the ranking member. Members, in order of seniority (SWSS states bolded):

Republicans (26)	
Michael Conaway	TX
Glenn 'GT' Thompson	PA
Bob Goodlatte	VA
Frank D. Lucas	OK
Steven King	IA
Mike Rogers	AL
Bob Gibbs	OH
Austin Scott	GA
Rick Crawford	AR
Scott DesJarlais	TN
Vicky Hartzler	MO
Jeff Denham	CA
Doug LaMalfa	CA
Rodney Davis	IL
Ted Yoho	FL
Rick Allen	GA

Democrats (20)	
Collin Peterson	MN
David Scott	GA
Jim Costa	CA
Tim Walz	MN
Marcia Fudge	OH
Jim McGovern	MA
Filemon Vela	TX
Michelle Lujan Grisham	NM
Ann Kuster	NH
Rick Nolan	MN
Cheri Bustos	IL
Sean Patrick Maloney	NY
Stacey Plaskett	VI
Alma Adams	NC
Dwight Evans	PA
Al Lawson	FL

Mike Bost	IL
David Rouzer	NC
Ralph Abraham	LA
Trent Kelly	MS
James Cormer	KY
Roger Marshall	KS
Don Bacon	NE
John Faso	NY
Neal Dunn	FL
Jodey Arrington	TX

Tom O'Halleran	AZ
Jimmy Panetta	CA
Darren Soto	FL
Lisa Blunt Rochester	DE

Weed Science Societies Comments on EPA's Draft Guidance on Herbicide Resistance Management: Last summer EPA issued a Pesticide Registration Notice (PRN) that proposes an approach to address herbicide-resistant weeds by providing guidance on labeling, education, training, and stewardship for herbicides undergoing registration review or registration. The National and Regional Weed Science Societies recognize the critical need to protect all available weed management tools and are on record supporting proactive measures by EPA to combat the further evolution and spread of herbicide-resistant weeds. EPA's proposal represents a significant change in how resistance is monitored, mitigated and communicated to weed management stakeholders. We consider this proposal a first iteration that will need adaptation and evolution as our experience with it grows and we hope the Agency has those same expectations. Comments are at: http://wssa.net/wp-content/uploads/Natl-Regl-Weed-Sci-Comments-on-EPA-PRN-2016-XX.pdf

WSSA Comments on Glyphosate Carcinogenicity: WSSA fully supports EPA's Cancer Assessment Review Committee's (CARC) report on glyphosate and appreciates the scientific rigor and thoroughness of the CARC's review of all available epidemiology and carcinogenicity studies. WSSA agrees with the CARC's assessment that the few studies that the International Agency for Research on Cancer (IARC) selectively chose for its glyphosate review suffered from small sample sizes of cancer cases related to glyphosate exposure and had risk/odds ratios with large data variance beyond acceptable limits. Furthermore, WSSA feels that the IARC review process for glyphosate was flawed and represents a case of gross scientific negligence. There is no question that IARC arrived at their conclusion due to their inclusion of the positive findings from a selection of studies with known limitations, a lack of reproducible positive findings, and the omission of the negative findings from credible and reliable research. Finally, WSSA commented on the ongoing importance of glyphosate as a weed management tool and submitted information we developed surrounding some common misconceptions about glyphosate and herbicide resistance management. Comments are at: http://wssa.net/wp-content/uploads/WSSA-comments-to-FIFRA-SAP-on-glyphosate.pdf

WSSA Comments on Triazine Draft Ecological Risk Assessment: A number of concerns have been raised by various stakeholders relative to EPA's draft ecological risk assessment for the triazines. These concerns include: errors in endpoint data and the water monitoring database; use of models that are not validated with field data; estimates of inflated hypothetical risks (e.g. atrazine applications resulting in 36% bird mortality) that have not been observed in over 55 years of atrazine use; use of data or findings not conducted in accordance with EPA's scientific guidelines required under FIFRA; and ignoring the advice and findings of previous Science Advisory Panels on atrazine. The WSSA stresses the importance of addressing these concerns in order to maintain stakeholder confidence in the Agency's science-based regulatory framework. However, our main concern, based on the current ecological draft risk assessment, is that atrazine and simazine would be restricted to less than 0.25 lbs a.i./A and 0.5 lbs a.i./A, respectively. At these low rates, atrazine and simazine would not provide efficacious weed control. In addition, using sub-lethal rates of atrazine or simazine is not an effective option for resistance management as it has been shown that this practice is likely to result in weeds with multiple-site or polygenic resistance which would make it more difficult to control these weeds. Comments are at: http://wssa.net/wp-content/uploads/WSSA-Comments-on-Triazine-Ecological-Risk-Assessment.pdf

Education and Awareness of Auxin BMPs Critical

After the fallout from last summer's off label applications of dicamba, it is very clear that the weed science community will need to work extra hard on educating growers and applicators about appropriate best management practices (BMPs) for auxin herbicides. There is a lot of excellent work going on already in many states across the country, but we must continue to get those auxin herbicide BMPs out there anyway we can. The WSSA Public Awareness Committee will be issuing a couple press releases this winter highlighting the auxin herbicide BMP's that were developed for www.TakeActionOnWeeds.com

Kevin Bradley gave a great presentation at NCWSS about his experiences with off-label dicamba applications in Missouri: http://weedscience.missouri.edu/2017%20Dicamba%20Presentation.pdf. One of the biggest eye-opening pieces of information that I took away was that were 24 days with temperature inversions in June 2016 in the Missouri Bootheel. 24 days out of 30! Successful Farming magazine had a nice summary of his talk titled "10 Dicamba Damage Takeaways From Missouri" at http://www.agriculture.com/crops/soybeans/10-dicamba-damage-takeaways-from-missouri

Extendimax with Vapor Grip Technology

Final Product Label: https://www.regulations.gov/document?D=EPA-HQ-OPP-2016-0187-0957

For use in 34 states on cotton and soybean (Same states as Enlist Duo), some county restrictions due to Endangered Species concerns like Spring Creek Bladderpod, a rare mustard species found only in Wilson Country, Tennessee.

2 yr time-limited registration that expires Nov. 2018.

No Tank mixtures, No application from aircraft, No application when wind speed is over 15 mph.

Use only Tee Jet® TTI11004 nozzle with a maximum operating pressure of 63 psi or any other approved nozzle found at http://www.xtendimaxapplicationrequirements.com/

15 mph max ground speed, 24 inch max boom height above crop canopy. Maintain 110 or 220 foot downwind buffer when applying 22 or 44 fl oz/A, respectively. Do not apply this product during a temperature inversion.

"AVOIDING SPRAY DRIFT AT THE APPLICATION SITE IS THE RESPONSIBILITY OF THE APPLICATOR"

Engenia (BAPMA salt) has nearly identical restrictions, also with a 2 yr time-limited registration.

Enlist Duo: Final Product Label: https://www.regulations.gov/document?D=EPA-HQ-OPP-2016-0594-0659

For use in 34 states on corn, cotton, and soybean (Same states as Xtendimax), some county restrictions.

5 yr time-limited registration that expires Jan. 12, 2022.

No Tank mixtures, some adjuvants approved- see www.EnlistTankmix.com ; No application from aircraft; No application when wind speed is over 15 mph;

Nozzle Selection: See chart on label for 23 nozzles and pressures currently approved for Enlist Duo

15 mph max ground speed; Use the minimum boom height based upon the nozzle manufacturer's directions.

Maintain a 30 foot downwind buffer, Do not apply this product during a temperature inversion.

Weed Science Societies Comments on Tank Mix Prohibitions: The National and Regional Weed Science Societies are especially concerned about the proposed tank mix prohibitions on new registrations due to EPA uncertainty on synergism effects on non-target organisms. We have strongly urged EPA to reconsider this prohibition, as it is counterproductive for herbicide resistance management, will result in significant economic costs to growers, will increase the carbon-footprint associated with weed management, and could be, frankly, ignored by many practitioners. Mike Barrett, WSSA-EPA Liaison organized educational seminars at EPA by Bryan Young in June who talked about herbicide mixtures and by Greg Kruger in October who talked about droplet size and drift reduction technologies. There will be a full day symposium on these topics at the WSSA meeting in Tucson and many federal agency personnel will be in attendance. http://wssa.net/wp-content/uploads/Weed-Science-Societies-comments-on-dicamba.pdf

Problems with EPA Worker Protection Standards (WPS) final rule. NASDA and the Assoc. of American Pesticide Control Officials (AAPCO) asked EPA to delay compliance of WPS revisions until Jan. 2, 2018. State lead agencies don't have the tools and financial resources necessary to effectively implement the rule changes (i.e. updated materials to train farm workers and especially to"Train-the-trainers"). EPA denied request. Most WPS revisions kick in on Jan. 2, 2017. New Application Exclusion Zone (AEZ) requirements don't kick in until Jan. 2, 2018 for pesticide handlers. AEZ is the 100 feet "halo" surrounding aerial, air blast, fumigant, smoke, mist and fog application equipment, as well as spray applications using very fine or fine droplet sizes (<294 microns). AEZ is 25 feet for medium droplet sizes or larger. See: https://www.epa.gov/pesticide-worker-safety/revisions-worker-protection-standard

New Paraquat Risk Mitigation Measures Final, EPA Grants Research Exemption

As part of the registration review process for paraquat, EPA proposed additional mitigation measures last year, such as paraquat-specific applicator training material and prohibiting backpack applications, in order to minimize human health incidents from paraquat. These proposals were open for a 60 day comment period that closed last May. The WSSA had several concerns related to the costs and requirements of some of the proposed mitigation measures, but our greatest concern was that prohibiting paraquat applications from hand-held equipment would essentially eliminate the weed science community's ability to do small plot research with paraquat. WSSA's comments are at: http://wssa.net/wp-content/uploads/WSSA-comments-on-paraquat-mitigation_FINAL.pdf

EPA addressed many of our concerns with their final decision: https://www.regulations.gov/document?D=EPA-HQ-OPP-2011-0855-0112 Most importantly, EPA said they will grant a research exemption from 1) the closed system requirement; and 2) the 'certified applicator only' requirement.

Key provisions in the paraquat mitigation decisions include:

All paraquat non-bulk (less than 120 gallon) end use product containers must comply with EPA-approved closed system standards (e.g Lock and Load type systems). Registrants must comply with these standards by March, 30 2019.

EPA is permitting the continued use of handheld and backpack application equipment, so long as it complies with EPA-approved closed system technology. Additionally, paraquat products intended for handheld and backpack equipment should contain an indicator dye to aid in early detection of paraquat leaks and spills, effective March 30, 2019.

Paraquat products are only to be used by certified applicators who have met the applicator competency standards established by states, tribal, and federal agencies to use or handle paraquat. They are not to be used by uncertified individuals working under the supervision of a certified applicator.

Seven Regional Herbicide Resistance Listening Sessions: Excellent work being done by WSSA Herbicide Resistance Education Committee, in particular David Shaw, Jill Schroeder, Mike Barrett, to organize these.

Dec. 5, Starkville, MS. Darrin Dodds & Larry Steckel.

Jan. 18. Lancaster, PA. Bill Curran, Mark VanGessel, Annie Klodd

Jan. 24. Pasco, WA. Ian Burke & Don Morishita

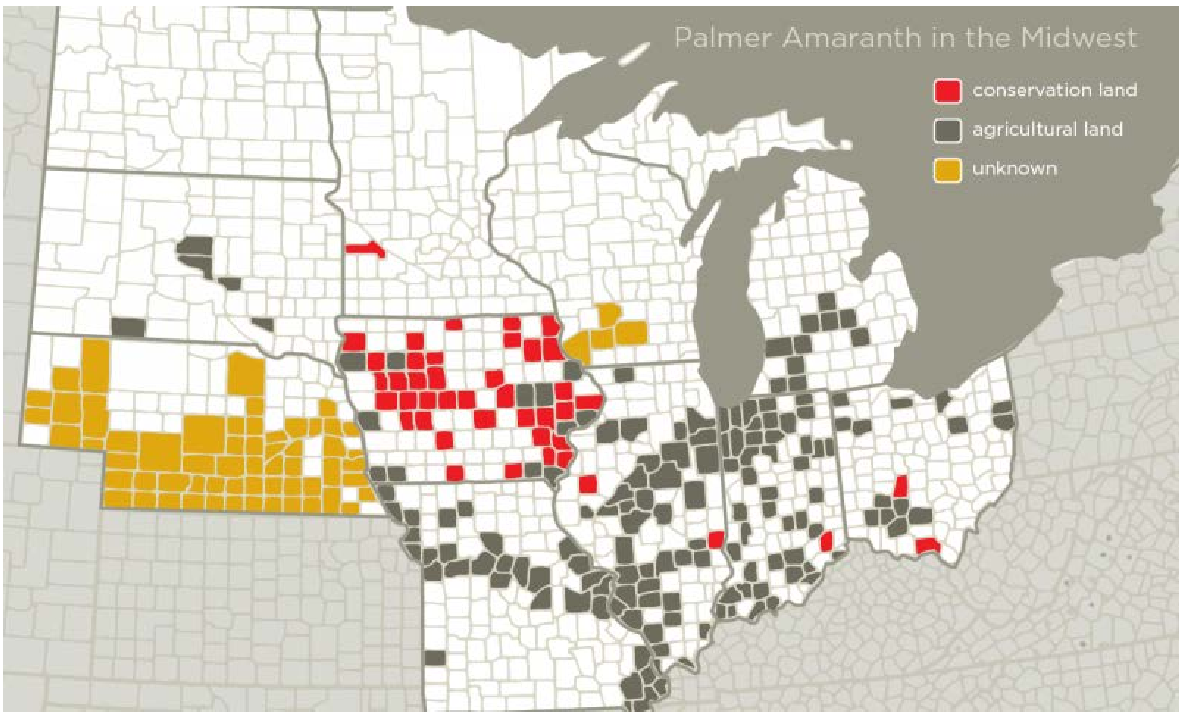
Feb. 15. Tulare, CA. Brad Hansen & Brian Schutte

Feb. 17. Holyoke, CO. Phil Stahlman, Todd Gaines, Andrew Kniss & Sandra McDonald

Mar. 4. San Antonio, TX. Commodity Classic. (Midwest region). Christy Sprague & Jeff Gunsolus

April TBD. Southeast region. Ramon Leon & Stanley Culpepper.

"100% Weed-Free" Pollinator Habitat Seed Spreading Palmer Amaranth in CRP Land



Weed scientists are finding Palmer amaranth across the Midwest. Counties in black indicate Palmer amaranth was first found in an agricultural field, whereas red indicates it was first detected on conservation program land. Yellow signifies the source of introduction was not identified. Credit: Graphic by Julie McMahon, University of Illinois

Read more at: https://phys.org/news/2016-12-effort-seeds-destruction-midwest.html#jCp

Monarchs and Milkweed: States need to continue to map and track milkweed distributions.

Waters of the United States (WOTUS) rule: On November 1, 2016, opening briefs to the 6th Circuit Court were filed by 31 states, plus various organizations and companies opposed to the expanded federal jurisdiction over streams and wetlands. The WOTUS rule, challengers argue in their briefs, undermines state authority. Challengers take particular issue with what they say is the federal government's disregard for whether a body of water is considered "navigable," which they say should be key in determining where it can regulate. The EPA and the Army Corps of Engineers have until Jan. 18 to file their response to the challengers in court. A 6th Circuit Court hearing is unlikely to occur before April 2017.

On Jan. 12, 2017, a pair of Senate Republicans resurrected a resolution calling for the WOTUS rule to be scrapped. The nonbinding resolution introduced by Joni Ernst (IA) and Deb Fisher (NE), both members of the Senate Environment and Public Works Committee, would put the upper chamber on record as calling for the water rule to be withdrawn or vacated. The resolution calls the Clean Water Act "one of the most important laws in the United States," but lays out what critics see as a series of flaws with the regulatory process around the rule.

The Senate fell just short of the 60 votes necessary to kill it last year, but with multiple moderate Democrats facing tough reelections in 2018, that could change. The new resolution could offer a test vote to see where lawmakers stand on the water rule now.

NPDES "Fix" Legislation – Will be introduced in the new Congress. This legislation has been passed by the House of Representatives in 2011, 2013, and 2016, but could not get a floor vote in the Senate. I'm saying there's a chance!

National Invasive Species Awareness Week (NISAW)- Feb. 27-Mar. 3, 2017. www.nisaw.org Webinars and lunch briefings on invasive species topics as well as a Congressional Fair on March 1. The National Invasive Species Council (NISC) released 3rd invasive species management plan this summer. Last week Obama issued an Executive Order (EO) that makes some amendments to the original invasive species EO issued in 1999. See: https://www.whitehouse.gov/the-press-office/2016/12/05/executive-order-safeguarding-nation-impacts-invasive-species .

Invasive Species Issues Farm Bill Task Force Team. Working with a group of about 20 invasive species management stakeholders to draft language for the 2019 Farm Bill. Here are a few examples:

Adding weed treatment area designations under Healthy Forest Restoration Act

Promoting Areawide IPM language and funding through USDA NIFA

Prevent NRCS program participants from planting "invasive plant species" on "reserve" lands

Pilot projects for landscape-scale testing of grazing as a tool for rangeland invasive species control

Add "invasive species" to the Foundation of Food and Agricultural Research's list of national priorities

Invasive Species Executive Order Amended

On December 5th, President Obama issued an Executive Order amending President Clinton's Executive Order 13112 issued in 1999. This new order:

- directs actions to continue coordinated Federal prevention and control efforts related to invasive species
- maintains the National Invasive Species Council (NISC) and the Invasive Species Advisory Committee (ISAC)
- expands the membership of NISC
- clarifies the operations of NISC
- incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and
- strengthens coordinated, cost-efficient Federal action

For details, please see: https://www.whitehouse.gov/the-press-office/2016/12/05/executive-order-safeguarding-nation-impacts-invasive-species

SWSS- Most Common and Troublesome Weeds in Broadleaf Crops

In 2016, the National and Regional Weed Science Societies conducted a survey of the most common and troublesome weeds in the following broadleaf crop categories: 1) alfalfa, 2) canola, 3) cotton, 4) fruits & nuts, 5) peanuts, 6) pulse crops, 7) soybean, 8) sugar beets, 9) vegetables-cole crops, 10) vegetables-cucurbits, 11) vegetables-fruiting, and 12) vegetables-other. Common weeds refer to those weeds you most frequently see, while troublesome weeds are those that are most difficult to control (but may not be widespread). There were approximately 200 responses from weed scientists across the U.S. and Canada. Nationwide- the three most common weeds in broadleaf crops were: 1) Chenopodium album, 2) Setaria spp. and 3) Ipomoea spp.; while the three most troublesome were 1) Amaranthus palmeri, 2) Chenopodium album, and 3)Conyza canadensis.

Top 10 Weeds in Broadleaf Crops in SWSS States

Most Common	# times listed
Ipomoea spp.	53
Amaranthus palmeri	42
Digitaria spp.	24
Cyperus spp.	21
Urochloa spp.	20
Echinochloa crus-galli	12
Amaranthus spp.	11
Senna obtusifolia	11

Sida spinosa	10
Amaranthus tuberculatus	9
Most Troublesome	# times listed
Ipomoea spp.	48
Amaranthus palmeri	43
Cyperus spp.	34
Conyza canadensis	17
Senna obtusifolia	13
Amaranthus spp.	9
Sida spinosa	9
Amaranthus tuberculatus	8
Sorghum halepense	8
Ambrosia trifida	7

End of report

Legislative and Regulatory Committee

Report produced by: Bob Nichols

Southern Weed Science Society (SWSS) Legislative and Regulatory Committee Report - Birmingham, Alabama, January 23, 2017

To: Gary Schwarzlose, President – 2017

Peter Dotray, Immediate Past President – 2016

From: Bob Nichols - Chair, Angela Post – Incoming Chair, Lee Van Wychen – Weed Science Society of America (WSSA) Science Policy Director

cc: Members of the SWSS Leg. & Reg. Committee: William Vencill, Matthew Goddard, James Holloway, Vernon Langston,

WSSA Officers and Others:

- Daniel Stephenson, Secretary of SWSS
- Donn Shilling, Chair of the WSSA Science Policy Committee
- Michael Barrett, WSSA Liaison to U. S. Environmental Protection Agency
- Jill Schroeder

This report summarizes only the issues updated at the 1-hour meeting. During the year, the SWSS Leg. & Reg. Committee deliberates with the WSSA Sci. Policy Committee in quarterly conference calls and at other times as issues may require attention.

Proposed Meeting Agenda

Updates from Drs. Van Wychen and Nichols on:

1. Atrazine – Environmental Review
2. Glyphosate Carcinogenicity Classification
3. Paraquat Limitations and Research Exclusion (time permitting)
4. Changes in Worker Training and Protection Standards (time permitting)
5. Registration of Auxin Herbicides on Respective Auxin-Resistant Cultivars

Requested Inputs from Committee

6. State Restrictions on Use of Dicamba
7. Possible Classification of Palmer amaranth as Noxious Weed.

Because time was limited only Atrazine (1), Glyphosate (2), the Auxins (5 & 6) and possible Classification of Glyphosate-Resistant Palmer amaranth as a Noxious Weed were discussed. Subsequently Drs. Nichols and Post reported to the SWSS Executive Committee and presented extensively on topics Glyphosate, the Auxins, and the certain actions of the U. S. 9th Circuit Court with respect to the Endangered Species Act. Drs. Nichols and Van Wychen gave tandem reports to the SWSS Business Meeting on sustaining critical herbicide modes of action, and activities of the new administration transition team and possible changes in federal agencies due to the new administration, respectively.

I. Environmental Review of Atrazine.

Atrazine remains one of the most commonly used herbicides in corn (*Zea mays*), the U. S. crop with the largest acreage. Arguably atrazine remains the most cost effective herbicide for corn weed control. Equally important is atrazine's role as a rotation herbicide that controls broadleaf weeds which have escaped, reproduced, and left seed to emerge in the succeeding crop. In this role, atrazine is a critical tool for resistance management for weeds escaping other herbicides, often those that have been used in soybeans and cotton.

Atrazine has low acute toxicity (3090 mg/kg rat) and is not carcinogenic, mutagenic, nor teratogenic, but it is heavily used in certain watersheds in the Mid-West and has been a concern with regard to ground water pollution. Atrazine has been reviewed three times by the Environmental Protection Agency (EPA) since 1985. In this most recent instance, the environmental risk assessment is in progress. Preliminary conclusions could result in significant rate reductions, possibly bordering on abnegating the utility of the herbicide. The Committee acknowledges the key role of atrazine in the overall U. S weed management system and viewed severe limitations on the use of atrazine as a potentially serious consequence for weed resistance management.

II. International Agency of Research on Cancer (IARC) Review of Glyphosate

Glyphosate has long been considered one of the safest herbicides ever synthesized because of its very low acute toxicity (5600 mg/kg rat), and its inactivation upon soil contact. IARC communications infer that the organization is subordinate to the United Nations World Health Organization (WHO) but this is not the case in fact. IARC is an independent, quasi-governmental agency. In March 2015 IARC reviewed glyphosate and found that it was a carcinogen. EPA immediately denounced this finding, as did several other national pesticide regulatory agencies. EPA subsequently convened its Cancer Assessment Review Committee (CARC) to review the information. The committee finished their report by Oct. 2015, but due to internal EPA politics, the CARC report was not released until Sept. 2016. In its final report, the CARC confirmed EPA's initial declaration and found that glyphosate is not a carcinogen (See: https://www.regulations.gov/document?D=EPA-HQ-OPP-2016-0385-0014). This definite finding and IARC's history of declaring substances to be carcinogenic based on slight evidence has cast serious doubt on the credibility of IARC.

III. Registration of New Auxin Herbicide Formulations for Use on Auxin-Resistant Crop Cultivars.

The 2016 growing season was very difficult for soybean (*Glycine max*) growers in the 'Big Rivers' area of southern Illinois, the Boot heel of Missouri, Northeast Arkansas and western Kentucky and Tennessee. In this area, Palmer amaranth *(Amaranthus palmeri*) is resistant to ALS herbicides, glyphosate, and in 2015 resistance to PPO herbicides was found in 15 counties. With such loss of efficacy, glufosinate was the only post emergence herbicide available to control resistant Palmer amaranth in soybeans. In this situation Roundup Ready Xtend® (dicamba – resistant) crop cultivars were released by USDA-APHIS, but no new dicamba product was registered for use on them. Thus the dicamba formulations that were registered and available were not only illegal for use on dicamba resistant cultivars, but were insufficient to minimize post-depositional, off-target movement. Few problems were encountered in the Southeast, where there is a history of avoidance of mid-season use of auxin herbicides because of the proximity of high-value horticultural crops, and low soybean acreage. However, in the upper Delta, where large fields of different row-crops are side-by-side and herbicide resistant pigweed is prevalent, crop injury occurred in Arkansas on at least 200,000 acres of soybeans where formal claims of damage have been filed and with a similar number of official claims filed in Missouri. Claims have also been filed in Tennessee and Mississippi, but on smaller acreage. These reported incidents strongly suggest that there was wide-spread use of inappropriate diglycolamine salt (DGA) formulations of dicamba. EPA enforcement has been active in the Bootheel of Missouri.

In 2017, Dow's 2,4-D choline salt formulation, Enlist Duo®, a pre-mix of 2,4-D and glyphosate received a 5-year registration for use on 2,4-D resistant cultivars of corn, soybean, and cotton (*Gossypium hirsutum*). Monsanto's dicamba for use on dicamba cultivars, Xtendimax® and BASF's new BAPMA dicamba formulation, Engenia®, have received 2-year registrations for use on soybean and cotton. Because of events in 2016, the states of Arkansas, Georgia, Mississippi, and North Carolina have interposed regulations on the use of dicamba on dicamba-cultivars that are more restrictive than those on the respective federal labels. Legislation is pending in Missouri (Feb. 2017)

IV. Listing Glyphosate-Resistant Palmer amaranth as a Noxious Weed

Dr. Van Wychen sought the Committees' guidance on possible declarations by state agencies of glyphosate-resistant Palmer amaranth as a noxious weed. Such a declaration has been made in Delaware where the state Department of Agriculture has apparently been helpful, by visiting growers and helping them formulate management plans. Minnesota and Ohio have also listed Palmer amaranth as a noxious weed, plus included it on their state prohibited seed list. There is interest by other states in the Mid-West and Plains, notably South Dakota, where glyphosate-resistant Palmer amaranth is appearing. Advantages and possible disadvantages were discussed, but the Committee made no recommendation.

Motion to accept all reports; Bob Scott; Don Shilling second; PASSED UNANIMOUSLY

Old Business, Peter Dotray:

None

New Business, Peter Dotray:

None

Motion to adjourn; Gary Schwarzlose; Bob Scott second; PASSED UNANIMOUSLY

SWSS Executive Board Meeting Minutes

Thursday, January 26, 2017

Hyatt Regency – The Wynfrey Hotel – Birmingham, AL

Meeting called to order by President Schwarzlose at 7:16 AM

Attendance

Attendance sheet passed around and signed. Those present included: Gary Schwarzlose, Tom Mueller (for Jim Brosnan), Angela Post, Carroll Johnson, Jason Bond, John Byrd, James Holloway, Matt Goddard, Bob Scott, John Brewer (Grad student rep), Henry McLean (local arrangements Chair, 2018 meeting in Atlanta), Hunter Perry (grad student program chair, 2017 meeting), Tara Steinke, Phil Banks, Peter Dotray, Greg Stapleton, and Joyce Tredaway (local arrangements Chair, 2017).

Scott moved, Johnson seconded to approve agenda distributed by Schwarzlose. Motion Passed (MP).

Annual Meeting Report

Banks gave meeting report. 360 total paid attendance, 8 packets not picked up, attendance over last 3 years is stable. Net contributions to endowment foundation estimated to be $ 12,000. Commented on the several room changes in meeting locations at the meeting, and suggested future local arrangements carefully preview room assignments in printed program.

Local Arrangements Report

Tredaway provided local arrangements report. Meeting went well. Tredaway was commended on job well done, including excellent choices for meal functions. Tredaway suggested minor revision in local arrangements MOP, including need for some assignments, such as “security”.

Graduate Student Program Report

Perry made grad student program report. 72 total contest titles, 37 posters, 35 papers, winners (1^{st} or 2^{nd}) were from 8 different universities. Incoming chair for 2018 = Darren Dodds, vice chair = Charles Cahoon, and second vice chair = Kelly Backsheider (Dupont). Perry suggested that judges breakfast not start as early as this year (6:15 AM), have each student only be allowed to compete in one contest category each year, to augment the website to notify grad students (and possibly advisors) of contest entry status. Goddard suggested that website be enabled to do “batch print” jobs to facilitate judge’s packets assembly.

Bond moved, Scott seconded to accept most recent report. MP.

Manual of Operating Procedures (MOP) Report

Johnson made MOP report. He requested committee chairmans names so he can request MOP changes from them. Johnson plans to update MOP to reflect changes in business manager. Johnson requested a "fresh" or most recent copy of contract with business manager and SWSS for his files. Scott and Holloway suggested SWSS consider changes to the MOP with respect to committee leadership. Johnson requested written proposal from research committee to consider these changes. Post informed Board of Directors (BOD) of intent to propose changes to MOP for Legislative and Regulatory affairs committee.

Goddard moved, Post seconded to accept MOP report. MP.

Schwarzlose lead discussion on letters sent to sustaining members, and requested a copy to BOD, for their information. Holloway requested good information flow with respect to continuity of sponsored awards.

Summer Board Meeting

Dates for summer BOD meeting dates were discussed, first choice = June 20-22, second choice = July 18-20, and third choice = June 27-29. Tara was asked to check with hotel and report to BOD.

Old Business

Endowment committee. Holloway will provide update and change contact person to Brent Sellers (new chairman). Holloway will send thank you notes/letters to sponsors and donors, and also the appropriate tax information for those that donated.

Scott moved, Bond seconded to accept Holloway report. MP.

New Business

Finance report (comments from Dan Stephenson), committee recommended change in annual meeting registration fee. Holloway moved, Byrd seconded to raise normal registration from 275 to 300, and no change in student registration. Discussion occurred with respect to providing other incentives included in registration packet, but final decision was to not formally include in registration packet. MP.

Stephenson also introduced the idea of having financial audit, given the change in business manager. Holloway moved, Dotray seconded to have an external audit of SWSS finances, with the following discussion: Johnson and Steinke to gather more information with respect to need of full audit and possible costs, to have a report to the BOD for the summer meeting, and to have an email vote to approve the cost of the audit, (which may be substantial.) MP.

Steinke reminded all BOD members to "reply all" whenever email votes are tallied to provide full transparency to business conducted via email.

Byrd moved, Johnson seconded to dedicate the 2017 proceedings to Dennis Elmore. MP. Appropriate letters from SWSS president should be sent to Elmore family, etc.

2018 SWSS Program Update

Scott already has 3 possible symposiums proposed. Some discussion ensued about having a function for graduate students on Sunday night of the annual meeting. Several other ideas related to the conductance of the meeting were discussed.

Scott moved, Holloway seconded to authorize travel for Steinke to attend 2017 weeds contest in August in Vero Beach, FL. Steinke will decide if she wishes to travel to this event.

Graduate Student Report

2017 SWSS Graduate Student Organization Report

Hyatt Regency-Wynfrey Hotel, Birmingham, AL

John Brewer, Graduate Student Organization Chair

From the student's point of view, I heard no complaints about the meeting, and felt that all student events went very well. As you know we had a fair turn out by graduate students at the golf tournament this year. Hopefully I can encourage more involvement by the students next year especially if we are able to plan an educational event for that Sunday evening. We had a great turn out for the graduate luncheon, and the food was great. Everyone seemed very engaged during our speaker session, which was given by Dr. Ratliff from Syngenta. He did a great job teaching us about how companies use and implicate the Target Selection Interview process, and ways to better prepare ourselves for this interview style. Dr. James Holloway has already confirmed a speaker for next year's graduate student luncheon. The speaker will be Melinda Sung from the Morgan Stanley Wealth Management company, and she plans to present about financial planning.

During our business meeting, we elected students for four positions. These included Student Program Committee, Herbicide Resistance Committee, Secretary, and Vice-President. The Endowment Committee chair (Zach Lancaster; University of Arkansas) will not be re-elected until the next meeting since it is a two-year term. We also needed to get a new list of university representatives, but unfortunately not every school elected a student for this position, so I am still working on getting a complete list of university representatives.

2017-2018 Student Officers and Committee Chairs

President- John Brewer; Virginia Tech

Email: jbrew10@vt.edu

Vice President- Zach Lancaster; University of Arkansas

Email: zdlancas@uark.edu

Secretary- John Buol; Mississippi State

Email: jtb@msstate.edu

Herbicide Resistance Committee Chair- Savana Davis; Mississippi State

Email: ssd134@msstate.edu

Endowment Committee Chair- Zach Lancaster; University of Arkansas

Email: zdlancas@uark.edu

Student Committee Chair- Brad Wilson; Mississippi State

Email: brw257@msstate.edu

Post moved, Stapleton seconded to accept grad student report. MP.

Bond Moved, Post seconded to adjourn meeting at 9:28 AM. MP

Respectfully submitted,

Tom Mueller.

Meeting Site Selection Committee Report

For the 2019 SWSS annual meeting, Business Manager Phil Banks sent RFPs to hotels in San Antonio, Dallas, Houston, and Oklahoma City. Three properties returned proposals: Marriott Dallas City Center, Hyatt Regency Houston, and Renaissance Oklahoma City. After reviewing these proposals, the Meeting Site Selection Committee unanimously recommended the Renaissance Oklahoma City Convention Center be selected as the meeting site for the 2019 SWSS annual meeting. Dates for the 2019 meeting will be February 3-7, 2019. The date and location can be found on the inside cover of the meeting program. The 2020 annual meeting will rotate back to states in the central portion of the region. The committee recommends Memphis, New Orleans, Lexington, and Knoxville for the 2020 meeting.

Respectfully submitted,

John Byrd, Chair
Luke Etheredge
Timothy Grey
James Holloway
Angela Post
Eric Webster

Necrologies and Resolutions

Report submitted by: David Black

Five necrology reports were submitted, Dr. Theodore Webster, Dr. Harold Ray Hurst, Dr. Carroll Dennis Elmore, Dr. John Baker, and Dr. Henry Palmer Wilson, Jr.

Dr. Theodore "Ted" M. Webster, 46, died February 16, 2016. He was born on September 1, 1969 in Pensacola, FL and grew up in Mentor, OH.

Ted received his undergraduate degree in Agronomy in 1991 and his Masters of Sciences degree in Agronomy in 1993 from Ohio State University, followed by his Ph.D. in Crop Science from North Carolina State University in 1996 under the direction of Dr. Harold Coble. Following completion of his Ph.D., Ted took a Post-Doctoral Research Associate position with Ohio State University, OARDC in Wooster, OH.

Ted began his career with the USDA-ARS in Tifton, GA in 1998 as a Research Agronomist with the Crop Protection and Management Unit focusing on biology and management of difficult to control weeds (e.g. Palmer amaranth, Benghal dayflower, and purple nutsedge). Additionally, Ted was instrumental in research that developed cost-effective alternatives to methyl bromide fumigation in vegetable crop production. Ted's research was the foundation on which many the cost-effective and ecologically responsible management systems for these troublesome weeds are based. Ted was invited to present his findings at several national and international meetings. His research attracted numerous international visitors, including a delegation of the U.N. Methyl Bromide Technical Options Committee and scientists from Australia, Brazil, China, Denmark, England, and Germany.

Ted was an active member of the SWSS and the WSSA, generously volunteering service in numerous capacities for many years. Ted was a prolific and gifted writer. As a M.S. student, Ted's article published in WEED TECHNOLGY was chosen as the outstanding article for that journal in 1994. Ted was elected to serve as Editor of the SWSS Proceedings and during his service he converted publication of the Proceedings to on-line access, which included archiving earlier volumes. Dr. Webster provided an invaluable service to the weed science discipline by coordinating and publishing SWSS Weed Survey annually for 18 years. This survey provided irrefutable documentation of changes in weed species diversity, including the development of Palmer amaranth as the most troublesome weed in multiple cropping systems throughout the southern region. The WSSA benefitted from Dr. Webster's dedication by his long-time service as Associate Editor of the journals WEED SCIENCE and WEED TECHNOLGY.

Dr. Webster was a long standing active member of the SWSS and WSSA.

While Ted's accomplishments and impact as a researcher were stellar, he was civic minded and contributed much to the Tifton community. Ted was Scoutmaster for Troop 62 in Tifton where he had great camaraderie with his scouts and fellow leaders. Ted volunteered time as a local Election Poll Worker. Ted was an active member of New Life Presbyterian Church.

He is survived by his parents Michael Clifford Webster and Janet Lillian Pouttu Webster, his wife Lisa Marie Darragh Webster, two daughters Meagan Elisabeth and Mary Ellen Ida Webster, two sons Jonathan Theodore and Benjamin Vail Webster, one sister and brother-in-law, two nephews, and one uncle.

WHEREAS Dr. Webster served with distinction with the United State Department of Agriculture and,

WHEREAS Dr. Webster provided numerous contributions to weed science and the Southern Weed Science Society,

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

Dr. Harold Ray Hurst, 80, dies March 20, 2016. He was born in 1936 in Coal Hill, AR. Harold began working on his father's small family farm at the age of 9 years old. Harold was the first in his family to earn a college degree, going on to earn his Masters of Science degree from the University of Arkansas followed by his Ph.D. from Kansas State University.

Harold began his career as a weed scientist/plant physiologist with the University of Arkansas Cooperative Extension Service. He then worked for 29 years for Mississippi State University as head of the state weed control research program and assistant superintendent of the Delta Branch Experiment Station (MAFES). Dr. Hurst retired in 2003 as the Coordinator of Field Crop Research for the Delta Branch Experiment Station.

Dr. Hurst was a long standing active member of the SWSS and WSSA.

Harold is survived by his devoted wife of 56 years, Ann Milam Hurst; four children, Michelle Hurst, Melanie Bilyeu, Michael Hurst, and Melissa Hurst; six grandchildren, and five nephews.

WHEREAS Dr. Hurst served with distinction at Mississippi State University and,

WHEREAS Dr. Hurst provided numerous contributions to weed science and the Southern Weed Science Society,

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

Dr. Carroll "Dennis" Elmore, 76, died July 27th, 2016. He was born on April 3rd, 1940 in Clay County, Mississippi. Dennis grew up in eastern Mississippi and graduated from Cumberland High School in Webster County.

Dennis continued his education at Mississippi State University earning his Bachelors' Degree in 1962. After graduation, he served for the United States Army as a Lieutenant at Fort Polk, LA. After his discharge from the Army, Dennis continued his education completing a Masters' Degree from the University of Arizona in 1966 and a PhD from the University of Illinois Urbana-Champaign in 1970.

After completing his PhD, Dennis moved to Leland, Mississippi where he began a 32 year career as a research scientist at the Jamie Whitten Delta States Research Center (USDA-ARS). Dr. Elmore's primary research focussed around plant physiology, genetics, and weed and herbicide applications. His research culminated in several published books and field study guides on morning glories and weeds. Dennis retired from the USDA in 2003, and after his retirement was able to continue his love of learning and teaching by serving as an adjunct faculty at Mississippi Delta Community College at Moorhead and their satellite campus in Greenville, MS. Dennis taught botany and biology at Mississippi Delta CC from 2005 until his death.

Dr. Elmore was a long standing active member of SWSS receiving the Distinguished Service Award in 1983. During his many years of service with the SWSS Dennis served as the editor of the Southern Weed Science Society's Weed Identification Guide.

Dennis is survived by his two brothers and one sister-in-law Glen (Ellen) and Robert Elmore; three daughters, Elizabeth, Anne, and Harriet; one grandson, Peyton (Anne) and one nephew, Christopher (Glen and Ellen). Dennis was preceded in death by his wife, Anne Noble Elmore (2014).

WHEREAS Dr. Elmore served with distinction at Mississippi State University and Mississippi Delta CC and,

WHEREAS Dr. Elmore provided numerous contributions to weed science and the Southern Weed Science Society,

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

Dr. John Bee Baker, 89, died September 21st, 2016. He grew up in Clarksdale, MS where he graduated from high school in 1945 receiving recognition for scholastic achievement. That same year he joined the Navy and was later honorably discharged in July of 1946. Following his military service John pursued his academic career at Mississippi State University where he was a member of many scholastic organizations, honor societies, and was president of Lambda Chi Alpha Fraternity. He graduated from Mississippi State University with a B.S. in Botany. John continued his education at the University of Wisconsin earning a PhD in Plant Physiology.

In 1953, Dr. Baker was hired by Louisiana State University to teach and conduct research on weed control in rice crops in Louisiana and around the world. While living in Baton Rouge, John attended First Methodist Church where he met and married Mildred Myrtle Bullock in May 1956. They made their home in Baton Rouge for the 59 years they were married. They often entertained family and friends, especially graduate students from rice growing countries around the world. He was employed by LSU for 38 years and ended his career as Head of his Department "Plant Pathology".

Dr. Baker was a long standing active member of the WSSA and SWSS, serving as president of the SWSS in 1969 – 1970 and receiving the Distinguished Service Award from the society in 1984. John held many positions of responsibility in organizations related to his field and received countless honors, awards and recognitions for the service he gave to the study of weed science.

John was preceded in death by his wife Myrtle in 2015. John is survived by his daughters Susan Hiemenz and Joan Baker, Susan's husband J.J. Hiemenz, his grandsons, John (wife Amy) of New York, NY and grandson Clark of Baton Rouge.

WHEREAS Dr. Baker served with distinction at Louisiana State University and,

WHEREAS Dr. Baker provided numerous contributions to weed science and the Southern Weed Science Society,

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

Dr. Henry Palmer Wilson, Jr., 74, died January 11^{th}, 2016.

Henry received his BS and Master's degrees from the University of Delaware and PhD in Weed Science from Rutgers University. He began work at the Virginia Truck and Ornamental Research Station, which became the Virginia Tech Eastern Shore Agricultural Research and Extension Center, in Painter, VA. Dr. Wilson was revered by growers and colleagues throughout the region, especially those who worked closely with him on the Eastern Shore. During his tenure at Virginia Tech, Dr. Wilson was the principal or co-principal investigator on more than 130 competitive and non-competitive grants researching new herbicides and herbicide-resistant weeds. He authored or co-authored more than 400 peer reviewed journal articles, extension publications, and abstracts.

Dr. Wilson held officer positions in 16 academic/professional societies, served as President of the Northeast Weed Science Society during 1975-1976, and was the recipient of the 2013 NEWSS Award of Merit. He was also an active member of the Weed Science Society of America, being elected to the society's highest honor, Fellow. After 47 years as a professor of weed science and 13 years as the director of the Eastern Shore A.R.E.C. he retired from Virginia Tech as Professor Emeritus.

He is survived by his wife Shirley Rue Wilson, two children Sara R. Wilson and Brian R. Wilson (wife Maura); a sister, Linda Wilson; a brother, Stephen Wilson and a granddaughter, Lula Wilson

WHEREAS Dr. Wilson served with distinction at Virginia Polytechnic Institute and, WHEREAS Dr. Wilson provided numerous contributions to weed science and the Southern Weed Science Society,

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

End of report

2017 MEETING ABSTRACTS

RAINFASTNESS CHARACTERIZATION OF RINSKORTM ACTIVE, A NEW ARYLPICOLINATE RICE HERBICIDE. D.G. Ouse*[1], M. Morell[1], J.G. Gifford[1], D. Bingham-Burr[2], I. Grijalva[1]; [1]Dow AgroSciences LLC, Indianapolis, IN, [2]Kelly Services, Indianapolis, IN (1)

ABSTRACT

Rinskor™ [Florpyrauxifen-benzyl] is a new arylpicolinate herbicide that offers control of barnyardgrass (*Echinochloa crus-galli*), and the most important sedges and broadleaf weeds in rice. Comprehensive characterization of performance attributes of new herbicides enables accurate positioning in the market. The rainfast period (point at which, after an herbicide application, rainfall does not reduce product performance) is an important attribute. An experiment was conducted applying simulated rainfall of 1.3 cm in 20 minutes to weeds at 0.5, 1, 2, 4, and 6 hours after application (HAA) of the herbicide and compared to treatments with no rain applied after herbicide treatment. Rinskor™ formulated as an emulsifiable concentrate, GF-3206, (30 g ai ha^{-1}) and Rinskor™ + cyhalofop-butyl, GF-3479, (24 + 320 g ai/ha^{-1}) were rainfast on ECHCG (*Echinochloa crus-galli*), CYPDI (*Cyperus difformis*), SEBEX (*Sesbania exaltata*) and AESSE (*Aeschynomene sensitiva*) 1 HAA, 21 days after herbicide application.

EVALUATION OF PETHOXAMID APPLIED ALONE AND AS TANK-MIXTURES IN RICE. J.A. Godwin Jr.*, J.K. Norsworthy, M.H. Moore, N.R. Steppig; University of Arkansas, Fayetteville, AR (2)

ABSTRACT

Due to the evolution of herbicide resistance, chemical control of weed species such as barnyardgrass (*Echinochloa crus-galli*) is becoming more difficult in U.S. rice production. One of the most effective ways to combat herbicide resistance is by alternating effective herbicides with different sites of action (SOA). Currently, no long-chain fatty acid-inhibiting herbicides are labeled for use in U.S. rice production; however, pethoxamid is one such herbicide currently under development. If appropriate rice tolerance and weed control can be established, pethoxamid would represent a unique herbicide SOA for use in U.S. rice. Field trials were conducted in Arkansas in 2015 and 2016 near Stuttgart and in 2016 near Colt and Lonoke to assess the use of pethoxamid applied alone and in combination with other herbicides as a postemergence application. Pethoxamid was applied at 560 g ai ha^{-1} alone and in combination with clomazone, quinclorac, propanil, imazethapyr, and carfentrazone. No rice injury greater than 12% was observed following any treatment assessed, and all treatments resulted in rice yields equivalent to that of the nontreated control as a function of rice injury. Adequate levels of barnyardgrass control were observed even late in the growing season. Barnyardgrass control of 90% or greater was seen 4 weeks after rice flooding for treatments containing clomazone + pethoxamid applied to 1-leaf rice, clomazone preemergence (PRE) followed by (fb) pethoxamid + quinclorac to 3-lf rice, clomazone PRE fb pethoxamid + propanil to 3-lf rice, and clomazone PRE fb pethoxamid + imazethapyr to 3-lf rice. Considering the minimal rice injury and high levels of barnyardgrass control associated with the use of pethoxamid in rice, it appears to be an excellent tool to combat herbicide-resistant barnyardgrass and offer producers a unique SOA in U.S. rice.

INFLUENCE OF HEAT UNIT ACCUMULATION IN COTTON ON SYMPTOMOLOGY AND YIELD LOSS DUE TO SUB-LETHAL RATES OF 2,4-D. S.A. Byrd*[1], G.D. Collins[2], A.S. Culpepper[3], D.M. Dodds[4], K.L. Edmisten[5], D.L. Wright[6], G.D. Morgan[7], P.A. Baumann[7], P.A. Dotray[8], M.R. Manuchehri[9], A.S. Jones[10], T.L. Grey[3], T.M. Webster[11], J.W. Davis[12], W.R. Jared[3], P.M. Roberts[3], J.L. Snider[3], W.M. Porter[3]; [1]Texas A&M University AgriLife Extension, Lubbock, TX, [2]North Carolina State University, Rocky Mount, NC, [3]University of Georgia, Tifton, GA, [4]Mississippi State University, Starkville, MS, [5]North Carolina State University, Raleigh, NC, [6]University of Florida, Quincy, FL, [7]Texas A&M University AgriLife Extension, College Station, TX, [8]Texas Tech University, Lubbock, TX, [9]Oklahoma State University, Stillwater, OK, [10]University of Missouri, Portageville, MO, [11]USDA, Tifton, GA, [12]University of Georgia, Griffin, GA (3)

ABSTRACT

The release of new auxin herbicide technologies in cotton has increased concerns over not just off-target movement, but also over how to estimate cotton yield loss in these scenarios. While numerous studies have evaluated the response of cotton to sub-lethal rates of 2,4-D or dicamba, in regards to both visual injury symptoms and yield loss, relating the two has proved to be a challenge. One of the complications is year to year variability in the magnitude of yield loss from the same location. Because vegetative growth and reproductive development of cotton is governed by heat unit or degree day (DD) accumulation, the environmental conditions following exposure to these herbicides may play a role in how much yield is impacted. Further, these herbicides function by mimicking the auxin hormone that regulates plant growth, which could strongly link the magnitude of yield loss from these herbicides with environmental conditions present after exposure. The objective of this study was to determine the influence of environmental growing conditions on yield loss of cotton following exposure to sub-lethal rates of 2,4-D at various growth stages and locations. Two rates of 2,4-D amine representing 1/21 and 1/421 of the full rate (0.5 kg a.e. ha^{-1}) were applied to cotton at six growth stages: four leaf (4-lf), nine leaf (9-lf), first bloom (FB), and two (FB+2 wk), four (FB+4 wk), and six (FB+6 wk) weeks after first bloom. Locations included Lewiston, NC (2014), Moultrie, GA (2013), New Deal, TX (2013 & 2014), Portageville, MO (2014), Quincy, FL (2014), Snook, TX (2013 & 2014), Starkville, MS (2013 & 2014), and Tifton, GA (2013 & 2014). Management and inputs (irrigation, fertility, etc.) followed local extension recommendations for high-yielding cotton. Season-long heat unit accumulation was utilized to determine if year to year variability in yield response over all 2,4-D rate and growth stage combinations compared to non-treated cotton was a function of growing environment. Accumulation of heat units after 2,4-D exposure occurred was evaluated for each individual treatment to determine if conditions present were more favorable for cotton to recover from 2,4-D exposure in specific instances (locations; years) than others. Seasonal heat unit accumulation exhibited no pattern in regards to yield loss compared to the non-treated check. In fact, similar heat unit accumulation resulted in vast differences in yield loss from location to location. Accumulation of heat units after exposure resulted in similar results, no correlation between the amount of heat units accumulated from exposure to harvest and yield in comparison to the non-treated check. Instead, this showed a strong trend that the largest magnitude of yield loss occurred when cotton was exposed at 9-lf, FB and FB+2 wk at the majority of locations. Similar to visual injury, it appears that growing conditions do not accurately reflect the magnitude of yield loss that could be expected from

cotton following exposure to a sub-lethal rate of 2,4-D. Utilizing a new set of parameters may be necessary if yield loss estimates are needed in instances of off-target movement of 2,4-D in cotton.

OVERCOMING ANTAGONISM IN TANK MIXTURES OF GLUFOSINATE + GLYPHOSATE AND GLUFOSINATE + CLETHODIM ON GRASSES. C.J. Meyer*, J.K. Norsworthy, Z.D. Lancaster, M.L. Young; University of Arkansas, Fayetteville, AR (4)

ABSTRACT

Proper management of glufosinate and the LibertyLink® and Glytol/LibertyLink technology is needed to mitigate the likelihood of resistance evolution. Prior research determined glufosinate antagonizes the activity of both glyphosate and clethodim on annual grasses. However, a more thorough investigation of the effects of tank mix rate structure, and weed species, may have on identification of herbicide interactions is needed. An experiment with a randomized complete block design was conducted at the Arkansas Agricultural Research and Extension Center in Fayetteville, AR in 2015 and 2016 that included three grass weed species: barnyardgrass, large crabgrass, and broadleaf signalgrass. The singe factor, herbicide treatment consisted of glufosinate, clethodim, and glyphosate alone and tank mixtures of glufosinate plus glyphosate or clethodim. Weed control and biomass data were collected 4 weeks after the herbicide application for the three species. Tank mixtures were evaluated for herbicide interactions using Colby's method. When a low rate of glyphosate (867 g ae ha^{-1}) was applied with glufosinate at 451 or 595 g ai ha^{-1}, antagonism was identified for control of barnyardgrass. Increasing the rate of glyphosate to 1735 g ha^{-1} in mixture with glufosinate at 867 g ha^{-1} mitigated the antagonism for banryardgrass control. Antagonism was present for all tank mixtures for control of large crabgrass. For broadleaf signalgrass control, antagonism was identified for two mixtures: glufosinate (451 g ha^{-1}) + glyphosate 1735 g ha^{-1} and glufosinate (535 g ha^{-1}) + glyphosate 867 g ha^{-1}. Therefore, antagonism was identified for both glufosinate + glyphosate mixtures and glufosinate + clethodim mixtures; however, the instances of antagonism were both dependent upon the rates used and the grass weed species in question. Overall, the least instances of antagonism and highest control of all species occurred when the highest rates of both herbicides in a given mixture were used.

PHENOTYPING WEEDY RICE FOR THE DISCOVERY OF DROUGHT AND SUBMERGENCE TOLERANCE FOR THE IMPROVEMENT OF CULTIVATED RICE.

S.D. Stallworth*[1], T. Tseng[2], S. Shrestha[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (5)

ABSTRACT

Over the last 68 years, rice (*Oryza sativa*) production has continued to grow in Mississippi, placing it in fourth place after Arkansas, Louisiana, and California. Approximately 250,000 acres of rice are planted in the Mississippi Delta area each year contributing to more than $130 million to the state's economy. Due to the high economic importance, it is imperative to protect rice from its very competitive neighbor, weedy rice (WR). WR is a noxious weed with increased competition to cultivated rice in the areas of plant height, shatter sensitivity, and panicle length. WR has also proved that it can withstand abiotic stresses such as drought and submergence. Tolerance to the stresses above in WR can serve as genetic sources for the development of drought and submergence tolerant rice cultivars. Fifty-four WR accessions were germinated for approximately 21 days, along with two positive controls, followed by drought conditions for approximately 14 days and submergence conditions for 7 days in the greenhouse. Plant height and injury were recorded weekly for a period of 28 days, and plants were harvested at maturity to determine the yield potential. Results show that some WR accessions were significantly tolerant to submergence and drought stress. These tolerant plants recovered significantly after removing the stress and performed similarly to the non-stressed control plants. These tolerant WR accessions can potentially serve as valuable genetic resources for rice improvement that if achieved, either through conventional breeding or marker assisted breeding, can increase vegetative biomass production.

STAKEHOLDER PERSPECTIVES ON WEED MANAGEMENT ISSUES IN TEXAS RICE. R. Liu*[1], V. Singh[1], X. Zhou[2], J. Samford[2], M.V. Bagavathiannan[1]; [1]Texas A&M University, College station, TX, [2]Texas A&M AgriLife research, College station, TX (6)

ABSTRACT

Weeds present a major constraint to rice production in Texas. To understand the stakeholders' perspectives on weed management issues and research needs in Texas rice, a paper-based survey was carried out in 2015 and 2016, especially targeting rice growers, crop consultants, county extension personnel, and distributors. A questionnaire was designed to acquire specific information on farm size, crop rotation, herbicide program, problematic weed species, and factors that influence weed management decision making in rice. A total of 250 questionnaires were distributed during rice field days that were widely attended by stakeholders in the region. Of the 90 responses received, 72 were complete and usable. Sixty-one out of the 72 respondents were growers, and the rest were extension personnel and distributors.

Results revealed that the average land holding was 814 ha. Barnyardgrass (*Echinochloa crus-galli*), sprangletops (*Leptochloa* Spp.), weedy rice (*Oryza sativa*) and sedges were among the most problematic rice weeds judged by the respondents in both 2015 and 2016. Among the sprangletops, the Nealley's sprangletop (*Leptochloa nealleyi*), a relatively new species to the region, was raised as an emerging concern. Clomazone was the most often used (92%) pre-emergence herbicide, whereas quinclorac (50%) propanil (52%), bispyribac-sodium (48%), and were the important post-emergence herbicides of choice. Most respondents made weed control decisions based on weed problems from previous years (57%), economic threshold (52%), and recommendations from dealers (46%). Sixty-three percent of the respondents expressed moderate to high concern for herbicide-resistant weeds, while the percent of respondents who don't have a concern drop from 10% to 0 from 2015 to 2016. Strategies to manage herbicide-resistant weeds and economical weed management practices were among the top research priorities in the two years. Results of this survey will help direct future research and outreach efforts for sustainable weed management in Texas rice culture.

EVALUATION OF FLURIDONE IN COTTON AND PEANUT. D. L. Teeter*[1], T. A. Baughman[1], P. A. Dotray[2], R. W. Peterson[1]; [1]Oklahoma State University, Ardmore, OK, [2]Texas Tech University, Lubbock, TX (7)

ABSTRACT

Resistant weeds in Southern Great Plains cropping systems have become an increasing issue in recent years. This has resulted in a renewed interest in fluridone as a potential option to control these resistant weeds. Therefore, studies were conducted in Oklahoma and Texas to evaluate peanut and cotton tolerance to 1 and 2X rates of fluridone applied preemergence alone and in combination with other herbicides in cotton and peanut. Cotton was planted at the Oklahoma State University Research Stations near Fort Cobb and Tipton and the Texas Agricultural Experiment Station near Lubbock during the 2016 growing season. Cotton was grown under irrigated conditions at Fort Cobb and Lubbock while being rainfed at Tipton. Fluridone was applied preemergence at 0.168 (1X) and 0.337 (2X) kg ai ha^{-1} alone or in combination with fluometuron at 0.84 (1X) and 1.68 (2X) kg ai ha^{-1}. Peanut trials were conducted near Fort Cobb during the 2015 and 2016 growing seasons. Fluridone was applied preemergence at 0.168 (1X) and 0.337 (2X) kg ai ha^{-1} alone or in combination with flumioxazin at 0.107 kg ai ha^{-1} and metolachlor at 1.42 kg ai ha^{-1}. All treatments were applied with a CO_2 backpack sprayer in 93.457 L ha^{-1}. All trials were maintained weed free and standard production practices used throughout the growing season. Cotton and peanuts were evaluated for visual injury, plant stand counts, and yield; and plant height recorded for cotton.

All treatments injured cotton 10% or less 2, 4, and 8 WAP except for the 2X rate of fluridone + fluometuron at all 3 locations. Late season injury was less than 5% at both Oklahoma locations. Cotton stand counts and heights were not affected by the 1X rate of fluridone applied alone or in combination with fluometuron. The 2X rate of fluridone alone reduced stand counts 2 WAP at Tipton but did not affect stands counts at Fort Cobb or Lubbock. Fluridone + fluometuron applied at the 2X rate reduced cotton stand counts and plant height at both Oklahoma locations but did not affect cotton at Lubbock. Cotton yields were not affected by any treatment in Oklahoma or Texas. Heavy rainfall shortly after planting in 2015, resulting in stand reductions greater than 15% when fluridone was applied at the 2X rate alone and in combination. This was evident even 10 WAP. These same rainfall events contributed to visible peanut injury of at least 10% with all treatments except metolachlor applied alone PRE at 2 and 4 WAP. Peanut injury at 8 and 10 WAP was at least 20% with all 1X fluridone treatments and at least 35% with all 2X treatments. Peanut yields were reduced compared to the untreated control with all fluridone PRE treatments. Peanut stand reduction were less than 5% during the 2016 growing season except with fluridone at 1 or 2X rate plus with metolachlor. Visual peanut injury was less than 10% season long except with fluridone applied alone or in combination at the 2X rate 4 WAP. This injury was 5% or less by late season. Peanut yields were not affected by any treatment in 2016. These trials would indicate that fluridone is safe for use in Southwest cotton. This will potentially add another tool for residual weed management in cotton. Additional studies in peanut need to be conducted to determine if the injury observed in 2015 was likely resulting from heavy rainfall after planting considering the injury and yield results observed in 2016.

EVALUATION OF SOYBEAN TECHNOLOGIES IN OKLAHOMA. T.A. Baughman*, D. L. Teeter*, R. W. Peterson, C.D. Curtsinger; Oklahoma State University, Ardmore, OK (8)

ABSTRACT

The continued development and increase of glyphosate resistant weeds has made the development of new weed control technologies critical. The most troublesome in Oklahoma and other parts of the United States being Palmer amaranth (*Amaranthus palmeri*). To deal with these problematic issue new technologies are currently being developed and evaluated to determine their effectiveness. Studies were established in Oklahoma to compare the new Roundup Ready 2 Xtend soybean technology to the already existing Roundup Ready and Liberty Link technologies. Weed management trials were established during the 2016 growing season at the Oklahoma State University Research Stations near Bixby, Chickasha, Fort Cobb, and Lane. Trials were planted with each of the three soybean technologies. Within each of the three technologies the following herbicide treatment regimens were established: Rowel FX PRE followed by Roundup Xtend (dicamba + glyphosate), Roundup PowerMax, or Liberty EPOST; Rowel FX + Warrant PRE followed by Warrant + Roundup Xtend, Roundup Powermax, or Liberty EPOST; Rowel FX + Warrant + Tricor followed by Warrant Ultra + Roundup Xtend, Roundup Powermax, or Liberty EPOST. Engenia (dicamba) + Roundup Powermax was substituted for Roundup Xtend at Chickasha, Fort Cobb, and Lane. Each of the treatments were visually evaluated for soybean stand reduction and injury and weed efficacy. Soybean were harvested to determine yield at each location with a small plot combine and adjusted to 13% moisture.

Bixby was the only location with soybean injury greater than 5% in the Roundup Ready system with the Rowel FX + Warrant and Rowel FX + Warrant + Tricor PRE mid-season. Palmer amaranth control (AMAPA) was 99% or greater season long at Bixby when Rowel FX + Warrant or Rowel FX + Warrant + Tricor was followed EPOST with Roundup Xtend or Liberty. Late season AMAPA control with Rowel FX followed by Roundup Xtend was 100% compared to 88% when followed by Liberty and 76% followed by Roundup PowerMax. AMAPA control was at least 98% season long at Lane and late season at Chickasha and Fort Cobb. AMAPA was not glyphosate resistant at these locations and populations were low at Fort Cobb and Lane. Large crabgrass (DIGSA) at Fort Cobb was controlled 100% season long. All treatments controlled DIGSA at least 98% late season except Rowel FX followed by Liberty at Lane and any of the PRE herbicides followed by Liberty at Chickasha. All PRE herbicides followed by Engenia + Roundup PowerMax controlled ivyleaf morningglory (IPOHE) at least 98% at Lane and Chickasha. Prostrate pigweed (AMABL) was controlled at least 97% season long with all treatments at Lane. Cutleaf eveningprimrose (OEOLA, *Oenothera lacinata*) control was less than 95% with all treatments late season at Fort Cobb. Carpetweed (MOLVE) control at Fort Cobb was at least 99% season long with all treatments. Soybean yields were increased over the untreated check with all treatments at Bixby, Chickasha, and Lane. The lack of yield response at Fort Cobb was likely due to depredation by deer. Due to the presence of glyphosate resistant AMAPA at Bixby, soybean yields were increased with the Roundup Ready Xtend and Liberty Link systems compared to the Roundup Ready system. These studies indicated that when the Roundup Ready 2 Xtend soybean system is used in combination with a sound preemergence foundation a wide array of weed species can be managed successfully.

EVALUATION OF SORGHUM HERBICIDE PROGRAMS. R.W. Peterson*[1], T.A. Baughman[1], D.L. Teeter[1], P.A. Dotray[2]; [1]Oklahoma State University, Ardmore, OK, [2]Texas A&M AgriLife Research, Lubbock, TX (9)

ABSTRACT

Weed control in grain sorghum can be problematic in the Southern Great Plains without sustaining major crop injury. With herbicide weed resistance on the rise, developing new technologies and using preemergence herbicides is important for successful weed control in the future. Two sorghum weed control projects were conducted during the 2016 growing season at the Caddo Research Station near Ft. Cobb, OK; the Vegetable Research Station near Bixby, OK; the OSU South Central Research Station near Chickasha, OK; and the Texas A&M Research and Extension Center near New Deal, TX to evaluate weed management systems in grain sorghum.

The first trial evaluated the Inzen™ Z herbicide tolerance sorghum system. Inzen Z grain sorghum is being developed with tolerance to the ALS-herbicide Zest (nicosulfuron). Herbicide programs included Cinch (s-metolachlor), Cinch ATZ (s-metolachlor + atrazine) and LeadOff (rimsulfuron + thifensulfuron) applied alone or in combination PRE. Zest + atrazine was applied EPOST or MPOST alone or following the PRE herbicides. At Fort Cobb sorghum injury was less than 10% mid-season for all treatments except Zest + Atrazine EPOST and Cinch ATZ + Zest + Atrazine EPOST. No visible injury was observed late season for with any treatment. Control of Texas millet (PANTE, *Urochloa texana*) was less than 60% for all treatments late season. Zest + Atrazine EPOST was the only treatment that controlled ivyleaf morningglory (IPOHE, *Ipomoea hederacea*) at least 98% late season. Palmer amaranth (AMAPA, *Amaranthus palmeri*) control was 100% late season except with Cinch ATZ PRE alone (75%). Sorghum injury was 5% or less for all treatments season long at Bixby. AMAPA control late season was 99% or greater with all treatments except Cinch PRE followed by (fb) Zest + Atrazine MPOST. Sorghum injury was less than 5% season long for all treatments at Chickasha. Late season AMAPA control was at least 98% for all treatments and johnsongrass (SORHA, *Sorghum halepense*) control was 100% for all treatments except Cinch ATZ PRE and Cinch PRE fb Zest + Atrazine MPOST. All PRE applications controlled large crabgrass (DIGSA, *Digitaria sanguinalis*) 100% 2 WAP (weeks after planting) and at least 90% 4 WAP. Sorghum injury at New Deal was at least 30% for all applications 4 WAP. However, no visible injury was observed late season. PANTE control was 100% late season for all treatments except Cinch ATZ PRE and Cinch ATZ + Zest + Atrazine MPOST. AMAPA control was 96% with Cinch ATZ + Zest + Atrazine EPOST.

The second trial evaluated various preemergence herbicide combinations followed by an application of Clarity (dicamba). The preemergence herbicides included Callisto (mesotrione), Zemax (s-metolachlor + mesotrione), Lumax EZ (metolachlor + atrazine + mesotrione), Verdict (saflufenacil + dimethenamid), Outlook (dimethenamid), Dual Magnum (s-metolachlor), Warrant (acetochlor), and atrazine. All preemergence herbicides containing the active ingredient mesotrione reduced sorghum stands 3 to 10% 2 WAP at Bixby. However, this delay in emergence was not observed 4 WAP. Sorghum injury was 10% or less for all treatments 4 weeks after post treatment (WAPT). However, some brace root fusion and crookneck injury at the base of the plant was observed from the Clarity POST application at Bixby. AMAPA control

was at least 95% with all treatments 4 WAPT. Sorghum injury was less than 5% with all treatments at Chickasha 4 WAPT. AMAPA control was at least 99% with all treatments. Only treatments containing mesotrione controlled DIGSA at least 95% 4 WAPT at Chickasha. No sorghum injury was observed at New Deal 4 WAPT. Only Callisto, Zemax, and Dual Magnum + Atrazine controlled AMAPA at least 80% at New Deal. Continued research is needed in evaluating and developing successful weed management programs for grain sorghum in the Southern Great Plains.

HERBICIDE MIXTURES FOR LATE BURNDOWN APPLICATION IN SOYBEAN. T.L. Phillips*[1], J.D. Peeples[1], H.M. Edwards[1], B.H. Lawrence[1], H.T. Hydrick[2], J.A. Bond[1]; [1]Mississippi State University, Stoneville, MS, [2]Stoneville - Delta Research and Extension Center, Stoneville, MS (10)

ABSTRACT

Herbicide treatments applied when no crop is present are collectively referred to as burndown applications. Typically, burndown herbicide treatments targeting winter annual weeds are applied in late winter or spring prior to planting. Herbicides labeled for spring burndown include POST products such as glyphosate and auxinic herbicides. Protoporphyrinogen oxidase (PPO)-inhibiting herbicides including Valor, Goal 2XL, Sharpen, and Verdict are commonly applied with POST burndown treatments of glyphosate plus an auxinic herbicide to improve weed control. Because these herbicides offer different levels of POST control, research was designed to compare the efficacy of PPO-inhibiting herbicides applied in mixtures with glyphosate and 2,4-D on winter annual weeds.

A study was conducted in 2016 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to compare the efficacy of PPO-inhibiting herbicides applied in mixtures with glyphosate and 2,4-D on annual bluegrass (*Poa annua* L.), lesser swinecress [*Coronopus didymus* (L.) Sm.], and shepherd's-purse [*Capsella bursa-pastoris* (L.) Medik.]. Experimental design was a randomized block design with four replications. Herbicide treatments included Roundup PowerMax (glyphosate) at 0.77 lb ae/A plus 2,4-D Amine (2,4-D) at 0.5 lb ae/A applied alone and in mixtures with Sharpen (saflufenacil) at 0.022 and 0.033 lb ai/A, Verdict (saflufenacil plus dimethenamid) at 0.22 lb ai/A, Valor (flumioxazin) at 0.032 lb ai/A, Goal 2XL (oxyfluorfen) at 0.16 lb ai/A, and Aim (carfentrazone) at 0.023 lb ai/A. All treatments included methylated seed oil at 1% (v/v) plus ammonium sulfate at 2.5% (v/v). A nontreated control was included for comparison. Treatments were applied to weeds <10 inches in height or diameter with a tractor-mounted, compressed-air boom equipped with regular flat-fan nozzles calibrated to deliver 15 GPA. Visual weed control estimates were collected 7, 14, and 28 d after treatment (DAT). All data were subjected to ANOVA with means separated by Duncan's new multiple range test at $P=0.05$.

Roundup PowerMax plus 2,4-D Amine plus Valor controlled more annual bluegrass than all other treatments 7 and 14 DAT. However, annual bluegrass control with all herbicide mixtures was ≥92% 28 DAT. Lesser swinecress control 7 DAT was greater with mixtures including Verdict or Valor compared with Roundup PowerMax plus 2,4-D Amine applied alone or in combination with Goal 2XL or Aim. At 14 and 28 DAT, herbicide mixtures containing Verdict or Valor provided greater control than all other treatments. Lesser swinecress control with Roundup PowerMax plus 2,4-D Amine plus both rates of Sharpen was greater than that with Roundup PowerMax plus 2,4-D Amine alone. The addition of Goal 2XL to Roundup PowerMax plus 2,4-D Amine did not improve lesser swinecress control 14 or 28 DAT. At all three evaluations, herbicide mixtures containing Verdict, Sharpen, or Valor provided greater control of shepherd's-purse than those with no PPO-inhibiting herbicide, Goal 2XL, or Aim. Shepherd's-purse control with treatments including Verdict was similar to that from treatments with both rates of Sharpen 7, 14, and 28 DAT. At 28 DAT, Roundup PowerMax plus 2,4-D Amine

controlled shepherd's-purse as well as all treatments that included a PPO-inhibiting herbicide. The effect of adding a PPO-inhibiting herbicide to burndown treatments of Roundup PowerMax plus 2,4-D varied with PPO-inhibiting herbicide, evaluation interval, and weed species. In fields with dense populations of lesser swinecress, Verdict or Valor could be included with Roundup PowerMax plus 2,4-D Amine to augment POST control. The addition of PPO-inhibiting herbicides to Roundup PowerMax plus 2,4-D Amine would not be beneficial if winter annual weed spectrum was primarily annual bluegrass and/or shepherd's-purse.

WEED CONTROL PROGRAMS WITH ENGENIA IN MISSISSIPPI. M.T. Bararpour*[1], J.A. Bond[2], D.M. Dodds[3], H.M. Edwards[2], B.H. Lawrence[2], A.R. Rhodes[4]; [1]University of Arkansas, Fayetteville, AR, [2]Mississippi State University, Stoneville, MS, [3]Mississippi State University, Starkville, MS, [4]BASF, Madison, MS (11)

ABSTRACT

Widespread glyphosate-resistant (GR) Palmer amaranth (*Amaranthus palmeri*), the most troublesome weed in Mississippi row crop production, has led to a heavy reliance on PRE herbicides in addition to POST residual herbicides in cotton. A field study was conducted in 2016 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate weed control programs with Engenia in Bollgard II Xtendflex cotton. Cotton (DP1522 B2XF) was planted at seeding rate of 3 seeds/ft on May 10, 2016. The study was designed as a randomized complete block with six treatments and four replications. Treatments were as follows: 1) Roundup PowerMax (RPM) (glyphosate) at 1.13 + ammonium sulfate (AMS) at 2.5% v/v at one- to two-leaf cotton; 2) Cotoran (fluometuron) at 1 PRE followed by (fb) Liberty 280 (glufosinate) at 0.53 + RPM + Dual Magnum (*S*-metolachlor) at 1.25 + AMS at one- to two-leaf cotton fb Liberty 280 + Warrant (acetochlor) at 1.13 + AMS at three- to four-leaf cotton; 3) Prowl H2O (pendimethalin) at 0.95 + Cotoran PRE fb RPM + Engenia (dicamba) at 0.5 + Outlook (dimethenamid-p) at 0.56 at one- to two-leaf cotton fb Liberty 280 + Dual Magnum + AMS at layby; 4) Prowl H2O + Cotoran PRE fb RPM + Engenia + Outlook at one- to two-leaf cotton fb Zidua (pyroxasulfone) at 0.08 + Liberty 280 + AMS at layby; 5) Prowl H2O + Cotoran PRE fb RPM + Engenia at one- to two-leaf cotton fb RPM + Engenia at three- to four-leaf cotton; 6) Prowl H2O + Cotoran PRE fb Liberty 280 + Outlook + AMS at one- to two-leaf cotton fb RPM + Engenia + Dual Magnum at three- to four-leaf cotton. A nontreated check was included. Herbicide rates were in lb ai/A, except for Roundup PowerMax and Engenia, which were in lb ae/A.

Cotton injury was 0, 6, 9, 7, 5, and 9% 2 wk after emergence (WAE), and 0, 3, 3, 0, 1, and 4% at 4 WAE from treatments 1 through 6, respectively. There was no cotton injury by 6 WAE. Glyphosate-resistant Palmer amaranth control was 0, 93, 89, 82, 86 and 88% from the application of treatments 1 through 6 at 6 WAE, respectively. Browntop millet (*Urochloa ramose*) was difficult to control. Treatments 1 through 6 provided 0, 91, 89, 74, 71, and 86% control of browntop millet, respectively. There were no differences in ivyleaf morningglory (*Ipomoea hederacea*) control (86 to 90%) among treatments 2, 3, 4, 5, and 6. Roundup PowerMax alone did not provide adequate control of ivyleaf morningglory. Cotton lint yield was 1, 835, 832, 985, 865, and 694 lb/A for treatments 1 through 6, respectively. Weed interference reduced cotton lint yield 99.8% as compared to the treatment with maximum yield (Trt. 4). There were no differences between treatment 2 (without Engenia application) and treatment 4 (with Engenia application) in terms of cotton yield. However, treatment 2 provided better Palmer amaranth and browntop millet control. Treatment 6 (with Engenia application) provided comparable Palmer amaranth and ivyleaf morningglory control and comparable cotton yield as treatment 2 and 4, but it was weak on browntop millet control (71%) compared to treatment 2 (91%). Engenia will provide growers an option to fight GR weeds especially in cotton, but it needs a herbicide partner for grass control.

INFLUENCE OF GLUFOSINATE RATE AND RESIDUAL HERBICIDES IN A SEQUENTIAL POSTEMERGENCE PROGRAM. P.A. Dotray*[1], S. Taylor[2], R. Perkins[3]; [1]Texas Tech University, Lubbock, TX, [2]Texas A&M AgriLife Research, Lubbock, TX, [3]Bayer CropScience, Idalou, TX (12)

ABSTRACT

New dicamba and 2,4-D formulations received federal approval late in 2016 and early in 2017, respectively, for use in new cotton germplasms. Both dicamba-tolerant (Bollgard II XtendFlex™) and 2,4-D-tolerant (Enlist™) cotton germplasms will be tolerant to glufosinate. Neither of the currently approved dicamba formulations (XtendiMax™ with VaporGrip™ and Engenia®) and the 2,4-D formulation (Enlist™ Duo with Colex-D™ Technology) currently allow herbicide tank mix partners. Glufosinate has been shown to be effective on several annual broadleaf weeds including glyphosate-resistant Palmer amaranth, but efficacy is influence by several factors including rate and application timing (weed size). The objective of this research was to evaluate the influence of glufosinate (Liberty 280 SL) rate and sequential application timing on control of Palmer amaranth. Field studies were established at the Texas A&M AgriLife Research and Extension Center at Lubbock and Halfway. Plots, 4 rows by 30 feet, were arranged in a randomized complete block design with 3 or 4 replications. Natural populations of glyphosate-susceptible and glyphosate-resistant populations were present. Glufosinate (Liberty® 280 SL) at 0.58, 0.66, and 0.79 lb ai/A. For each rate, glufosinate was applied early-postemergence (EPOST) followed by (fb) mid-postemergence (MPOST) or MPOST fb late-postemergence. Glyphosate (Roundup PowerMax®) at 1.38 lb ai/A was also applied EPOST fb MPOST. All initial sequential application treatments included acetochlor (Warrant®) at 1.12 lb ai/A. Palmer amaranth control was assessed 2 and 4 weeks after the sequential treatments (WAST). Palmer amaranth was controlled 96 to 99% (Lubbock) and 95 to 100% (Halfway) 2 weeks after the EPOST fb MPOST glufosinate treatments. Delaying the sequential application to MPOST fb LPOST was less effective at controlling Palmer amaranth. Glyphosate EPOST fb MPOST controlled Palmer amaranth 73% (Lubbock) and 58% (Halfway), which was less than glufosinate EPOST fb MPOST regardless of rate. Palmer amaranth was controlled at least 92% at Lubbock and at least 88% at Halfway 4 weeks after the EPOST fb MPOST sequential treatments. Increasing the rate of glufosinate EPOST fb MPOST improved Palmer amaranth control. Delaying the sequential application to MPOST fb LPOST was less effective at controlling Palmer amaranth. Glyphosate EPOST fb MPOST was less effective at control Palmer amaranth than glufosinate EPOST fb MPOST regardless of rate. This is likely the result of glyphosate-resistant weeds present at both locations. Glufosinate will continue to play a role in weed management systems in Texas. It will be most effective when applications are made to weeds less than 3-inches in height. If weeds are too large following the initial glufosinate sequential application, it will be extremely difficult to “catch up” and achieve effective control of this troublesome weed.

POTENTIAL SAFENING OF TOPRAMEZONE ON SEASHORE PASPALUM WITH TRICLOPYR. C.G. Goncalves[1], A.P. Boyd[1], A. Brown[1], J. Harris*[1], J.S. McElroy[1], D. Martins[2]; [1]Auburn University, Auburn, AL, [2]UNESP, Jaboticabal, Brazil (13)

ABSTRACT

Turf managers are searching for new options for the management of bermudagrass invasion of seashore paspalum turf. Due to the limited alternatives available and the high level of aggressiveness of this species as a weed, new findings are important tools for maintaining warm-season turfgrass. As data on suppression of bermudagrass in paspalum turf is limited, an experiment was conducted to determine the bermudagrass control and seashore paspalum turf tolerance for sequential applications of topramezone used alone or combined at different rates with the synthetic auxin herbicide triclopyr. Treatments included two sequential applications of topramezone (0.2086 a.i oz acre^{-1}) and topramezone + triclopyr (0.2086 + 0.616; 0.2086 + 1.232; 0.2086 +2.464; 0.2086 + 4.928 and 0.2086 + 9.856 a.i oz acre^{-1}). Applications of topramezone in combination with triclopyr improved control of bermudagrass (Tifway) and reduced injury to seashore paspalum (Sea Spray) compared to the isolated topramezone application. Although topramezone + triclopyr provided excellent control of bermudagrass, this species is highly aggressive, which allows for rapid regeneration by subterranean regenerative organs. Precise sequential applications to ensure maximum control are essential; however, sequential applications of topramezone + triclopyr may cause injury on seashore paspalum reducing overall quality. Based on this research, future studies should evaluate the combination of topramezone with triclopyr in different cultivars of seashore paspalum and bermudagrass. Applications at different times of the year to ensure the quality and stability of seashore paspalum turfgrass should also be evaluated.

EFFECT OF HERBICIDES AND APPLICATION TIMING UPON WARM AND COOL SEASON NATIVE GRASSES SOWN ON SOUTHEASTERN USA GOLF COURSES.

M.P. Richard*, J. McCurdy, B.S. Baldwin; Mississippi State University, Starkville, MS (14)

ABSTRACT

Research was conducted to evaluate the effects of herbicides and application timing upon warm and cool season native grasses commonly sown on Southeastern US golf courses. The experiment was a completely randomized design (4 replications). Treatments included atrazine (1.12 kg ai ha^{-1}), prodiamine (0.596 kg ai ha^{-1}), dithiopyr (0.56 kg ai ha^{-1}), isoxaben (1.12 kg ai ha^{-1}), pronamide (1.16 kg ai ha^{-1}), pendimethalin (1.66 kg ai ha^{-1}), metolachlor (2.78 kg ai ha^{-1}), simazine (2.24 kg ai ha^{-1}), topramezone (0.037 kg ai ha^{-1}), liquid and granular applied oxadiazon (2.24 kg ai ha^{-1}), indaziflam (0.0327 kg ai ha^{-1}), flumioxazin (0.286 kg ai ha^{-1}), mesotrione (0.28 kg ai ha^{-1}), dimethenamid (1.68 kg ai ha^{-1}), and a non-treated check. Grasses evaluated were *Andropogon gerardii*, *Elymus canadensis*, *Elymus glabriflorus*, *Elymus virginicus*, *Panicum virgatam*, *Schizachyrium scoparium*, *Sorghastrum nutans*, and *Tridens flavus*. Plants were grown in 53 cm^3 conetainers containing native soil. Treatments were applied preemergence and early postemergence (4 weeks after germination). In the preemergence study 10 seed were sown and covered with 14.79 cm^3 (0.6 cm depth) of soil before application. Treatments were applied in a broadcast carrier volume of 374 L water ha^{-1}. Granular oxadiazon was soil applied on an inert carrier. Visual injury was evaluated biweekly. Root and shoot dry mass and germination were recorded 8 weeks after treatment (WAT). Data were subjected to analysis of variance by PROC GLIMMIX and means were separated by adjusted 95% confidence intervals. Data were forced pooled by grass type.

When applied preemergence, dithiopyr, indaziflam, and oxadiazon (except liquid formulation in warm-season grasses) significantly reduced germination in both grass types greater than 35% and up to 55% when compared to the non-treated; while atrazine, simazine, pendimethalin, and prodiamine showed no difference in germination. Germination reduction in warm-season grasses did not exceed 35% which may be acceptable for establishment. Results indicate multiple preemergence herbicides may have utility in native grasses.

At early postemergence timing, atrazine, simazine, dimethenamid, dithiopyr, indaziflam and metolachlor injured warm-season grasses, but ≤35% 6WAT. No root or shoot dry weight reduction was detected in warm-season grasses 8 WAT. At the same timing, atrazine, simazine, indaziflam, pronamide, dimethenamid, and metolachlor injured cool-season grasses greater than 45% and up to 90% 6 WAT. Mesotrione and topramezone were safe across both grass types.

PHENOTYPIC AND GENOTYPIC DIVERSITY OF HERBICIDE TOLERANT TOMATO. G. Sharma*, Z. Yue, H. Yates, C. Barickman, R. Synder, T. Tseng; Mississippi State University, Starkville, MS (15)

ABSTRACT

Solanum lycopersicum, the domesticated species of tomato, are consumed and produced globally. It is one of the economically important vegetable crop worldwide. US ranks 2nd in tomato production worldwide. In commercial production of tomatoes weeds are controlled using herbicides; however, herbicide options are limited because tomatoes are sensitive to most herbicides, one of them being auxin herbicides. Injury on tomatoes from auxin herbicides and glyphosate were shown at rates as low as 0.01X. At present, auxin herbicides and glyphosate have greatest potential of being drifted to tomato plants from adjacent fields, resulting in significant reduction in yield, and plant growth. We conducted a field experiment for characterization of herbicide tolerant lines of tomatoes, selected from our previous greenhouse study. Plants were treated with stimulated drift rates of herbicide one week after transplant, and visual injury was recorded on the scale of 0-100%. Plant height and chlorophyll content was recorded every week since application, for eight weeks, and at harvest, fruit weight was measured for each plant. Also, to look at the genetic diversity we choose 35 accessions from greenhouse study which were classified as tolerant (0-20%injury), intermediate (50-60% injury) and susceptible (100% injury). Twenty SSR markers were used in this study. All 35 lines were clustered based on the estimated genetic distance, and, the genetic diversity analysis was conducted based on the unweighted pair-group method using arithmetic average clustering and principal component analysis. Out of these 20 markers 17 were found to be polymorphic and there were equally diverse among and within. Findings from this study will help understand the level of diversity within and among herbicide-tolerant populations. A highly diverse population of tomato will be a preferred candidate for tolerance screening with additional herbicides, as they will have higher degree of adaptability to herbicide and abiotic stress. These tomato line can be further use in the breeding programs, which will encourage farmers of Mississippi to grow tomatoes

ASCORBATE PEROXIDASE 2 EXPRESSION IN RICE, WEEDY RICE, AND ECHINOCHLOA COLONA IN RESPONSE TO DROUGHT. C. Oliveira*1, D. Benemann1, N.R. Burgos2, D. Agostinetto1; 1Universidade Federal de Pelotas, Pelotas, Brazil, 2University of Arkansas, Fayetteville, AR (16)

ABSTRACT

Stress from drought is largely responsible for loss in world grain production especially in tropical regions. At the molecular level, the response to drought stress is a mutagenic trait. The products of stress-tolerance genes are proteins that directly protect against stress such as the transcription of ascorbate peroxidase 2 (*APX 2*)-encoding genes, which helps in the scavenging of cytosolic H_2O_2. The cytosolic H_2O_2 level is induced by abiotic stress. This study was designed to evaluate the *APX 2* expression in rice, weedy rice, and *E. colona* in response to drought. A greenhouse experiment was conducted in randomized complete design with four repetitions, with a factorial combination of plant x drought treatments. The two factors were: (A) plants: rice, weedy rice, and *E. colona* and (B) water status: without drought and with drought. The plants were established in trays filled with washed sand. Seedlings were transferred to a hydroponic solution 7 d after emergence, in 4-L pots, with 12 plants per pot. Drought stress was imposed 15 d after transplanting by adding 15% p/v polyethylene glycol 6000. Plant leaves were collected 5 d after. The genes selected for expression were the *APX2*, *UBC-E2* (ubiquitin-conjugating enzyme E2), and *UBQ10* (ubiquitin 10); the last two were used as reference genes. The amplification conditions were in accordance with the manufacturer's instructions for the LightCycler 480 system (Roche Applied Science). The relative levels of expression were quantified using the "CT comparison method" and the equation $QR= 2^{-\Delta\Delta CT}$. There was interaction between the species of plants and water conditions for *APX2* gene expression. The *APX2* gene expression was higher in weedy rice than in rice and barnyardgrass, with or without drought stress. Drought stress increased the expression of *APX2* 4-fold in drought stressed weedy rice relative to the control plants. Therefore, the weedy rice ecotype used is expected to be more drought-tolerant than cultivated rice or *E. colona* and its tolerance to drought was primarily endowed by increased *APX2* expression during drought stress.

ROUNDUP READY 2 XTEND SOYBEAN SYSTEMS. S.A. Nolte*; Monsanto, St. Louis, MO (17)

ABSTRACT

Managing tough-to-control and herbicide-resistant weeds economically, has been and continues to be a challenge that soybean growers are faced with. Successful integrated weed management systems require an understanding of crop and weed interactions. Weeds impact soybean yield potential by competing for limited light, water, and nutrient resources. Nearly complete weed control is needed during the first weeks after soybean emergence to avoid potential yield losses due to early emerging weeds. Soybeans are especially sensitive to moisture deficiencies in late summer and even a few large weeds left in the field can severely reduce yield potential. Roundup Ready 2 Xtend® Soybeans is the industry's first biotech-stacked soybean trait with both dicamba and glyphosate herbicide tolerance. Use of the Roundup Ready® Xtend Crop System can help maximize weed control and increase yield potential by enabling the use of multiple modes of action on soybean products built on the high yielding Genuity® Roundup Ready 2 Yield® Soybean technology.

Field studies were conducted in 2016 at 10 Northern and 6 Southern locations across multiple states to evaluate weed control, grain yield and the economic return of three levels of herbicide input within the Roundup Ready® Xtend Crop System as compared with a competitor soybean system. Roundup Ready 2 Xtend® soybeans and LibertyLink® soybeans were planted in a conventional tillage system. The study was a split plot design with the main plot being trait and herbicide input being the subplot. Herbicide input levels were low, medium and high based on the addition of modes of action to the system.

At canopy, regardless of herbicide input level, total weed control was 97% or greater in the Roundup Ready® Xtend Crop System, while in the LibertyLink® system weed control ranged from 80.9 to 96.9% at the low to high input levels. Yield was significantly higher in the Roundup Ready® Xtend Crop System, regardless of herbicide input level, at 71.0-72.4 bu/ac, compared to the LibertyLink® system at 63.1-67.1 bu/ac, in the Norther region. The Roundup Ready® Xtend Crop System also provided significantly greater economic return at the low and high herbicide input levels of 543.7 and 533.8 $/ac, compared to the LibertyLink® system at 481.7 and 476.1 $/ac, respectively in the Northern region. Optimizing profitability and management of tough-to-control and herbicide-resistant weeds can be achieved by selecting a high yield potential soybean product matched to the appropriate weed control program, for weed species present in the field. The Roundup Ready® Xtend Crop System can provide consistent weed control, high yield and maximized profit, while using multiple modes of action and practicing good weed resistance management.

HERBICIDE TIMING FOR TERMINATION OF FAILED CORN STAND. H.M. Edwards*[1], B.H. Lawrence[1], J.D. Peeples[1], T.L. Phillips[1], J.A. Bond[1], B.R. Golden[2]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Stoneville, AR (18)

ABSTRACT

With early planting dates in corn, sub-optimal or uneven emergence could lead to a failed corn stand that requires replanting. Because most corn hybrids now contain the glyphosate, glufosinate, or glyphosate plus glufosinate resistance genes, herbicide options for terminating a failed corn stand are limited. Clethodim (Select Max) or paraquat (Gramoxone 2 SL) can be utilized to terminate corn where soil tillage is not an option due to a previous herbicide application or other factors. When corn germination and emergence are non-uniform, growth stages vary within a single row. This can complicate crop management and will ultimately result in a yield reduction. Therefore, research was conducted to compare the efficacy of clethodim and paraquat for controlling a failed corn stand when applied at two early vegetative growth stages.

The experiment was conducted twice in 2016 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS. Treatments were arranged as a two-factor factorial within a randomized complete block design with four replications. Factor A was herbicide treatment and included no herbicide, clethodim at 0.031 and 0.047 lb ai/A, paraquat at 0.63 lb ai/A, and paraquat at 0.63 lb/A plus atrazine at 0.75 lb ai/A. Factor B was application timing and included spiking (VE) and one-collar (V1) corn growth stages. All clethodim treatments included COC at 1% (v/v), and all paraquat treatments contained NIS at 0.5% (v/v). Control of emerged corn plants was visually estimated 3, 7, 14, and 21 days after each application (DAT) on a scale of 0 (no control) to 100% (complete control). An arcsin-square root transformation did not improve homogeneity of variance, so nontransformed data were used in analyses. Nontransformed data were subjected to the Mixed Procedure with site and replication (nested within site) as random effects. Least square means were calculated and mean separation ($p \leq 0.05$) was produced using PDMIX800.

At 7 DAT, the main effects of herbicide treatment and application timing or their interaction were not significant for control of a simulated failed corn stand. The main effect of herbicide treatment was significant for control of emerged corn 3, 14, and 21 DAT. Pooled across application timings, control of the simulated failed corn stand was 28 to 34% greater 3 DAT with treatments containing paraquat compared with both rates of clethodim. Both rates of clethodim controlled more emerged corn 14 and 21 DAT than paraquat-based treatments. Control of emerged corn with both rates of clethodim was similar 3 and 14 DAT, but clethodim at 0.047 lb/A provided greater control 21 DAT. Only clethodim at 0.047 lb/A controlled the simulated failed corn stand >75% 21 DAT.

The main effect of application timing was significant for control of the simulated failed corn stand 14 and 21 DAT. Pooled across herbicide treatments, control of the simulated failed corn stand was greater when application was delayed until V1 compared with VE applications. Paraquat at 0.63 lb/A controlled more emerged corn when applied to V3 compared with V5 corn. Additionally, control of emerged corn was greater with paraquat plus atrazine at 1 lb/A compared with paraquat alone for applications at V3 but not V5 corn.

No treatment completely controlled the simulated failed corn stand at either application timing. However, by 21 DAT, control of emerged corn with clethodim at 0.047 lb/A was 13 to 35% greater than for all other treatments. Because control 14 and 21 DAT was greater with applications at V1 compared with VE, it is likely that more corn emerged following the VE application and decreased control. Control of emerged corn was ≤75% with V1 applications. Since the corn growing point remains below ground through the V6 growth stage, poor control with V1 applications resulted from regrowth of treated plants. In conclusion, clethodim at 0.047 lb/A was the most effective herbicide treatment for controlling a simulated failed corn stand, and control was less with applications at VE compared with V1.

COMPARISON OF TWO DICAMBA FORMULATIONS FOR RISK OF OFF-TARGET MOVEMENT TO SOYBEAN. G.T. Jones*, J.K. Norsworthy, J.K. Green, C.J. Meyer, N.R. Steppig; University of Arkansas, Fayetteville, AR (19)

ABSTRACT

The diglycolamine (DGA) form (XTendimax with VaporGrip, Monsanto) and N,N-Bis-(aminopropyl) methylamine (BAPMA) form (Engenia, BASF) of dicamba have recently been labeled for over-the-top use in dicamba-resistant soybean and cotton. Engenia is expected to exhibit decreased volatility over DGA dicamba; yet, no peer-reviewed research has been completed to compare the two. A study was conducted in 2015 and 2016 at the Northeast Research and Extension Center (NREC) in Keiser, AR to examine possible differences that these two forms of dicamba may display. DGA (Clarity, BASF) and BAPMA dicamba were applied simultaneously at 560 g ae ha^{-1} in the center of two side by side 8-ha fields to vegetative glufosinate-resistant soybean. Eight transects were established radiating in each cardinal direction from each application area, and plots were established at varying distances along the transect to the field edge. Buckets, 19 L in size, were used to protect plants from primary and secondary drift. On the same day, a rate titration experiment was established encompassing 9 different rates of each formulation. Visual injury measurements from the rate titration experiment were used to perform an Analysis of Covariance (ANCOVA) using SAS. Tissue samples collected at 7 DAA from both DGA experiments suggest that visual measurements of dicamba exposure are more reliable than laboratory methods in detecting the presence of dicamba. From the rate titration experiment, soybean response to DGA and BAPMA dicamba was concluded to be similar. In 2015, an unexpected rain event occurred 6 hours after application which eliminated the chance of further volatility. For this reason, little difference in movement of DGA and BAPMA dicamba was observed. In 2016, the downwind distance to 5% injury via secondary drift from Engenia was decreased by 57 m when compared to Clarity at 21 days after application. Dicamba-resistant soybean and cotton will provide an option for postemergence weed control; however, caution must be taken as this study demonstrates that dicamba formulations differ in risk for off-target movement via secondary drift.

INFLUENCE OF CO_2 LEVELS ON HERBICIDE SELECTIVITY IN RICE. J.P. Refatti*[1], L.A. Avila[1], N.R. Burgos[2], E.R. Camargo[1], J.I. Oliveira[1]; [1]UFPel, Pelotas, Brazil, [2]University of Arkansas, Fayetteville, AR (20)

ABSTRACT

Consumption of fossil fuels, the burning of forests, and industrial activities have contributed to the increasing CO_2 concentration in the atmosphere. High level of CO_2 can affect physiological processes and growth of cultivated and weedy plants. Responses to CO_2 vary among species and may affect the selectivity of herbicides. The objective of this study was to evaluate the response of rice to atmospheric CO_2 concentration and herbicides. An experiment was conducted in 2015, in a growth chamber with two CO_2 concentrations. Light duration was set at 14 hours, humidity was 70 %, and night/day temperature was at 25/32 ^{o}C. The experimental units were composed of 800-mL pots filled with field soil, planted with 5 seeds of rice 'Pampa/EMBRAPA'. The experimental units were arranged in a completely randomized design with four replications in a factorial arrangement of treatments. Factor A was atmospheric CO_2 concentration [400 ± 40 ppm (current level) and 700 ± 40 ppm (projected level in 2100)]. Factor B was herbicide [metsulfuron-methyl (2.4 g ai ha^{-1}), saflufenacil (147 g ai ha^{-1}), quinclorac (375 g ai ha^{-1}), bispyribac-sodium (50 g ai ha^{-1}), penoxsulam (60 g ai ha^{-1}) and no herbicide (control)]. Antioxidant activities [catalase (CAT), ascorbate peroxidase (APX), superoxide dismutase (SOD)], content of hydrogen peroxide (H_2O_2), and lipid peroxidation were assayed 10 days after application. Lipid peroxidation activity was determined indirectly by measuring malondialdehyde (MDA) content. Total protein content and plant height were also recorded. The increase in atmospheric CO_2 concentration did not affect SOD activity and total protein contents, but increased CAT and APX activities. The APX activity was lower in plants treated with quinclorac, regardless of CO_2 concentration. Rice grew better in elevated concentration of CO_2 regardless of the herbicide used. High CO_2 concentration did not impact the selectivity of herbicides on rice.

COMPARISON OF ONE- AND TWO-PASS WEED MANAGEMENT PROGRAMS IN CORN. D. Stephenson*[1], B.C. Woolam[1], T.B. Buck[2]; [1]LSU AgCenter, Alexandria, LA, [2]LSU AgCenter, Baton Rouge, LA (21)

ABSTRACT

Research was conducted at the LSU AgCenter Dean Lee Research and Extension Center near Alexandria, LA in 2015 and 2016 to compare one-or two-pass weed management programs in corn. One-pass programs included either a PRE or POST herbicide application, while a two-pass program consisted of a PRE followed by a POST herbicide application. Experimental design was a factorial arrangement of PRE and POST herbicide treatments in a randomized complete block design with four replications. PRE treatments evaluated were atrazine:mesotrione:*S*-metolachlor at 1.46:0.19:1.46 kg ai ha^{-1}, saflufenacil:dimethenamid-P at 0.07:0.62 kg ai ha^{-1}, pyroxasulfone + atrazine at 0.15 + 1.68 kg ai ha^{-1}, and no PRE. POST treatments included glyphosate:mesotrione:*S*-metolachlor + atrazine at 1.05:0.11:1.05 + 1.12 kg ae or ai ha^{-1}, glyphosate + thiencarbazone-methyl:tembotrione + atrazine at 0.86 + 0.01:0.08 + 1.12 kg ae or ai ha^{-1}, glyphosate + pyroxasulfone + atrazine at 0.86 + 0.09 + 1.12 kg ae or ai ha^{-1}, and no POST. Visual evaluations of barnyardgrass, entireleaf morningglory, hemp sesbania, prickly sida, and sicklepod control were recorded just prior to POST application and 28 d after POST application. Yields were collected at harvest and adjusted to 15% moisture prior to analysis.

Just prior to the POST application, all PRE treatments provided greater than 90% weed control. Barnyardgrass and hemp sesbania control following saflufenacil:dimethenamid-P PRE alone was 89 and 94% 28 d after POST application, respectively, which was less than all other treatments. The one- or two-pass programs controlled all weeds at least 89% 28 d after POST application. Corn yields did not differ among herbicide treatments and the nontreated, with yields ranging from 12,140 to 12,640 kg ha^{-1}. In these experiments, weed control was excellent and did not differ between one- and two-pass programs. However, the lack of yield differences between the treated and nontreated in both years peaked our interest. In Louisiana, corn is historically planted in early- to mid-March and summer annual weeds typically begin to emerge in mid-April. Seeding corn 4 to 6 wk prior to summer annual weed emergence could potentially allow corn to reach a growth stage beyond the critical period for weed control, thus avoid yield reduction via early-season crop/weed competition. In these experiments, poor weed densities were not an issue with densities ranging from 5 to 20 m^{-2} for all weeds evaluated. Even in light of this scenario, corn producers will be advised to apply a herbicide, but application timing can depend upon their farming practices if corn is seeded in normal planting window for Louisiana.

COMMON RICE HERBICIDE TANK MIXTURES FOR FLATSEDGE CONTROL. R.R. Hale*, J.K. Norsworthy, J.A. Godwin Jr., M.L. Young, M.H. Moore; University of Arkansas, Fayetteville, AR (22)

ABSTRACT

Rice flatsedge [*Cyperus iria* (L.)] is a common weed found in Midsouth rice production, but heavy reliance of using acetolactate synthase-inhibiting herbicides for control has led to resistant biotypes. Additional modes of action (MOA) must be used to slow the spread of such herbicide-resistant weeds. In 2014, saflufenacil was labeled for use in rice for preplant, preemergence, or postemergence applications to help control problematic weeds. Saflufenacil exhibits good control of rice flatsedge when plants are small (<8 cm) in height. However, the addition of a graminicide or other herbicide to the tank mixture with grass activity will be needed to control grasses that are likely present within the same field. Field studies were conducted in 2015 and 2016 to examine the influence of application timing on the control of rice flatsedge by various tank-mixes including saflufenacil at the Pine Tree Research Station near Colt, AR, and the Rice Research and Extension Center near Stuttgart, AR. Application timings included pre-flood (PREFLD), 2 weeks after flooding (2 WAF), and 4 weeks after flooding (4 WAF). Herbicides consisted of quinclorac, cyhalofop, propanil, and fenoxaprop. A nontreated control was included in each study. Herbicides were evaluated for efficacy alone and in combination with saflufenacil. At 2 to 3 weeks after treatment (WAT) and 4 to 5 WAT, significantly greater control was observed when saflufenacil was included in the tank mixture, except propanil. By 4 to 5 WAT, the addition of saflufenacil with cyhalofop or fenoxaprop provided significantly greater control. Based on these results, adding saflufenacil may be a viable tank-mix partner for additional control of rice flatsedge.

OPTIMIZING THE EFFICACY OF BENZOBICYCLON BY TANK-MIXING WITH OTHER POSTFLOOD HERBICIDES. M.L. Young*[1], J.K. Norsworthy[1], R.C. Scott[2], R.R. Hale[1], M.R. Miller[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (23)

ABSTRACT

Due to the repetitive use of the same herbicide sites of action (SOA) in rice, many weeds have evolved resistance. Growers need to integrate multiple SOA in herbicide applications by tank-mixing herbicides for effective weed control. Benzobicyclon is a new post-flood herbicide being developed by Gowan Company that is expected to be commercially available in 2018. A Group 27 herbicide, benzobicyclon will offer a new SOA to rice producers in the U.S. Research evaluating benzobicyclon in combination with other post-flood herbicides has yet to be conducted. Field experiments were conducted in 2016 at the Pine Tree Research station near Colt, AR and at the University of Arkansas Pine Bluff Farm near Lonoke, AR to evaluate benzobicyclon at 247 g ai ha^{-1} tank-mixed with other post-flood herbicides. The addition of benzobicyclon at 247 g ha^{-1} to other post-flood herbicides generally increased control of barnyardgrass (*Echinochloa crus-galli*) and sprangletop spp. (*Leptochloa* spp.). Benzobicyclon at 247 g ha^{-1} added to halosulfuron at 53 g ha^{-1} resulted in increased control of barnyardgrass at Pine Tree. The addition of benzobicyclon at 247 g ha^{-1} to other post-flood herbicides like, halosulfuron at 53 g ha^{-1}, imazamox at 45 g ha^{-1}, and cyhalofop 280 g ha^{-1} resulted in increased control (>90%) of sprangletop spp. at both locations in 2016. Based on these findings, the addition of benzobicyclon to other post-flood herbicides will broaden and improve spectrum of weed control in U.S. rice.

POSTEMERGENCE PREMIX OF *S*-METOLACHLOR, ATRAZINE AND MESOTRIONE IN COMBINATION WITH METRIBUZIN FOR FALL PANICUM CONTROL IN SUGARCANE. D. Odero*, J.V. Fernandez; University of Florida, Belle Glade, FL (25)

ABSTRACT

Field studies were conducted at the Everglades Research and Education Center in Belle Glade, Florida, in 2016 to evaluate crop safety and efficacy of postemergence mesotrione, the premix of *S*-metolachlor + mesotrione + atrazine, and tank-mix partners (metribuzin, 2,4-D amine, ametryn) on fall panicum control. The fields were a second ratoon 'CP 96-1252' and 'CP 88-1762' sugarcane with heavy infestation of fall panicum. The premix of *S*-metolachlor + mesotrione + atrazine (3.25 qt/A) and mesotrione (3 fl oz/A) were applied alone or in combination with metribuzin (2-4 pt/A), ametryn (0.25 lb/A), or 2,4-D amine (2 qt/A). Asulam at 8 pt/A was included as a standard treatment for fall panicum control. There were no varietal differences with regard to sugarcane injury. Tank-mixing mesotrione or *S*-metolachlor + mesotrione + atrazine with metribuzin at 4 pt/A resulted in 14 to 18% and 6 to 10% injury at 7 and 21 days after treatment (DAT), respectively. Similar tank-mixes with metribuzin at 2 pt/A resulted in up to13% injury at 7 DAT and <8% injury at 21 DAT. *S*-metolachlor + mesotrione + atrazine applied alone resulted in <3% injury at 7 DAT and no injury was observed at 21 DAT. Tank-mixing *S*-metolachlor + mesotrione + atrazine with 2, 4-D amine resulted in the highest injury with differences in level of injury depending on the adjuvant. Use of crop oil concentrate resulted in more injury (35% at 7 DAT and 24 to 28% at 21 DAT) compared to the nonionic surfactant (21% at 7 DAT and 9 to 20% at 21 DAT). Injury from asulam was 11 to 13% at 21 DAT. Overall, injury was transient and was not observed at later ratings (from 49 DAT). The initial injury was probably exacerbated by dry and warm conditions prior to and immediately after herbicide application. Tank-mixing mesotrione or *S*-metolachlor + mesotrione + atrazine with metribuzin (4 pt/A) resulted in 77 to 88% fall panicum control at 77 DAT compared to 90% control provided by asulam. In contrast, the tank-mix (mesotrione or *S*-metolachlor + mesotrione + atrazine) with the lower rate of metribuzin (2 pt/A) provided <30% fall panicum control at 77 DAT suggesting an additive effect from the higher rate of metribuzin. Addition of crop oil concentrate to *S*-metolachlor + mesotrione + atrazine plus 2,4-D amine resulted in better fall panicum control (up to 77% at 77 DAT) compared to the tank-mix with the nonionic surfactant (0 and 15% at 77 DAT). Also, the tank-mix of *S*-metolachlor + mesotrione + atrazine with ametryn did not provide any residual fall panicum control (0% control at 77 DAT). The results show that tank-mixing *S*-metolachlor + mesotrione + atrazine or mesotrione with metribuzin (4 pt/A) provided fall panicum control which was not significantly different from asulam at 8 pt/A from 21 to 77 DAT.

RESPONSE OF COASTAL BERMUDAGRASS TO SELECTED LOW USE RATES OF GLYPHOSATE. M.W. Marshall*, C.H. Sanders; Clemson University, Blackville, SC (26)

ABSTRACT

Selective control of weedy grasses in warm season grass forages is often challenging with few herbicide options. For many years, imazapic has been the standard for selective control of many annual and perennial weedy grasses including crabgrass, vaseygrass, and dallisgrass in bermudagrass. However, imazapic can be highly injurious to bermudagrass resulting in lower forage production after application. Pastora (a premix of metsulfuron and nicosulfuron) was recently labeled for bermudagrass hayfield and pastures and provides control of common grassy weeds, especially annual sandburs. However, for optimum control, annual sandburs need to be treated with Pastora at the 2-3 leaf stage. Tank mixing a low-rate of glyphosate with Pastora provides increased control of larger annual sandburs (>3 leaf) when growers tend to notice presence of this weed in their forage crop. However, crop response to glyphosate in this tank mix combination has not been characterized. The objective of this experiment was to quantify coastal bermudagrass crop response to different rates and combinations of glyphosate at 2,4,6,8, and 10 oz/A alone and in combination with Pastora at 1.0 oz/A. A commercial check of Impose at 6 oz/A was included as a comparison. Field experiments were conducted at Edisto Research and Education Center (EREC) located near Blackville, SC. An established coastal bermudagrass 'TIF 85' field was clipped approximately 4 weeks prior to initiation of this study. Experimental design was a randomized complete block design with six replications. Postemergence herbicide treatments were applied in water on August 24, 2016 and study was repeated on another site on September 26, 2016. Percent bermudagrass injury was evaluated at 2 and 4 weeks after treatment (WAT). Bermudagrass regrowth biomass was collected using a 1.5 ft2 quadrat at 4 WAT (2 subsamples per plot). Percent bermudagrass injury and regrowth biomass were analyzed using ANOVA and means separated at the $P = 0.05$ level. Bermudagrass injury increased significantly as the rate of glyphosate applied alone went from 4 oz/A to 10 oz/A. A similar pattern was observed in the tank mixture of Pastora plus glyphosate (Figs. 1 and 3). The untreated bermudagrass yield was significantly higher in both studies at 4629 and 4065 lb/A compared to the herbicide treated plots. Bermudagrass yield was higher in treatments where the glyphosate rate was 4 oz/A; however, the Pastora plus glyphosate (regardless of rate) tank mixture yields were more variable (with overall trend of decreasing yield with higher rates of glyphosate). Overall, Bermudagrass productivity was impacted by use of low rates of glyphosate; however, presence of grassy weeds, including sandburs can have greater impact of profitability of forage Bermudagrass.

EVALUATION OF SPOT SPRAY OPTIONS FOR RESISTANT PALMER AMARANTH.

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ABSTRACT

In 2016 a trial was conducted to evaluate spot spray options to control glyphosate- resistant Palmer Amaranth at different plant sizes. This trial was conducted at the University of Arkansas Lon Mann Cotton Research Station in Marianna Arkansas and was arranged in a randomized complete block design with 6 by 10-foot plots. This trial was conducted in a non-crop situation to avoid potential crop injury on a Calloway silt loam soil. Treatments were applied using a compressed air broadcast backpack sprayer with 11002 Greenleaf Air-Mix nozzles on 19-inch spacing utilizing 20 GPA carrier volume. Data was analyzed using Fisher's protected LSD at $P \leq 0.05$ for significance to separate treatment means. Natural glyphosate-resistant Palmer amaranth (*Amaranthus palmeri)* populations were flagged in each plot to represent 2, 5,8,12, and 18-inch plant sizes. Visual assessment of control was taken at 1, 2, and 3 weeks after treatment (WAT) using a scale of 0% (no control) to 100% (complete plant death). Herbicides and rates utilized in this study were glufosinate at 0.78 lb ai/A and 1.34 lb ai/A, paraquat at 1.12 lb ai/A, paraquat at 0.75 lb ai/A plus prometryn at 1 lb ai/A, dicamba at 0.5 lb ai/A, and at 1lb ai/A. All treatments controlled two-inch Palmer Amaranth 100% at three weeks after application. At 3 WAT paraquat alone and paraquat + prometryn provided above 85% control over all stages of Palmer Amaranth. glufosinate provided above 50% control through all stages of Palmer Amaranth, with the 1.34 lb. ai/A rate providing 60% or more control. Only 65% or less of Palmer Amaranth was controlled with either rate of dicamba on weeds 5 inches or taller. Overall, paraquat and paraquat + prometryn produced the greatest Palmer amaranth control, over a range of sizes. Generally, control declined more rapidly with dicamba at both a low and high rate compared to other herbicides. Due to crop sensitivity more evaluations of herbicides for in crop applications are needed for it to be a viable weed control option.

PALMER AMARANTH MANAGEMENT MODEL (PAM): A USER-FRIENDLY DECISION SUPPORT TOOL. M.V. Bagavathiannan*[1], K. Lindsay[2], M. Lacoste[3], M. Popp[2], S. Powles[3], J.K. Norsworthy[2]; [1]Texas A&M University, College Station, TX, [2]University of Arkansas, Fayetteville, AR, [3]University of Western Australia, Perth, Australia (28)

ABSTRACT

Palmer amaranth is among the most problematic weeds infesting row-crop production fields in the Southern US. Various best management practices (BMPs) encompassing diverse chemical and non-chemical strategies have been developed by University researchers and extension specialists. To disseminate these BMPs, a user-friendly decision support tool was developed using the Microsoft Excel® platform. This tool provides a real-time simulation of Palmer amaranth soil seedbank size and economic returns over a 10-year period. The user can build a crop production and weed management strategy that fits his/her operations, and evaluate its impact on long-term population dynamics of Palmer amaranth and overall profitability. Number of Palmer amaranth escapes present for each cohort and for each management timing is automatically generated for the user to review in the same window, to facilitate the selection of alternative management options accordingly. The model performs comparative economic analysis, using crop budgeting and discounting methods to compare profitability among various strategies for the user-specified crop and weed management options. Additionally, a herbicide resistance risk tool bar has been integrated within the model. This tool simulates overall risk associated with the host of management options selected by the user and provides feedback on strategies that could be followed to reduce risk of resistance. The tool also allows for visual comparison of two selected strategies side-by-side and export results into most commonly used file formats. Integration of the Visual Basic interface provides this tool a software-like appearance. The model development has been complete and is currently used in outreach activities. This tool is now available for download from http://agribusiness.uark.edu/decision-support-software.php#PAM.

LABORATORY METHODS FOR DETERMINING VOLATILITY POTENTIAL OF HERBICIDES. D.G. Ouse*, J.G. Gifford, M. Li, S. Wilson, F. Tu, C. Jennings, S. Annangudi, I. Grijalva; Dow AgroSciences LLC, Indianapolis, IN (29)

ABSTRACT

A method was developed to quantify volatility of 2, 4-D and dicamba acids. Compressed air, an air pressure regulator, a pressure relief valve and air flow gauges (Dwyer Instruments Inc. Hwy 210 E, Fergus Falls, MN 56537, Model No. RMB-53D-SSV) were used to deliver uniform air flow through polycarbonate aquariums that contained treated plants. Aquariums dimensions measure 24.5 cm wide by 38.5 cm long by 49.5 cm tall for a total volume of 0.047 m^3. Air sampling tubes (SKC Inc. 863 Valley View Road Eighty Four, PA 15330, Catalog No. Xad-2 OVS) were inserted through a hole in the lid of the aquarium and connected to a vacuum line. A rubber stopper with a hole for the vacuum line was fitted into the lid to seal the inlet hole for the sampling tube. Each sampling tube was calibrated using an adjustable low flow tube holder (SKC Catalog No. 224-26-01) to set air flow to 1 liter / minute. An airflow rate of 20 liters / minute through each aquarium eliminated issues of condensation inside the aquarium, sampling tubes and vacuum lines. Several aquariums were placed in a growth chamber where temperature was controlled. This method allows for comparison of treatments without the concern of cross-contamination since airflow into the aquariums is supplied from a remotely located air compressor. The 2, 4-D acid or dicamba acid in the vapor phase was captured in the SKC sampling tubes. Tubes were changed every 24 h for 4 days and frozen after collection. Sampling tubes were later extracted with 10 ml of methanol for 2 hr. During the extraction process all of the internal contents of the tubes were expelled into a glass vial with disposable wooden dowels. Quantification of 2, 4-D acid or dicamba acid was determined using LC / MS-MS with sensitivity limit of 5 ppb. Data are presented as a percent of herbicide applied by calculating the amount of herbicide applied to the surface area treated. Using this method the cumulative volatility over 4 days of 2,4-D choline was determined to be about 10-fold lower than the volatility of 2,4-D dimethylammonium. This method has provided repeatable results with standard deviation of $\leq$ 0.15 % of herbicide applied. Previous volatility research using humidomes allowed comparison between formulations using injury on sensitive crops as a bio-indicator of volatility. This method allows for the quantification of volatility over time and a means to compare formulations with quantative data.

EFFECTS OF SUB-LETHAL DICAMBA RATES APPLIED TO SOYBEAN CULTIVARS DURING THE REPRODUCTIVE STAGE. A. Growe*, W.J. Everman; North Carolina State University, Raleigh, NC (30)

ABSTRACT

Dicamba-tolerant crop varieties have the potential to become utilized in North Carolina as a tool to control glyphosate-resistant weeds. Current soybean cultivars, commonly glyphosate or glufosinate-resistant varieties, are highly susceptible to dicamba, and there is growing concern of off-site movement of this broadleaf herbicide to sensitive cultivars. Tank contamination, wind drift, and volatility of dicamba can cause injury and reduce soybean yields. To date, there has been little information reported on soybean varietal responses to sub-lethal doses of dicamba.

The objective of this study was to evaluate the effects of sub-lethal rates of dicamba on five maturity group V and five maturity group VI soybean cultivars at the reproductive growth stage. Effects of dicamba were determined by collecting visual injury ratings, height reductions and yield. Experiments were conducted in Lewiston-Woodville, Kinston, and Rocky Mount, North Carolina during 2015 and 2016. Five soybean varieties were treated with dicamba at 1.1, 2.2, 4.4, 8.8, 17.5, 35, and 70 g ae ha (1/512 to 1/8 of the labeled use rate for weed control in corn) during the R2 growth stage. Experiments were conducted using a factorial arrangement of treatments in a randomized complete block design, with two factors being dicamba rate and soybean cultivar. All data were subjected to analysis of variance and means were separated using Fisher's Protected LSD at p= 0.05.

Analysis showed a wide range of visual injury and height reduction 2 and 4 WAT for all 10 varieties. Higher levels of height reductions and injury were associated with increasing dicamba rates. When data was pooled across all soybean varieties in each maturity group, height reductions 4 WAT ranged from 2-35% and 4-30% for maturity group V and VI respectively. Injury 2 WAT ranged from 20-65% for group V and 18-67% for group VI soybeans. For all trials, yield was reduced by 8% or more when soybeans were treated with 4.4 g ae ha^{-1} of dicamba. Statistical analysis revealed a location and variety interaction for height reductions and yield. This data suggests the potential for a varietal response to sub-lethal rates of dicamba.

CHARACTERIZATION OF ROADSIDE FERAL SORGHUM POPULATIONS IN SOUTHERN TEXAS: IMPLICATIONS FOR NOVEL TRAIT MANAGEMENT. S. Ohadi*, W. Rooney, M. Bagavathiannan; Texas A&M University, College Station, TX (31)

ABSTRACT

Feral forms of cultivated crops can exchange alleles with compatible relatives within agricultural landscapes and may contribute to the escape and spread of novel transgenic traits. They can give rise to nuisance weeds through hybridization with their congener weeds or rapid dedomestication. Sorghum (*Sorghum bicolor*), a major crop in Texas, has a high propensity to become feral in roadsides and other habitats once escaped out of cultivated fields. Feral sorghum populations can outcross with Johnsongrass (*S. halepense*), a weedy relative of cultivated sorghum, which is known to occur frequently in roadsides. To understand the extent of ferality in sorghum, we conducted a roadside survey in South Texas comprising of Upper Gulf Coast, Coastal Bend and Rio Grande Valley regions in fall 2014. A total of 2077 sites were visited and the presence/absence of feral sorghum and johnsongrass was recorded. Seed samples were also harvested for further characterization. For each sampled site, nearby land use, road type and distance to grain facilities were recorded and their relationships with the presence of feral sorghum was investigated using generalized linear models. To examine the evidence of hybridization, seeds collected from feral sorghum were grown in the greenhouse and tested for their ploidy level, assuming hybrids deviate from diploid. Feral sorghum and Johnsongrass were found in 17 and 45% of the surveyed locations, respectively but the two species co-located at only 48 (2%) sites. The probability of finding feral sorghum was lower in the presence than in the absence of Johnsongrass. The presence of feral sorghum was positively related to sorghum cultivation in the nearby fields, but not to the road type and distance to the grain facilities. These results suggest that the persistence of feral sorghum largely depends on a continued supply of seed from an adjacent field. Sporadic drops from passing vehicles will not likely result in self-sustaining feral populations. Preliminary findings of the flow cytometry analysis showed that all plants tested were diploid implying that intergeneric hybridization until in vivo systems is rare. More research is currently underway to fully characterize the phenotype and genotype of different feral sorghum populations.

IMPACT OF ACTIVATED CHARCOAL ON HERBICIDE INJURY IN VEGETABLE CROPS. V. Singh*[1], J. Masabni[2], P. Baumann[1], T. Isakeit[1], M. Matocha[1], T. Provin[1], K.H. Carson[1], R. Liu[3], M. Bagavathiannan[1]; [1]Texas A&M University, College station, TX, [2]Texas A&M University, Overton, TX (33)

ABSTRACT

A greenhouse study was conducted to evaluate the effect of activated charcoal on soil residual activity of the herbicides aminopyralid, aminocyclopyrachlor, and picloram, applied at recommended field rates of 120 g ae, 70 g ai, and 303 g ai ha^{-1} respectively, on tomato, okra, and cantaloupe. A non-herbicide applied check was included for comparison. A commercial source of activated charcoal was used at four rates [0, 0.5, 1, and 2X (1X = 336 kg ha^{-1})]. The experiment was arranged in a factorial (three factors: herbicides-4 levels, activated charcoal-4 levels, crop species-3 levels) completely randomized design with eight replications and two independent experimental runs. When no activated charcoal was applied, aminopyralid caused the greatest injury to tomato and okra, leading to plant death at 4 weeks after emergence/ transplanting (WAE/T). At the 2X activated charcoal rate, crop injuries due to aminopyralid were reduced by 72 and 78% respectively for okra and cantaloupe at 4 WAE, while tomato did not respond to the 2X rate. A lower rate of activated charcoal (0.5X) was sufficient to reduce more than 70% of the injuries caused by aminocyclopyrachlor on cantaloupe and okra. With 2X rate of activated charcoal, picloram injuries were reduced by 78-94% across the three crop species investigated. Results show that activated charcoal application can greatly reduce herbicide carryover effects, but effective application rates will vary depending on the crop species and herbicide in question.

IMPACT OF LONG-TERM TILLAGE PRACTICES ON WEED POPULATION DYNAMICS IN A CONTINUOUS SOYBEAN PRODUCTION SYSTEM IN CENTRAL TEXAS. P. Govindasamy*, J. Mowrer, T. Provin, F.M. Hons, M. Bagavathiannan; Texas A&M University, College Station, TX (34)

ABSTRACT

Conservation tillage systems are shown to be beneficial in reducing soil erosion and associated environmental costs. However, the impact of long-term tillage practices on the dynamics of weed communities is not well understood. The objective of this study was to evaluate long-term (34 yrs) tillage effects on weed seedling emergence and diversity in a continuous soybean system in Central Texas. The treatments included no- till (NT) and conventional tillage (CT) plots, arranged in a randomized complete plot design with four replications. Preliminary results revealed that CT plots had a greater number of weed species (diversity) compared to the NT plots, based on the Shannon-Weiner index. However, the CT plots exhibited low evenness values (high abundance of some species), compared to the NT plots (many species with considerable abundance) (Simpson index). Further, only about 35% of the weed species were shared by the two production systems (Steinhaus index), indicating the presence of a significant weed species shift. The NT system had much greater densities of waterhemp, prostrate spurge, and smell melon (13, 10, and 2% of total weed numbers, respectively) compared to CT (3, 2 and 2%, respectively). Moreover, NT plots showed earlier weed emergence and growth compared to the CT system. Seedling emergence of several weed species occurred much earlier with prolonged seedling emergence patterns in the NT system. Winter annual weeds such as henbit flowered much earlier during early spring in NT, compared to that of CT system. This study established the impact of tillage system on weed community dynamics.

EVALUATION OF THE IMPACT OF HARVEST-TIME AND POST-HARVEST INTEGRATED TACTICS FOR MANAGING JOHNSONGRASS IN INZEN™ SORGHUM. B.L. Young*[1], J.K. Norsworthy[2], M.V. Bagavathiannan[1], L.M. Schwartz[2], M.J. Walsh[3]; [1]Texas A&M University, College Station, TX, [2]University of Arkansas, Fayetteville, AR, [3]The University of Sydney, Sydney, Australia (35)

ABSTRACT

Sorghum with non-transgenic herbicide resistance (Inzen™ sorghum) to nicosulfuron, an acetolactate-synthase (ALS)-inhibitor, will soon be available for commercial cultivation. This trait will provide a valuable grass weed management tool for sorghum producers, including the management of johnsongrass for which no selective control option exists in sorghum till today. However, potential risk of pollen-mediated gene flow and transfer of the herbicide resistance trait into johnsongrass may jeopardize the longevity of the tool. Development of best management practices and stewardship protocols have been shown to be beneficial in similar situations. The objective of this experiment was to understand the value of integrated tactics for managing johnsongrass in Inzen™ sorghum production systems. Large-scale experiments were initiated in summer 2016 in College Station, TX and Keiser, AR in areas with high densities of natural johnsongrass infestation. The treatments were as follows: 1) *S*-metolachlor PRE (1071 g ai ha^{-1}) followed by (fb) atrazine (1122 g ai ha^{-1} + 1% COC by v/v) at 30 cm tall sorghum (standard practice in conventional sorghum), 2) *S*-metolachlor PRE fb atrazine (1122 g ai ha^{-1} + 1% COC by v/v)+ nicosulfuron (35 g ai ha^{-1}) at 30 cm tall sorghum (standard Inzen™ program), 3) Program #2 fb glyphosate (1262 g ai ha^{-1}) desiccant prior to harvest, 4) Program #3 fb chaff removal at harvest, 5) Program #4 fb shredding and disking the field after harvest and treat the regrowth with clethodim (140 g ai ha^{-1}) at 30 cm height, and 6) Program #5, except no chaff removal at harvest. To simulate a worst-case scenario, known ALS-inhibitor-resistant johnsongrass seedlings were transplanted into each plot. Soil seedbank proportion of ALS-inhibitor-resistant as well as susceptible johnsongrass are being monitored, along with above-ground johnsongrass population densities. At the end of the first growing season, treatment #1 had the highest densities (11.5 plants m^{-2}) and infestation spread (74% of entire plot) compared to all other treatments. The standard Inzen™ program (treatment #2) reduced johnsongrass densities (8.6 plants m^{-2}) and greatly reduced infestation spread (28%), yet not sufficient to provide complete control. However, application of glyphosate (desiccant) prior to harvest and disking the field after harvest were very effective in further reducing johnsongrass densities. Preliminary findings show the importance of integrated tactics for effective management johnsongrass within Inzen™ sorghum production systems.

PREVALENCE OF *PPX2L* GLY$_{210}$ DELETION IN PPO-RESISTANT PALMER AMARANTH FROM ARKANSAS. R.A. Salas*[1], R.C. Scott[2], N.R. Burgos[1], G. Rangani[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (36)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S Watson) is an aggressive, prolific, and fast-growing weed species that has become a serious weed problem in row crops and vegetables in the southern US. The widespread distribution of glyphosate-resistant Palmer amaranth has led to elevated use of PPO-inhibiting herbicides. Resistance to PPO-inhibiting herbicides in *Amaranthus* species has been attributed to a Gly$_{210}$ codon deletion in the *PPX2L* gene. This research was conducted to investigate the occurrence of PPO-resistant accessions in Arkansas and to survey the prevalence of *PPX2L* Gly$_{210}$ codon deletion in PPO-resistant biotypes. Composite seed samples from 23 Palmer amaranth accessions collected in 2015 were planted in cellular trays in the greenhouse. Two- to three-inch seedlings were sprayed with fomesafen at 0.235 lb ai/acre. Mortality (%) and injury of survivors were recorded 3 wk after herbicide application. Genomic DNA isolated from survivors was subjected to a modified PCR-based assay to detect the presence of the *PPX2L* Gly$_{210}$ mutation. Of the 4,588 plants sprayed, 36% were resistant to fomesafen. Six accessions were poorly controlled ($\leq$40%) with fomesafen while 10 accessions were moderately controlled (41-75%). PPO-resistant plants from 16 accessions were confirmed positive for the Gly$_{210}$ deletion. Of the 107 total survivors tested across 23 accessions, 57% carried the Gly$_{210}$ mutation. The presence of the Gly$_{210}$ deletion was more frequent in survivors with low injury level ($\leq$30%) suggesting that Gly$_{210}$ deletion is a strong mutation, conferring high resistance level. The presence of Gly$_{210}$ deletion in plants with moderate resistance level indicates heterozygosity of the resistant allele. PPO-resistant plants that did not carry the Gly$_{210}$ mutation might have other target-site mutation or might have survived via transient, or heritable non-target-site resistance mechanism(s). As of 2016, PPO resistance in Palmer amaranth was confirmed in 13 counties in Arkansas. Mitigation of the spread of resistance entails broadscale adoption of best management practices.

CONFIRMATION OF GLYPHOSATE, ALS- AND PPO-RESISTANT COMMON RAGWEED IN NORTH CAROLINA. B.W. Schrage*, W.J. Everman; North Carolina State University, Raleigh, NC (37)

ABSTRACT

Beginning in 2014, soybean growers in northeastern North Carolina have had increasing difficulty controlling common ragweed with available PPO-inhibiting herbicides. These herbicides included: aryl triazinones, diphenylethers, and N-phenylphthalimides-many of which are labeled for *Ambrosia* control in soybeans. The presence of previously confirmed ALS- and glyphosate-resistant biotypes in the state prompted the need to conduct a bioassay to determine if common ragweed had developed multiple resistance.

In 2015, a putative-resistant population from Currituck County along with a control population from Edgecombe County were screened against several PPO- and ALS-inhibiting herbicides. Application rates for the susceptible population were 1/32, 1/16, 1/8, ¼, ½ and 1X the labeled field rate. Putative-resistant individuals were treated with 1, 2, 4, 8, 16, and 32x the labeled field rate. It was determined that Edgecombe County biotype had indeed inherited resistance to PPO- and ALS-inhibiting herbicides, allowing individuals to survive a 32x application of lactofen. A second screening involving additional herbicides and a larder range of rates for a multitude of populations is currently being conducted. PPO-resistant common ragweed in North Carolina confirms the first agronomic, dichotomous weed species to exhibit resistance to three modes of action within the state.

EFFECT OF PRE-PLANT NITROGEN (N) RATES ON WHEAT YIELD IN CORN/SORGHUM-WHEAT ROTATION. M.K. Bansal*, W.J. Everman; North Carolina State University, Raleigh, NC (38)

ABSTRACT

Sorghum production has gained interest in recent years as regional grain demands increased which lead swine producer to offer a competitive sorghum grain price. Sorghum can be a good alternative for corn in rotation with wheat. Sorghum has ability to tolerate hot dry weather, a condition that can be challenging for corn in drought season. However, with the advantages, sorghum has some disadvantages as well when used in rotation. Grain sorghum is known to have negative impact on the following crop. Sorghum residue when incorporated in soil can make N immobilize making it less available to following wheat.

Experiments were conducted in 2013-14 at Rocky Mount, 2014-15 at Rocky Mount and Kinston (two locations), and 2015-16 at Rocky Mount and Kinston, North Carolina to evaluate the effect of different rates of pre-plant nitrogen (15, 30, 45, and 60 lbs per acre) applied to wheat following different hybrids either sorghum (DKS 53-67, P83P17) or corn (DKC 60-67) on wheat yield. There was no significant effect of pre-plant nitrogen on wheat yield in both 2013-14 and 2015-16. In 2013-14, there was significant effect of hybrids on wheat yield. Wheat yield was not significantly different when planted after either DKC 60-67 or DKS 53-67. Yield was significantly different when planted after DKC 60-67 and P83P17. In 2014-15 and 2015-16, there was no significant effect of different hybrids on wheat yield at all locations. Pre-plant nitrogen had significant effect only at one location in Kinston in 2014-15. Results suggests that wheat yield is not affected when planted after sorghum (DKS 53-67) compared to corn (DKC 60-67). At Rocky Mount, each year there was no significant effect of pre-plant nitrogen on wheat yield

DOES FLURIDONE STIMULATE THE GERMINATION OF PALMER AMARANTH?
S. Abugho*, V. Singh, S. Ohadi, M.V. Bagavathiannan; Texas A&M University, College Station, TX (39)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S. Watson), especially glyphosate-resistant populations, is one of the most troublesome weed in crops such as soybean and cotton. Fluridone, a carotenoid biosynthesis inhibitor, is recently labeled as a preemergence herbicide in cotton to control Palmer amaranth. Fluridone is currently studied for its potential in breaking seed dormancy of *Amaranthus* spp. thereby reducing the weed seedbank in the soil. A germination study was conducted at the Weed science laboratory at Texas A&M University, College Station, TX to determine the effect of varying doses of fluridone on germination behavior of Palmer amaranth. The study was conducted using a completely randomized design with four replicates consisting of 9 different treatments of fluridone [(0, 0.25, 0.5, 0.75, 1, 1.5, 2X, where 1X = 50mM) in an agar media. Germination count was recorded every two days for 14 days. A modelling approach was used to describe the relationship between the germination percentage and the doses of herbicide. A hormesis regression model provided the best fit to the germination percentage data. Non-treated seeds had 33% (SE: 8.73) total germination. Highest germination percentage was recorded in seeds at 1X dose of fluridone (48%; SE: 6.28). Model prediction shows that germination percentage of Palmer amaranth starts to decline when fluridone dose increases more than the recommended dose. Preliminary results of this study show that low doses of fluridone can be used to break dormancy of Palmer amaranth. Future studies will be conducted to determine the effect of fluridone on other common weeds of cotton.

BIOHERBICIDAL EFFICACY OF A *MYROTHECIUM VERRUCARIA*-SECTOR ON SEVERAL PLANT SPECIES. R.E. Hoagland*[1], C. Boyette[2], K.C. Stetina[1], R.H. Jordan[1]; [1]USDA-ARS, Stoneville, MS, [2]USDA_ARS, Stoneville, MS (40)

ABSTRACT

Comparative studies were conducted on mycelial preparations of the bioherbicide, Myrothecium verrucaria (MV) strain IMI 361690 and a recently discovered sector (MV-Sector BSH) of this fungus. The whitish sector was discovered, isolated, grown in pure culture on PDA and found to be a stable, non-spore producing mutant when cultured over several months under conditions that cause circadian sporulation during growth of its MV parent. Application of MV and MV-Sector BSH mycelial preparations to intact plants (hemp sesbania and sicklepod) and leaf discs (kudzu and glyphosate-resistant Palmer amaranth) showed that the sector efficacy was generally equal to, or slightly lower than MV. Bioassays of MV and this sector on seed germination and early growth of sicklepod and hemp sesbania seeds demonstrated that hemp sesbania seeds were slightly more sensitive to the fungus than sicklepod seeds and that the sector bioherbicidal activity was slightly less than that of MV. SDS-PAGE protein profiles of cellular extracts of MV and the sector and their respective culture supernatants showed several differences with respect to quantity and number of certain protein bands. Overall results showed that the isolate was a non-spore producing mutant with phytotoxicity to several weeds (including weeds tolerant or resistant to glyphosate), and that the phytotoxic effects were generally equivalent to those caused by MV treatment. Results of this first report of a non-sporulating MV mutant suggest additional studies on protein analysis, and an extended weed host range under greenhouse and field conditions are needed in order to further evaluate its possible bioherbicidal potential.

TESTING OF HERBICIDES AND ADJUVANTS FOR TANK MIX COMPATIBILITY IN OKLAHOMA ROADSIDE VEGETATION MANAGEMENT PROGRAMS. C.Z. Hurst*, L.J. Calhoun, D. Martin; Oklahoma State University, Stillwater, OK (41)

ABSTRACT

Oklahoma Department of Transportation (ODOT) Roadside Vegetation mangers considers a wide range of herbicide and adjuvant products for use in their roadside herbicide programs. ODOT requires that herbicide and adjuvant products be tested for physical tank mix compatibility before being added to ODOT’s Approved Herbicide and Adjuvant List (AHAL) because ODOT applicators use many tank mix combinations while conducting their herbicide programs. Herbicide labels typically recommend that applicators should perform small scale herbicide and adjuvant tank mix compatibility tests using an industry standard jar test method prior to mixing products for actual use on a large scale. Identifying tank mix incompatibilities using a standard jar test can help applicators avoid potential equipment damages and pesticide waste that may occur in situations where untested products are combined in a sprayer tank and undesired incompatibility reaction occur. This poster will summarize the findings of herbicide and adjuvant tank mix compatibility testing conducted by the Oklahoma State University (OSU) Roadside Vegetation Management (RVM) program for ODOT during the 2015 – 2016 time period. During 2015 – 2016 compatibility testing was performed to determine the compatibility of one drift control adjuvant and five herbicides products. The products were tested for compatibility with other herbicide and adjuvant products commonly used by ODOT applicators. No compatibility issues were observed with the six products tested, however, two herbicide and drift control mix combination were observed to be incompatible in the 2016 trials. One of the incompatible tank mixtures was a treatment replicating a mixture tested in the 2011 compatibility trials, performed by the OSU RVM program. The test results observed in the 2016 compatibility trials support observations reported in the 2011 compatiblity trials concerning the herbicide and adjuvant mixture in question. The other incompatible tank mix observed during 2016 compatibility trials was also a tank mix combination previously tested in the 2011 compatibility trials, where no compatibility issues were observed, however, in the 2016 trials the herbicide rate was replicated and the drift control rate was increase to a higher end use rate. This was done to determine if tank mix compatibility, concerning the mixture in question, is rate dependent. The findings of the tank mix compatibly trials performed in 2015 - 2016 allowed for six products to be added to ODOT's AHAL. Additionlly, the results of these 2015 and 2016 compatibility trials continue to support that the industry standard jar test method is still a simple, low-cost, and effective approach to identifying physical tank mix incompatibilities prior to mixing and loading pesticides and adjuvants together on a large scale in the field.

EVALUATION OF POTENTIAL HERBICIDES AND HERBICIDE PROGRAMS FOR USE IN LIMA BEAN PRODUCTION. C.E. Rouse*, T.M. Penka, N.R. Burgos; University of Arkansas, Fayetteville, AR (42)

ABSTRACT

Lima bean is a specialty crop produced on a limited number of acres in the state of Arkansas. Due to its similarity to other legume vegetables, lima bean response to herbicides is expected to be like most other legumes. In 2014, a preliminary experiment was established at the AAREC, Fayetteville, AR, and the VRS, Kibler, AR. Herbicide applications included both preplant (PPL-2 weeks before planting) and preemergence (PRE) treatments of common legume crop residual herbicides. Residual treatments included S- metolachlor and S-metolachlor + imazethapyr as a commercial standard, pyroxasulfone, chloransulam-methyl, flumioxazin, and a premix herbicide, Envive, containing chlorimuron + flumioxazin + thifensulfuron, at various timings and standard application rates; S-metolachlor was also paired with fomesafen (Reflex and Flexstar) and flumioxazin. Most herbicides caused very little injury to the crop. The greatest prolonged injury occurred with the Envive treatment (>95%, 6 WAP). S-metolachlor + fomesafen application resulted in high injury (>95%) across both locations. Based on these findings, a modified set of treatments were implanted in 2015 and 2016. Fomesafen at three rates (0.21, 0.28, and 0.42 kg ha^{-1}) applied pre-bloom were included and some high-injury treatments were retained for reevaluation. In 2015 at the AAREC, pyroxasulfone (preplant) and Envive caused very high levels of injury 3 WAP (>80%), but only the Envive caused persistent injury late into the season (98%). Saflufencil (PRE) resulted in 54% injury 3 WAP and 41% 9 WAP, at the AAREC, while the pre-plant application had lower injury (<30%) regardless of the rate applied. In 2016, Envive was removed from the experiment. Injury was much higher at the VRS than at the AAREC, where none of the treatments caused greater than 20% injury. At the VRS, heavy rainfall increased the herbicide activity, increasing the injury to the crop. Flumioxazin, pyroxasulfone, and salfufenacil caused high injury ranging from 50% to 100%, which would be unacceptable. The pre-bloom fomesafen treatments caused some foliar necrosis but did not persist. The impact on yield could not be evaluated because the crop was not able to develop pods in any year due to suboptimal environmental conditions for lima bean pod development.

USE OF EH1587 FOR POSTEMERGENCE BROADLEAF WEED CONTROL IN TURF.
G.M. Henry*[1], K.A. Tucker[1], J.T. Brosnan[2], G.K. Breeden[2], A.G. Estes[3]; [1]University of Georgia, Athens, GA, [2]University of Tennessee, Knoxville, TN, [3]PBI Gordon Corporation, Pendleton, SC (43)

ABSTRACT

Field experiments were conducted at the University of Georgia Veterinary College in Athens, GA and the East Tennessee Research and Education Center in Knoxville, TN during the spring and summer of 2016 to evaluate the postemergence control of broadleaf weeds with EH1587. Both cool- and warm-season turfgrasses exhibit tolerance to postemergence applications of EH1587. Research in GA was conducted on bermudagrass (5.1 cm) with a mature infestation of buckhorn plantain (*Plantago lanceolata* L.), while research in TN was conducted on bermudagrass (3.8 cm) with infestations of purple deadnettle (*Lamium purpureum* L.) and hairy bittercress (*Cardamine hirsuta* L.). The experimental design was a randomized complete block with four replications in GA and three replications in TN. Herbicide treatments were initiated in GA on June 3, 2016 and TN on March 4, 2016. Treatments consisted of EH1587 (halauxifen-methyl + fluroxypyr + dicamba) (0.11 kg ai ha^{-1}, 0.21 kg ai ha^{-1}, and 0.31 kg ai ha^{-1}), 2,4-D + mecoprop + dicamba (Triplet) at 1.58 kg ai ha^{-1}, and 2,4-D + triclopyr + dicamba + pyraflufen-ethyl (4-Speed XT) at 1.4 kg ai ha^{-1}. A non-treated check was added for comparison. Herbicides were applied with a CO_2 powered backpack sprayer calibrated to deliver 187 L ha^{-1} (GA) or 375 L ha^{-1} (TN). Visual ratings of % broadleaf weed cover were recorded at 0, 14, 28, and 35 days after treatment (DAT). Percent control was determined by comparing % cover on individual rating dates with % cover at trial initiation (0 DAT). EH1587 at 0.21 and 0.31 kg ai ha^{-1} resulted in 57 to 60% purple deadnettle control 14 DAT, while applications at 0.11 kg ai ha^{-1} only provided 47% control. Hairy bittercress control was 57 to 67% 14 DAT, regardless of EH1587 rate. Buckhorn plantain exhibited the highest level of control 14 DAT in response to applications of EH1587. Control was 79 to 89%, regardless of EH1587 rate. Higher control of buckhorn plantain in GA may be attributed to June application timings compared to applications made during March in TN. Triplet at 1.58 kg ai ha^{-1} resulted in 33% purple deadnettle control, 53% hairy bittercress control, and 87% buckhorn plantain control 14 DAT, while 4-Speed XT resulted in 70% purple deadnettle control, 67% hairy bittercress control, and 92% buckhorn plantain control. Excellent broadleaf weed control (98 to 100%) was observed 28 and 35 DAT in response to EH1587, regardless of rate or broadleaf weed species. Control of hairy bittercress and buckhorn plantain with Triplet and 4-Speed XT was also excellent (97 to 100%) 28 and 35 DAT; however, control of purple deadnettle never exceeded 50% in response to Triplet. Purple deadnettle control in response to 4-Speed XT was 90% 28 DAT, but control declined to 77% 35 DAT as weeds began to recover from previous applications.

PEANUT RESPONSE TO TERBACIL. E.P. Prostko*[1], O.W. Carter[2]; [1]University of Georgia, Tifton, GA, [2]The University of Georgia, Tifton, GA (44)

ABSTRACT

Terbacil, sold under the trade name of Sinbar 80WDG, is a herbicide labeled for use in watermelon production systems. Watermelon and peanut are commonly grown in rotation in southern Georgia. Current rotational crop restrictions for terbacil would prohibit peanut planting for 2 years after application. Peanut tolerance to terbacil has not been well documented. Therefore, the objective of this research was to evaluate the tolerance of peanut to terbacil. A small-plot, replicated field trial was conducted in 2016 at the UGA Ponder Research Farm near Ty Ty, Georgia. 'GA-06G' peanut were planted in twin rows on May 9. In a RCB design with 4 replications, terbacil was applied preemergence 1 day after planting (DAP) at 0, 0.025, 0.05, 0.10 and 0.20 lb ai/A. Typical terbacil use rates in watermelon range from 0.10-0.15 lb ai/A. Immediately after application, the plot area received 0.5" of irrigation. All terbacil treatments were applied using a CO_2-powered, backpack sprayer calibrated to deliver 15 GPA @ 38 PSI using 11002AIXR nozzles. The plot area was maintained weed-free using a combination of hand-weeding and labeled herbicides (pendimethalin, imazapic, s-metolachlor, and 2,4-DB). Data collected included visual estimates of peanut stand loss, plant height at harvest, and yield. All data were subjected to ANOVA and means separated using Fisher's Protected LSD Test (P=0.05). Generally, 0.025 lb ai/A of terbacil had no effect on peanut stand, height, or yield. At 56 DAP, peanut plant stand was significantly reduced by 0.10 and 0.20 lb ai/A of terbacil (71% and 100% stand reductions, respectively). At 120 DAP, peanut plant heights were significantly reduced by 0.10 and 0.20 lb ai/A of terbacil (27% and 100% height reductions, respectively). Peanut yields were significantly reduced by 0.05, 0.10, and 0.20 lb ai/A (17%, 68%, and 100% yield reductions, respectively).

RESCUEGRASS CONTROL IN TALL FESCUE WITH HPPD-INHIBITORS. J. Yu*[1], P. McCullough[2]; [1]Univ. of Georgia, Griffin, GA, [2]University of Georgia, Griffin, GA (45)

ABSTRACT

Rescuegrass (*Bromus catharticus*) is a problematic weed of tall fescue (*Festuca arundinacea*) in Georgia with limited options for postemergence control. Two field experiments were conducted from 2013 to 2015 in Griffin, GA. ‘Titan’ tall fescue and rescuegrass were seeded together in October of 2013 and again on a separate field in 2014. Treatments were applied in fall or spring and included mesotrione at 280 g ai/ha, topramezone at 49 g ae/ha, fluazifop at 105 g ai/ha, and metamifop at 400 g ai/ha. All herbicides were applied twice at a three-week interval at both timings. Fall treatments of mesotrione and topramezone averaged 70% control of rescuegrass at 8 weeks after initial treatment (WAIT), and were comparable to fluazifop. Spring treatments of mesotrione and topramezone averaged 50% control of rescuegrass at 8 WAIT, while fluazifop provide 82% control. Metamifop at both timings provided 42% or less control of rescuegrass. Fall and spring fluazifop treatments caused unacceptable injury to tall fescue on several dates, ranging 25 to 42%, but mesotrione and topramezone never injured tall fescue greater than 16%. Overall, fall treatments of mesotrione and topramezone provided fair control (~70%) of rescuegrass during tall fescue establishment from seed. Further research is needed to refine application rates and regimens with these herbicides for rescuegrass control in tall fescue.

GOOSEGRASS CONTROL IN CREEPING BENTGRASS GOLF GREENS WITH TOPRAMEZONE. S. Williams*, P. McCullough; University of Georgia, Griffin, GA (46)

ABSTRACT

Goosegrass (*Eleusine indica*) is a problematic weed in creeping bentgrass (*Agrostis stolonifera*) golf greens and there are no selective herbicides labeled for postemergence control. Topramezone is an HPPD-inhibitor that effectively controls goosegrass at labeled use rates in turfgrass. Creeping bentgrass has also shown acceptable tolerance levels to topramezone at moderate rates in spring, but there is limited research for goosegrass control on golf greens. The objective of this research was to evaluate summer applications of topramezone for goosegrass control in creeping bentgrass greens. Treatments were applied on July 18, 2016 to a Penncross creeping bentgrass golf green in Peachtree City, GA with a CO_2-pressured sprayer calibrated to deliver 374 L ha^{-1}. Goosegrass was multi-tiller on the day of treatments. Topramezone was applied at 6, 12, or 18 g ae ha^{-1} with methylated seed oil at 0.5% vol/vol. Fenoxaprop was applied at 20 g ai ha^{-1} as a standard comparison. A nontreated check was included. At 7 days after treatment (DAT), creeping bentgrass was bleached 7, 22, and 38% from topramezone at 6, 12, and 18 g ha^{-1}, respectively. However, there was no bleaching detected at 14 DAT and creeping bentgrass injury ranged 10% or less from all rates tested. Goosegrass was controlled 73, 78, and 91% at 35 DAT from topramezone at 6, 12, and 18 g ha^{-1}, respectively, while control from fenoxaprop was only 13%. Turf treated with topramezone at all rates had 10 to 20% bareground after 35 days. This resulted from goosegrass control and limited creeping bentgrass lateral growth during the testing period. Overall, topramezone at rates tested have potential for selective postemergence goosegrass control. Further research is needed to refine application rates and regimens for improving the selectivity of topramezone on creeping bentgrass golf greens.

FRAGRANT KYLLINGA CONTROL IN BERMUDAGRASS WITH CELSIUS, TRIBUTE TOTAL, AND SULFENTRAZONE COMBINATION PRODUCTS. P. McCullough*, S. Williams; University of Georgia, Griffin, GA (47)

ABSTRACT

A field experiment was conducted on a Tifway bermudagrass fairway in Griffin, GA to evaluate the efficacy of herbicides for postemergence control of fragrant kyllinga and smooth crabgrass. Treatments were applied on June 23, 2016 and included Dismiss (sulfentrazone) at 420 g ai/ha, Blindside (sulfentrazone + metsulfuron) at 462 g ai/ha), Solitare (sulfentrazone + quinclorac) at 1680 g ai/ha, Celsius (thiencarbazone + iodosulfuron + dicamba) at 233 g ai/ha, Tribute Total (thiencarbazone + foramsulfuron + halosulfuron) at 136 g ai/ha, Katana (flazasulfuron) at 39 g ai/ha, Target 6 Plus (MSMA) at 2240 g ai/ha, and Sedgehammer (halosulfuron) at 70 g ai/ha. Applications were made with a CO_2-pressured sprayer calibrated to deliver 374 L/ha. At 1 week after treatment (WAT), Dismiss, Blindside, Solitare, and MSMA provided 89% or better control of fragrant kyllinga. All other treatments provided 45 to 54% control. At 2 WAT, all treatments provided 85 to 99% control of fragrant kyllinga. These levels of control were observed by 8 WAT, as all treatments provided 93 to 100% control, except Celsius, which provided 86% control. Solitare provided the fastest smooth crabgrass control of all treatments tested. Control measured 79% at 1 WAT from Solitare, while all others provided 58% or less control. At 2 WAT, smooth crabgrass control from MSMA was comparable to Solitare, averaging 91%. These treatments provided excellent control (>90%) from 2 to 8 WAT. Tribute Total provided good (80 to 89%) control of smooth crabgrass from 2 to 8 WAT. All other treatments provided poor control of smooth crabgrass at every evaluation. Bermudagrass was injured 23 and 25% from Solitare and 1 and 2 WAT, respectively, but injury declined to less than 20% at 3 WAT. All other treatments injured bermudagrass less than 20%. Overall, these herbicides provided good to excellent control of fragrant kyllinga. However, only Solitare, MSMA, and Tribute Total controlled smooth crabgrass to acceptable levels.

LOYANT ACTIVITY ON WEEDS COMMON TO SOUTH LOUISIANA RICE PRODUCTION SYSTEMS. G. Mack Telo*, E.P. Webster, B.M. McKnight, S.Y. Rustom Jr, E.A. Bergeron; Louisiana State University AgCenter, Baton Rouge, LA (48)

ABSTRACT

Weeds are a constant in rice production and can cause yield loss wherever rice is grown; therefore, effective weed control is very important for successful rice production. Florpyrauxifen-benzyl (Loyant herbicide, Dow AgroSciences, Indianapolis, IN 46268) is a new postemergence herbicide for control of broadleaf, grass and sedge weeds in rice. The objective of this research was to evaluate activity of florpyrauxifen herbicide for troublesome perennial grass and common rice weed control with different adjuvants and application timings in field studies, and different grass weed sizes in glasshouse studies.

A field study was conducted at Louisiana State University Agricultural Center H. Rouse Caffey Rice Research Station near Crowley, Louisiana in the 2015. Long grain ‘CL 111’ imidazolinone-resistant rice was planted on March 30, 2015 in 1.5 by 5.2 m plots. The experimental design was a two-factor factorial in a randomized complete block with four replications. Factor A was florpyrauxifen applied at 30 g ai ha^{-1} with different adjuvants: no adjuvant, Induce at 0.25%, Agri-Dex at 0.4%, Dow supplied MSO at 0.4%, Soy-Surf MSO at 0.4%, and Dyne-A-Pak at 0.4%. Factor B consisted of application timing: Preflood applied 9 days prior to permanent flood establishment and Postflood applied 24 hr after permanent flood establishement. Treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1}. Visual evaluation of weed control and crop injury was conducted for barnyardgrass (*Echinochloa crus-galli* L.), eclipta (*Eclipta prostrata* L.), hemp sesbania [*Sesbania herbacea* (Mill.) McVaugh], Indian jointvetch (*Aeschynomene indica* L.), rice flatsedge (*Cyperus iria* L.) and spreading dayflower (*Commelina diffusa* Burm. f.) at 36 days after treatment (DAT).

Eclipta, hemp sesbania, Indian jointvetch and spreading dayflower control was 90 to 98% when treated with florpyrauxifen mixed with all adjuvants evaluated regardless of application timing. Barnyardgrass treated with florpyrauxifen with no additional adjuvant applied preflood was controlled 64%. The addition of any adjuvant at this timing resulted in control of 73 to 83%. The addition of Agri-Dex or the Dow supplied MSO increased control compared with no adjuvant added. However, florpyrauxifen applied postflood with no adjuvant controlled barnyardgrass 44%, and control increased with the addition at the Dow supplied MSO or Dyne-A-Pak. These data indicate that barnyardgrass should be treated prior to the permanent flood with an additional COC or MSO added. Rice flatsedge control was similar to barnyardgrass control. These data indicate the addition of Agri-Dex or the Dow supplied MSO increased control over no adjuvant at the preflood timing. It is also important to apply florpyrauxifen preflood for increased activity on rice flatsedge.

A second study was established in a glasshouse on the Louisiana State University Baton Rouge Campus to evaluate the activity of florpyrauxifen on six troublesome grass weeds common to Louisiana rice production. The study was a completely randomized design with six replications. Fall panicum (*Panicum dichotomiflorum* Michx.) and Nealley’s sprangletop (*Leptochloa nealleyi* Vasey) at the two-leaf seedling stage were transplanted into 6- by 10-cm cone containers. Five

cm stem segments with a viable node of Brook's paspalum (*Paspalum acuminatum* Raddi), rice cutgrass (*Leersia oryzoides* L.), southern watergrass (*Luziola fluitans* Michx.) and water paspalum (*Paspalum modestum* Mez) were also planted into 6- by 10-cm cone containers, commonly referred to as cone-tainers. Each grass species evaluated was a separate study. These individual cone-tainers were placed into racks suspended above a 67-L water reservoir to allow for sub-surface irrigation. The water was held for the duration of the trials to simulate saturated rice field conditions. Urea fertilizer, 46-0-0, was added to the water at 280 kg ha^{-1}. Florpyrauxifen herbicide was applied to each of the weed species at two growth stages, three- to four-leaf, and one- to two-tiller. The herbicide was applied with a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1}. Weed control and fresh plant weight was evaluated at 21 DAT.

In the glasshouse trial, fall panicum and Nealley's sprangletop control was greater than 80% at 21 DAT. Brook's paspalum and southern watergrass treated with florpyrauxifen at the three- to four-leaf timing was controlled 63 and 65%, respectively. Florpyrauxifen applied to one- to two-tiller Brook's paspalum and southern watergrass resulted in control of 51 and 45%, respectively. Rice cutgrass and water paspalum control did not exceed 10%. Plant fresh weight of fall panicum and Nealley's sprangletop was reduced compared with the nontreated; however, all other species evaluated resulted in fresh weights similar to the nontreated.

THE UNIVERSITY OF TENNESSEE HERBICIDE STEWARDSHIP EDUCATIONAL PROGRAM: AN UPDATE. N. Rhodes*[1], D. McIntosh[2], L. Steckel[3]; [1]University of Tennessee, Knoxville, TN, [2]The University of Tennessee, Knoxville, TN, [3]The University of Tennessee, Jackson, TN (49)

ABSTRACT

Off-target movement of pasture herbicides to sensitive, high value crops continues to be an issue. Damage can result in lost productivity for growers, expensive fines and/or lawsuits, and negative publicity for the industry. We began a comprehensive educational program in 2011 that stresses the importance of proper stewardship with the use of pasture herbicides. The program was created to reduce the occurrence and impact of off-target damage to tobacco and other sensitive, high value crops; and to make available tools to help with the diagnosis of suspected cases of off-target damage. Funding has been obtained via grants from Philip Morris International, Altria Client Services, Dow AgroSciences, DuPont Crop Protection; and most recently, Monsanto. Four crops (tobacco, cotton, tomato and grape) and five herbicides (2,4-D, dicamba, aminopyralid, aminocyclopyrachlor and picloram) were selected for the development of educational materials and diagnostic tools. These include still images, time lapse videos and fact sheets that were created and made available when our initial website, herbicidestewardship.utk.edu, was launched in 2014. During 2015-16, the website was completely redesigned in an effort to make it more attractive and user friendly. Additionally, a shorter, less cumbersome address, herbicidestewardship.com, was created. Use of the website has steadily increased since its inception. The website has been visited over 9,500 times since it was launched in 2011. Visits have been from The United States, China, Japan, Germany, Canada, The United Kingdom, India, and Brazil. During 2017 we will be expanding the program and website to include educational resources focusing on in-crop applications of 2,4-D and dicamba in herbicide tolerant crop varieties. Information such as proper set-up of row crop herbicides for reduced drift and compliance with labels, sprayer cleaning and sanitation, information on relative sensitivity of non-target crops, and additional links to resources in other states and from basic manufacturers.

USING A CEREAL RYE/CRIMSON CLOVER COVER CROP MULCH FOR WEED SUPPRESSION IN CONVENTIONAL AND ORGANIC COTTON PRODUCTION. R.A. Atwell*[1], S.C. Reberg-Horton[2], A.C. York[1]; [1]North Carolina State University, Raleigh, NC, [2]NCSU, Raleigh, NC (50)

ABSTRACT

Cover crop mulches can be used for weed suppression by organic producers to alleviate dependency on tillage and by conventional producers to assist in the management of herbicide-resistant weeds. The objective of this experiment was to evaluate residue management of a cereal rye/crimson clover cover crop mulch at cotton planting and the effects on soil moisture, soil temperature, cotton emergence, weed suppression, and cotton yield under a conventional and organic weed control context. This experiment was conducted in Clayton, Rocky Mount, and Lewiston, NC from 2014-2016. A cereal rye/crimson clover cover crop mixture was planted in mid-October and was terminated one-week prior to cotton planting using a roller-crimper or herbicide application. Cotton was planted directly into the cover crop mulch. Main plot treatments included no cover crop, planting into standing cover crop, planting into roll-killed cover crop moved several inches from the cotton row, planting into fertilized and roll-killed cover crop moved several inches from the cotton row, and planting into roll-killed cover crop moved minimally from the cotton row. Subplot treatments included organic and conventional weed control scenarios. Without fertilizing the cover crop, cover crop biomass ranged from 3,820-6,610 kg ha^{-1} across our environments. Fertilizing the cover crop in early March with 34 kg N ha^{-1} enhanced cover crop biomass production by 250-1,320 kg ha^{-1}. Cotton emergence was reduced by plating into standing cover crop residue and when the cover crop residue was moved minimally from the cotton row at planting. Soil temperature was reduced by the presence of cover crops but soil moisture availability was enhanced by the presence of cover crops throughout the growing season regardless of cover crop residue management. Excellent weed control was achieved when the cover crop mulch was combined with herbicide use. When herbicides were not used, the cover crop biomass levels achieved did not provide adequate weed suppression to allow for respectable cotton yield. Cover crop residue management did not affect cotton yield in four of the five environments. Results indicate that producers have flexibility in cover crop residue management to obtain soil moisture conservation benefits and respectable cotton yield.

MONITORING SEASONAL CO_2 EFFLUX OF DALLISGRASS AND BERMUDAGRASS: IMPLICATIONS FOR NON-SELECTIVE DALLISGRASS CONTROL. C.R. Johnston*, G.M. Henry; University of Georgia, Athens, GA (51)

ABSTRACT

Dallisgrass (*Paspalum dilatatum* Poir.) is a problematic perennial weed of turfgrass environments including golf courses, athletic fields, and home lawns. Selective control of dallisgrass is often challenging to agronomists due to a lack of effective herbicide chemistries. MSMA is a popular selective herbicide for the control of dallisgrass in hybrid bermudagrass [*Cynodon dactylon* (L.) Pers. x *C. transvaalensis* Burtt-Davy], but requires sequential applications and is pending discontinuation due to EPA restrictions. Tribute Total has been reported to control dallisgrass, but applications are expensive and often sensitive to environmental changes. As a result, the identification of alternative control strategies is highly warranted. Anecdotal observations suggest that dallisgrass and hybrid bermudagrass proceed into winter dormancy at different times and/or rates in certain environmental settings. Identification of a time frame when bermudagrass is dormant while dallisgrass is physiologically active would allow for the safe, yet efficacious application of a non-selective herbicide for dallisgrass control. Two separate studies were conducted during the Fall of 2015 to investigate the onset of dallisgrass and hybrid bermudagrass dormancy. Studies were conducted at the University of Georgia Golf Course in Athens, GA and Lane Creek Golf Club in Bishop, GA. Plant respiration was measured with a Li-Cor 8100 to determine the level of dallisgrass and hybrid bermudagrass activity at each golf course. A fixed cross-sectional area of 318 cm^2 was measured for each sample. Four samples (replications) of dallisgrass and hybrid bermudagrass were obtained at two separate locations (full sun) per golf course. Samples were also recorded on bare ground at each location in order to account for background soil respiration. Respiration levels for each species at each location were fitted against cooling degree days with a base temperature of 21°C using the formula CDD = 21 – [(T_{max} + T_{min})/2]. Data were then fit to an exponential decay function (Respiration = a*e(-b*CDD)) using SigmaPlot. Results suggest that the total respiration per sample area was different for each species at the initiation of the study. However, dallisgrass did exhibit a higher amount of net respiration (μmol m^{-2} s^{-1}) than hybrid bermudagrass throughout the duration of the study at both golf courses. This indicates that differential behavior concerning initiation and proceeding of dormancy may exist between dallisgrass and hybrid bermudagrass at the locations sampled. This may not be true when examining different microclimates on golf courses such as shaded or low lying areas. Further research and statistical analysis are needed to determine the significance of this phenomenon that occurs between these two species.

RESPONSE OF BAHIAGRASS AND DALLISGRASS TO VERTICUTTING FREQUENCY. G.M. Henry*, R.A. Grubbs, C.R. Johnston; University of Georgia, Athens, GA (52)

ABSTRACT

Field experiments were conducted at the Athens Turfgrass Research and Education Center in Athens, GA during the summer of 2015 to evaluate the response of bahiagrass (*Paspalum notatum* Fluegge) and dallisgrass (*Paspalum dilatatum* Poir.) to verticutting frequency. Bahiagrass and dallisgrass plants were transplanted approximately 3 weeks prior to trial initiation from naturally occurring infestations present along College Station Rd., Athens, GA (33^{o} 55' 56.7" N, 83^{o} 21' 58.9" W) and in the common bermudagrass [*Cynodon dactylon* (L.) Pers.] rough (5.1 cm height) at Pine Hills Golf Course in Winder, GA (33^{o} 58' 10.8" N, 83^{o} 41' 21.7" W). A 10.2-cm golf course cup-cutter centered over each plant was used to remove the aboveground biomass and corresponding rhizomes together as a plug (12.7 cm depth). Plants were transplanted the same day they were harvested on June 22, 2015 into bare ground by removing and replacing a plug of soil with a plant plug. Fertilizer (18 N – 12 P_2O_5 – 6 K_2O) was applied to the study area at time of transplant and monthly thereafter at a rate of 49 kg N ha^{-1}. Plots were arranged in a 2 x 4 factorial within a split-plot experimental design with four replications. The main plot factor was verticutting treatment (no verticutting, verticutting 1x, verticutting 2x, and verticutting 3x). Verticutting was conducted on July 10, 2015, August 7, 2015, and September 4, 2015. Verticutting was performed with a Ryan Ren-O-Thin Pro grade dethatcher set to a 1.3 cm depth and 3.2 cm spacing. Subplot factors were *Paspalum* spp. Each experimental unit (subplot) measured 1.8 by 1.5 m and contained six plugs arranged in a 0.5-m grid. Plots were maintained at 10.2 cm with a rotary mower once per week. Irrigation was supplied as a supplement to rainfall at a rate of 3 to 4 cm wk^{-1}. Plots were maintained weed free by hand-weeding and through applications of glyphosate (0.28 kg ai ha^{-1}) with a hand-held pump-up sprayer. Therefore, plant response to verticutting was examined without competition. Lateral plant diameters were taken at the beginning of the study and were recorded every two weeks through mid-November. Two diameter measurements were taken perpendicular to each other (the first measurement was taken in the largest diameter) and averaged to obtain the reported diameter of a plant at each sampling time. Data from the six plugs were averaged to give estimates for each experimental unit. One month after initial treatment (MAIT) (August 6, 2015), dallisgrass plants exhibited similar plant diameters (20.5 to 22.4 cm), regardless of treatment. Bahiagrass plant diameters were also similar (16 to 18.8 cm) in response to verticutting treatments 1 MAIT. At 2 MAIT, dallisgrass plant diameters where similar (18.7 to 20 cm), regardless of verticutting treatment. Bahiagrass plant diameters 2 MAIT in response to no verticutting were 21.4 cm followed by (fb) verticutting 1x (19.8 cm) fb verticutting 3x (18.4 cm) and verticutting 2x (17.8 cm). At 3 MAIT, dallisgrass plants in response to verticutting 1x and 2x were 17.8 and 17.7 cm, respectively, fb no verticutting (15.1 cm) and verticutting 3x (14.5 cm). Bahiagrass plants exhibited similar diameters (18.7 to 21.5 cm) 3 MAIT, regardless of treatment. At 4 MAIT, dallisgrass plants exhibited similar diameters (14.9 to 16.6 cm), regardless of treatment. Bahiagrass plants exhibited plant diameters of 19.5 to 20.3 cm in response to no verticutting and verticutting 1x fb verticutting 2x (18.5 cm) fb verticutting 3x (16.3 cm). Verticutting had more of an impact on bahiagrass lateral spread than dallisgrass. This may be attributed to rhizome position within the soil profile. Dallisgrass

produces rhizomes deep within the soil while bahiagrass produces surface rhizomes. Verticutting may have been more detrimental to *Paspalum* spp. lateral spread if lower mowing heights were examined simultaneously.

OPTIMIZING WARRANT™ HERBICIDE PLACEMENT IN A PIGWEED (*AMARANTHUS SPP.*) CONTROL PROGRAM FOR ROUNDUP READY 2 XTEND® SOYBEAN PRODUCTION. J. Buol*[1], D.B. Reynolds[1], J. A. Mills[2]; [1]Mississippi State University, Mississippi State, MS, [2]Monsanto Company, Collierville, TN (53)

ABSTRACT

The development and spread of herbicide-resistant (HR) weed species continues to pose a serious challenge to crop producers. In response to the threat of HR weed species, seed companies have developed new biotechnologies that will incorporate the use of plant growth regulator herbicides over the top of the major row crops. The Roundup Ready 2 Xtend® weed control system will include POST applications of dicamba and holds great promise for mitigating the spread of HR pigweed (*Amaranthus* spp.) in soybean (*Glycine max*) production systems. In order to maximize the utility and longevity of this system, dicamba must be used with herbicides of other modes of action (MOA) such as the seedling shoot growth inhibitor acetochlor (Warrant™). Acetochlor is labeled for both PRE and POST use in soybeans and exhibits high efficacy in controlling two particularly troublesome pigweed species: palmer amaranth (*Amaranthus palmeri*) and tall waterhemp (*Amaranthus tuberculatus*). In order to optimize the timing of spray applications of acetochlor and dicamba in Roundup Ready 2 Xtend® soybean production systems, field experiments were conducted in 2016 in Starkville and Tunica, MS. Treatment consisted of herbicide combinations including dicamba, acetochlor, and dicamba + glyphosate by application timing (PRE, early POST, late POST). Preliminary results indicate that a PRE application of acetochlor (Warrant™) herbicide should be used followed by either an early or late POST application of dicamba + glyphosate in order to maximize pigweed (*Amaranthus* spp.) control and soybean yield, and that a tank-mix with dicamba PRE may be necessary to bolster control.

SESAME RESPONSE TO PRE HERBICIDES APPLIED EARLY POSTEMERGENCE.
W. Grichar*[1], P.A. Dotray[2], J.A. Tredaway[3], J.J. Rose[4]; [1]Texas AgriLife Research, Yoakum, TX, [2]Texas A&M AgriLife Research, Lubbock, TX, [3]Auburn University, Auburn, AL, [4]Sesaco Corp, Austin, TX (54)

ABSTRACT

Field studies were conducted during the 2016 growing season under weed-free conditions in south Texas (Castroville), the Texas High Plains (New Deal), and central Alabama (Shorter) to determine sesame (*Sesamum indicum* L.) tolerance to selected PRE herbicides applied early POST (3 and 6 d after sesame emergence). Herbicides included acetochlor at 1.7 kg ai/ha, *S*-metolachlor at 0.72, 1.43, and 2.86 kg ai/ha, dimethenamid at 0.84 kg ai/ha, pethoxamid at 0.22 kg ai/ha, and bicyclopyrone at 0.12 and 0.24 kg ai/ha. At Castroville and Shorter, all herbicides, with the exception of *S*-metolachlor at 0.72 kg/ha applied 3 d after sesame emergence (DASE) caused > 15% injury when rated 10-14 d after herbicide application. At New Deal, only acetochlor at 1.7 kg/ha applied 3 DASE caused ≤ 12% injury and all other herbicides caused ≥ 17% injury when evaluated 9 DASE. When rated prior to sesame harvest at Castroville (147 d after herbicide application), *S*-metolachlor at 2.86 kg/ha applied 3 DASE and bicyclopyrone at 0.24 kg/ha applied 3 and 6 DASE resulted in 37 to 77% sesame injury, which was greater than the untreated check. When evaluated 28 d after herbicide application at Shorter, acetochlor applied 3 and 6 DASE, *S*-metolachlor at 0.72 kg/ha applied 6 DASE, *S*-metolachlor at 1.43 kg/ha applied 6 DASE, S-metolachlor at 2.84 kg/ha applied 3 and 6 DASE, bicyclopyrone at 0.12 kg/ha applied 3 DASE, and bicyclopyrone at 0.24 kg/ha applied 3 and 6 DASE resulted in 10 to 95% sesame injury, which was greater than the untreated check. When evaluated 59 d after herbicide application at New Deal, *S*-metolachlor at 1.43 kg/ha applied 6 DASE, bicyclopyrone at 0.12 kg/ha applied 3 DASE, and bicyclopyrone at 0.24 kg/ha applied 3 DASE resulted in sesame injury greater than the untreated check.

Sesame yield at Castroville reflected the severe injury noted during the growing season. Yields from *S*-metolachlor at 0.72 kg/ha applied 3 DASE and *S*-metolachlor at 1.43 kg/ha were not significantly lower than the untreated check. At Shorter, the results were entirely different as only bicyclopyrone at 0.24 kg/ha produced yields that were lower than the untreated check while at New Deal yields were not significantly different than the untreated check with any herbicide. The yield results from Shorter and New Deal illustrated the great ability of sesame to compensate for poor growth and injury during the early portion of the growing season.

In summary, these results indicate that there are issues with applying herbicides soon after sesame emergence and more research is needed in this area to identify factors which contribute to these injury issues. Also, the severe injury noted with bicyclopyrone at all three locations and yield reductions noted at Castroville and Shorter are due to the excessive rate used. The rates of bicyclopyrone used are 2.5X the rates recommended by Syngenta Crop Protection for use in most crops.

OPTI-DGA^{TM}: AN IMPROVED DGA DICAMBA FORMULATION. M.C. Cox*, K.W. Miesse, J.R. Roberts, M. Wayland; Helena Chemical Company, Memphis, TN (55)

ABSTRACT

Renewed commercial interest and current formulation limitations warrant dicamba formulation enhancement. OPTI-DGA™ herbicide is a pre-mixture of the diglycolamine salt of dicamba and proprietary adjuvants formulated by Helena Chemical Company and designed to maximize spray mixture efficacy and field performance. Field studies conducted across ten states in the U.S. from 2014 to 2015 evaluated postemergence control of various broadleaf weeds with OPTI-DGA™. From 2014-2015, OPTI-DGA™ at 0.27 or 0.53 kg ae haË‰^{1} controlled Palmer amaranth (*Amaranthus palmeri*) equivalent to or better than the dimethylamine (DMA) and diglycolamine (DGA) salts of dicamba in field trials in Arkansas, North Carolina, and Tennessee, out to 28 DAT. OPTI-DGA™ also demonstrated superior wetting, spreading, and penetration through a waxy barrier in laboratory experiments, when compared to standard DMA and DGA salt formulations. In addition, proprietary compatibility agents in OPTI-DGA™ prevented tank-mixing and spray solution inconsistencies observed with other DMA and DGA dicamba formulations in hard water. OPTI-DGA™ will not be labelled for in-crop use with dicamba-tolerant cropping systems but will be utilized for preplant burndown, postharvest applications, and fallow systems.

OVERVIEW OF THE UNIVERSITY OF TENNESSEE WEED DIAGNOSTICS CENTER. J.T. Brosnan*, J.J. Vargas, G.K. Breeden, R.J. Trigiano, S.L. Boggess; University of Tennessee, Knoxville, TN (56)

ABSTRACT

The Weed Diagnostics Center (WDC) is a new diagnostic arm of the University of Tennessee (UT) Institute of Agriculture that opened in summer 2016. An initiative supported by both the UT Office of AgResearch and UT Extension, the mission of this Center is to provide end-users from across the United States diagnostic tests tailored to weeds of crop production systems as well as turf, ornamentals, and urban landscapes. Serving both the consumer and professional industries, specialists at the WDC incorporate both whole plant and molecular methods to provide a wide range of diagnostic services from basic weed identification to tests confirming herbicide resistance via DNA sequencing. The WDC can currently evaluate weeds for resistance to herbicidal inhibitors of acetyl CoA carboxylase (ACCase), acetolactate synthase (ALS), cellular mitosis, enolpyruvylshikimate phosphate (EPSP) synthase, photosystem II, and protoporphyrinogen oxidase (PPO). Work is on going to expand services to test other modes of action and develop more rapid methods of resistance testing. The WDC is also home to an additional suite of services specific to bermudagrasses (*Cynodon* spp.) used on golf course putting greens and fairways. All WDC test results are complemented with research-based control recommendations to promote proper weed management practices in the field. Additional information about the WDC can be found online at www.weeddiagnostics.org, or by contacting weeddiagnostics@utk.edu. More information on the WDC can also be accessed via Twitter (@WeedDiagnostics) and Instagram (@weeddiagnostics).

IMPACT OF REDUCED RATES OF 2, 4-D AND DICAMBA ON SWEET POTATO. D.K. Miller*; LSU AgCenter, St. Joseph, LA (57)

ABSTRACT

A field study was conducted in 2016 at the Sweet Potato Research Station near Chase, La with the objective to evaluate impacts of reduced rates of hormonal herbicides on sweetpotato. A four replication factorial arrangement of treatments was used and included herbicide application timing (Factor A: 10 or 30 d after planting (DAP), herbicide (Factor B: glyphosate + DGA salt of dicamba @ 1.0 + 0.5 lb ae/A use rate or glyphosate + 2,4-D @ 1.0 + 0.75 lb ae/A use rate), and reduced use rate (Factor C: 1/10, 1/33, 1/66, or 1/100 of the use rate). A non-treated control was included to aid in making visual assessments and also used to calculate percent reduction with respect to yield measurements but was not included in the statistical analysis. Treatments were applied to each 3 x 7.62 m plot at the scheduled timing following planting of ‘Beauregard” sweet potato on June 29. Parameter measurements included visual crop injury (chlorosis, stunting, twisting, leaf crinkling) 7, 14, and 28 d after application (DAT) and yield (U.S. #1, canner, jumbo, and total).

At 7 DAT, a significant reduced rate x application timing interaction was noted. Averaged across herbicides, visual injury was greater with application at 30 DAP for 1/10 (66 vs 28%), 1/33 (31 vs 10%), and 1/66 (20 vs 8%) of the use rate in comparison to 10 DAP but were equal for the lowest rate applied (11 and 8%). At 14 DAT, significant herbicide x reduced rate, herbicide x application timing, and reduced rate x application timing interactions were noted. Averaged across application timing, visual injury was greatest and equal for both herbicides applied at the highest rate (75 and 68%). Injury was greater following application of glyphosate + dicamba compared to glyphosate + 2,4-D at 1/33 (48 vs 25%), 1/66 (41 vs 16%), and 1/100 (29 vs 9%) of the use rate. Averaged across reduced rates, glyphosate + dicamba applied at 30 DAP resulted in 50% visual injury, which was greater than the 43% observed for the herbicide applied 10 DAP and the 43 and 20% injury noted for glyphosate + 2,4-D applied at 30 and 10 DAP, respectively. Averaged across herbicides, visual injury was greater with application at 30 DAP for 1/10 (85 vs 58%), 1/33 (44 vs 29%), and 1/66 (36 vs 21%) of the use rate in comparison to 10 DAP but were equal for the lowest rate applied (21 and 17%).

At 28 DAT, significant herbicide x reduced rate, herbicide x application timing, and reduced rate x application timing interactions were noted. Averaged across application timing, visual injury was greatest and equal for both herbicides applied at the highest rate (75 and 68%). Injury was greater following application of glyphosate + dicamba compared to glyphosate + 2,4-D at 1/33 (48 vs 25%), 1/66 (41 vs 16%), and 1/100 (29 vs 9%) of the use rate. Averaged across reduced rates, glyphosate + dicamba applied at 30 DAP resulted in 50% visual injury, which was greater than the 43% observed for the herbicide applied 10 DAP and the 43 and 20% injury noted for glyphosate + 2,4-D applied at 30 and 10 DAP, respectively. Averaged across herbicides, visual injury was greater with application at 30 DAP for 1/10 (85 vs 58%), 1/33 (44 vs 29%), and 1/66 (36 vs 21%) of the use rate in comparison to 10 DAP but were equal for the lowest rate applied (21 and 17%).

A significant herbicide x application timing interaction was noted with respect to percent yield reduction of U.S. no 1 grade sweet potato. For both herbicides, a significant and equal yield reduction was only noted when applied at the 30 DAP timing (42 and 49%) when averaged across reduced rates. A significant main effect of application timing was noted for canner grade yield reduction and averaged across herbicides and application timing yield was reduced only at the 30 DAP timing (14%). A significant main effect of reduced rate was observed for jumbo grade yield with a significant reduction noted only with the 1/10 (68%) and 1/33 (5%) of the rates. Significant main effects of herbicide, reduced rates, and application timing was noted with respect to total yield reduction. Significant reduction was observed for glyphosate + dicamba when compared to glyphosate + 2,4-D (25 vs 0%), the 1/10 (57%) in comparison to other reduced use rates, and 30 DAP (14%) when compared to the earlier timing (0%).

Producers with multi-crop operations including sweet potato are cautioned to thoroughly follow all labeled sprayer cleanout procedures when previously spraying one of the combination herbicides evaluated or to devote separate spraying equipment. Producers are also cautioned to follow all label restrictions to prevent off target movement to adjacent sweet potato fields.

RESPONSE OF GLYPHOSATE-RESISTANT AND -SUSCEPTIBLE ITALIAN RYEGRASS (*LOLIUM MULTIFLORUM*) TO HERBICIDE, CROP INTERFERENCE, AND DROUGHT STRESS. S. Chaudhari*[1], D.L. Jordan[1], A.C. York[1], K.M. Jennings[1], C.W. Cahoon[2], A. Chandi[3], M.D. Inman[1], R.J. Richardson[1], A. Brown[1]; [1]North Carolina State University, Raleigh, NC, [2]Virginia Tech, Painter, VA, [3]DuPont Crop Protection, Newark, DE (58)

ABSTRACT

Italian ryegrass is one of the most economically damaging glyphosate-resistant weeds in cereal crops. An understanding of the basic biology of resistant populations, including their growth and development relative to a segregating susceptible population collected from same geographical location, may yield information helpful in the management of resistant populations. A segregating population of Italian ryegrass collected in North Carolina during 2010 was used as a plant source for both glyphosate-resistant (GR) and glyphosate-susceptible (GS) traits for greenhouse studies. In first experiment, plants with 2-3 tillers were treated with postemergence applications of atrazine, clethodim, glyphosate, glufosinate, imazapic, paraquat, pinoxaden, pyroxasulfone, and tembotrione. As expected, variation in visible control for GS and GR Italian ryegrass was noted when glyphosate was applied. However, response to all other herbicides was similar for GR and GS Italian ryegrass. In a second experiment, interference from GR and GS Italian ryegrass populations on early season vegetative growth of barley, oat, grain rye, and wheat was determined for 45 days. Crop height reduction due to Italian ryegrass interference was similar for all crops. Greater interference from Italian ryegrass, measured as crop dry weight reduction, was noted in wheat compared with barley, oat, and grain rye. Crop height, tiller count, and dry weight was reduced similarly by GR and GS Italian ryegrass. Barley, oat, rye, and wheat interference caused similar reduction in both GR and GS Italian ryegrass height, tiller count, and shoot dry weight. Height reduction for GS Italian ryegrass due to crop interference was greater compared to GR population. There was no difference between GR and GS Italian ryegrass populations in terms of tiller count and shoot dry weight reduction due to crop interference. The third experiment was designed to determine recovery of GR and GS Italian ryegrass when grown either alone or with wheat from drought stress beginning 20 d after planting (DAP) for a duration of 0, 4, 6, 8, 10, or 12 days. Following exposure to drought, plants were grown under optimal moisture conditions until harvest at 40 DAP. Increasing duration of drought stress resulted in greater reductions in Italian ryegrass and wheat height, tiller count, and dry weight. Generally, reduction in wheat height, tiller count, and shoot dry weight by drought stress was similar for wheat grown alone and grown with GR or GS Italian ryegrass. There was no difference in height, tiller count, or dry weight reduction between GR and GS population grown either alone or with wheat. Collectively, these data suggest that GR and GS plants collected from the same location in North Carolina most likely respond similarly under drought stress; in presence of barley, oat, grain rye, and wheat; or when treated with POST herbicides currently used in several economically important crops.

UTILIZATION OF PIGEON PEA *(CAJANUS CAJAN)* FOR ERADICATION OF JOHNSONGRASS RHIZOMES *(SORGHUM HALEPENSE*). V. Kankarla*, F. Bullock, S. Chowdhury, C. Dumenyo, C. Reddy; Department of Agricultural and Environmental Sciences, Tennessee State University, Nashville, TN (59)

ABSTRACT

Johnsongrass (*Sorghum halepense)* is a notorious and invasive perennial weed in most croplands within the United States and tropical and sub-tropical countries. It is an extremely invasive weed that reproduces by seeds and underground rhizomes. A preliminary experiment was conducted at Tennessee State University research center to investigate the impact of Pigeon pea plant on the development of Johnsongrass rhizomes. The goal is to develop a management strategy that encourages growing Pigeon pea as a natural control of Johnsongrass while promoting it as a staple food crop. Pigeon pea was drilled in highly infested Johnsongrass fields using a randomized split block design with 4 replications and 6 treatments as follows: 1) Untreated Johnsongrass (no pigeon peas), 2) Johnsongrass + Metolachlor 8E @ 2.0 lbs. a.i. /A+ Pigeon peas, 3)Johnsongrass + Metolachlor 8E @ 2.0 lbs. a.i. /A + Pigeon pea + Clethodim @ 0.125 lbs. a.i. /A + Bentazon 4E @ 2.0 lbs. a.i. /A, 4) Johnsongrass + Cultivation + Pigeon pea, 5) Johnsongrass + Cultivation + Metolachlor 4E @ 2.0 lbs. a.i. /A + Pigeon pea and 6) Johnsongrass + Pigeon pea. Preliminary observations and data were recorded during four different phases of Johnsongrass rhizome growth. Measurements of the number, the length, and the width of rhizomes were taken of randomly selected Johnsongrass plants. The results indicate that Pigeon pea reduced the number of rhizomes and decreased the length of the rhizomes by 50 percent. Although the width of the rhizomes remains approximately the same, the structure changed significantly. These assessments support further investigation of Johnsongrass proliferation in the presence of Pigeon pea and development of a management strategy to encourage natural control of this invasive grass.

POSTEMERGENCE CONTROL OF CAROLINA DICHONDRA (*DICHONDRA CAROLINENSIS* MICHX.) IN HYBRID BERMUDAGRASS. G.M. Henry*, K.A. Tucker; University of Georgia, Athens, GA (60)

ABSTRACT

Field experiments were conducted at the Athens Turfgrass Research and Education Center in Athens, GA during the summer of 2016 to evaluate the postemergence control of Carolina dichondra (*Dichondra carolinensis* Michx.) in turfgrass. Research was conducted on 'TifTuf' hybrid bermudagrass [*Cynodon dactylon* (L.) Pers. x *C. transvaalensis* Burtt-Davy] (5.1 cm) with a mature infestation of Carolina dichondra. Plots measuring 1.5 x 1.5 m were arranged in a randomized complete block with four replications. Herbicide treatments were initiated on July 12, 2016 with a sequential application made on August 17, 2016. Treatments consisted of EH1587 (halauxifen-methyl + fluroxypyr + dicamba) at 0.31 kg ai ha^{-1}, EH1580 (penoxsulam + pyrimisulfan – fertilizer carrier) at 0.09 kg ai ha^{-1}, Surge (sulfentrazone + 2,4-D + MCPP + dicamba) at 0.99 kg ai ha^{-1}, 4-Speed XT (2,4-D + triclopyr + dicamba + pyraflufen) at 1.4 kg ai ha^{-1}, Celsius (thiencarbazone + iodosulfuron + dicamba) at 0.18 kg ai ha^{-1}, Triplet (2,4-D + MCPP + dicamba) at 1.58 kg ai ha^{-1}, and Negate (rimsulfuron + metsulfuron) at 0.04 kg ai ha^{-1}. An untreated check was included for comparison. Herbicides were applied with a CO_2 powered backpack sprayer calibrated to deliver 187 L ha^{-1} at 241 kPa. Visual ratings of % Carolina dichondra cover were recorded at 2, 5, and 10 weeks after initial treatment (WAIT). Percent control was determined by comparing % cover on individual rating dates with % cover at trial initiation (0 WAIT). Plots averaged approximately 60% Carolina dichondra cover at the start of the trial. Initial Carolina dichondra control (2 WAIT) was greatest in response to 4-Speed XT (83%), Triplet (78%), and Surge (72%). All other treatments resulted in ≤ 33% control 2 WAIT. Triplet, 4-Speed XT, Surge, and Celsius applications resulted in 96% to 100% Carolina dichondra control 5 WAIT. Control in response to EH1587 and EH1580 was 71% and 58%, respectively, while control with Negate was only 24% 5 WAIT. Surge, Triplet, 4-Speed XT, and Celsius maintained excellent control (96% to 100%) 10 WAIT. Control with EH1587 and EH1580 increased to 82% and 72%, respectively, while control with Negate was reduced to 19% 10 WAIT.

PREEMERGENCE AND POSTEMERGENCE CONTROL OF PPO-RESISTANT PALMER AMARANTH IN ROUNDUP READY 2 XTEND SOYBEAN. M.M. Houston*[1], T. Barber[2], J.K. Norsworthy[1], H.D. Bowman[1], J. Rose[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (61)

ABSTRACT

With nearly three and a half million acres of soybeans planted in Arkansas each year, proper weed management is important to keep competitive yields. Since the introduction of Roundup Ready soybean, growers have heavily relied on protoporphyrinogen oxidase inhibiting (PPO) herbicides or group 14 herbicides for difficult to control weeds such as morningglory. After glyphosate resistant-Palmer amaranth was identified in the mid-2000s, reliance on PPO-inhibiting herbicides increased drastically thus creating heavy selection pressure on Palmer amaranth with in most cases a single site of action (SOA). Since then multiple *Amaranthus* species including Palmer amaranth have been identified as PPO-resistant, with PPO-resistant Palmer amaranth being located in most Midsouth states including Arkansas in 2015. In just one growing season, PPO-resistant Palmer amaranth spread rapidly across fifteen counties in Eastern Arkansas. On-Farm field trials in Marion and Crawfordsville, AR in 2016 were conducted to assess numerous preemergence (PRE) herbicides and their ability to control PPO-resistant Palmer amaranth. The objective of these trials was to determine the effectiveness of PPO herbicides and combinations when applied PRE in plots infested with PPO-resistant Palmer amaranth. Roundup Ready 2 Xtend soybean was planted in 4 row plots and dicamba was applied postemergence (POST) in all treatments to determine effectiveness on these PPO-resistant populations. Plots were arranged as a randomized complete block and herbicide treatments were applied with a tractor mounted sprayer calibrated to deliver 12 gallons per acre. Treatments that included single PPO-inhibiting herbicides such as treatment 14 (flumioxazin + chlorimuron) or treatment 21 (sulfentrazone + cloransulam) had control ratings that were less than 70% at 21 days after treatment (DAT). Treatments that lacked multiple SOA also had reduced control ratings such as treatment 12 (metolachlor) or treatment 25 (metribuzin). PRE treatments that provided higher than 80% control included mixtures with more than one effective mode of action. Treatment 20 (saflufenacil + dimethenamid-P + pyroxasulfone + metribuzin), treatment 15 (flumioxazin + pyroxasulfone), or treatment 19 (pyroxasulfone + metribuzin) all utilized multiple SOA and provided the longest residual control of PPO-resistant Palmer amaranth. Applications of dicamba were made at 28 days following planting. Some improvement in Palmer amaranth control was noted following application of dicamba (.56 kg ai ha^{-1}), POST however, dicamba treatments did not provide complete control of PPO-resistant palmer amaranth, especially in plots where PRE herbicides were less effective. Recommendations include PRE programs including some combination or metribuzin and pyroxasulfone, with POST applications of Dicamba being made no later than 21 days after planting.

EVALUATION OF LOYANT™ EFFICACY ON COLLECTED BARNYARDGRASS ACCESSIONS AND RESPONSE ON ALS-, PROPANIL-, AND QUINCLORAC-RESISTANT BIOTYPES. M.R. Miller*, J.K. Norsworthy, M.H. Moore, M.L. Young; University of Arkansas, Fayetteville, AR (62)

ABSTRACT

Loyant™ herbicide with Rinskor™ active, a new active ingredient (florpyrauxifen-benzyl) by Dow AgroSciences LLC, provides an alternative mechanism of action to control barnyardgrass in rice. Greenhouse experiments were conducted to evaluate Loyant efficacy on barnyardgrass accessions collected in rice fields across Arkansas, and its efficacy on herbicide-resistant biotypes. In one experiment, Loyant was applied at 30 g ai ha^{-1} to 152 barnyardgrass accessions collected from 21 Arkansas counties. Loyant at 30 g ai ha^{-1} was effective at controlling barnyardgrass, reducing plant height and aboveground biomass. In a dose-response experiment, susceptible, acetolactate synthase (ALS)-, propanil-, and quinclorac-resistant barnyardgrass biotypes were subjected to nine rates of Loyant ranging from 0 to 120 g ai ha^{-1}. ED_{90} values for percent control, plant height, and biomass reductions of all resistant biotypes were controlled by 30 g ha^{-1}. Quinclorac-resistant barnyardgrass as well as other herbicide-resistant biotypes were controlled by Loyant. Loyant provides an effective tool for controlling susceptible and herbicide-resistant barnyardgrass biotypes. Loyant herbicideis an alternative mechanism of action will contribute to improved herbicide resistance management.

RICE RESPONSE TO SIMULATED DRIFT OF PARAQUAT APPLIED IN PROPORTIONAL CARRIER VOLUME. B.H. Lawrence*[1], J.A. Bond[1], B.R. Golden[2], H.T. Hydrick[1], J.M. McCoy[1]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Stoneville, AR (63)

ABSTRACT

In Mississippi, rice (*Oryza sativa* L.) is ideally seeded between April 1 and May 20; however, these dates often coincide with preplant herbicide applications for corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), and soybean [*Glycine max* (L.) Merr.]. These herbicide applications often include paraquat applied at 840 g ai ha^{-1} for glyphosate-resistant weed control. Off-target movement of paraquat applications is common during the spring in Mississippi. Two techniques for studying effects of off-target herbicide movement are utilization of varying or constant carrier volume. Both techniques are accepted to test the effects off-target herbicide movement at reduced rates to sensitive plant species, but inconsistent results are possible. Therefore, research was conducted to determine the effects on rice following paraquat applied in a constant carrier volume with reduced rates and in a proportionally reduced rate and carrier volume.

Two studies were conducted in 2016 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate rice response to paraquat applied at constant or varying rates in proportional carrier volumes. Experimental design for both studies was a randomized block design with five replications. In both studies, carrier volumes were decreased proportionally from a recommended carrier volume of 187 L ha^{-1}. A constant paraquat rate study evaluated a constant paraquat rate of 84 g ai ha^{-1} applied in carrier volumes of 10 and 25% of the recommended volume. A proportional paraquat rate study evaluated paraquat rates that decreased proportionally with carrier volumes. Paraquat was applied at 84 and 210 g ha^{-1} in carrier volumes of 10 and 25% of the recommended volume, respectively. A nontreated control was included for comparison in both studies. Treatments were applied to rice during panicle differentiation using a CO_2-pressurized sprayer mounted on an all-terrain vehicle with speed adjusted to obtain targeted volumes. Visual estimates of rice injury were recorded 3, 7, 14, and 21 d after treatment (DAT). Plant heights were recorded 14 DAT. Aboveground rice biomass was collected 21 DAT. Rice height and dry biomass were converted to a percent of the nontreated control. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with $\alpha = 0.05$.

In the constant carrier volume study, rice injury from paraquat at 84 g ha^{-1} was less when applied in 10 compared with 25% carrier volume at all evaluation intervals. At 3 and 7 DAT, injury from paraquat applications in 25% carrier volume was at least 22% greater than that with applications in 10% carrier volume. Similar to rice injury, height following application in 25% carrier volume (42% of nontreated) was less than that following application in 10% carrier volume (61% of nontreated). In the study evaluating proportional paraquat rate, rice injury with the higher paraquat rate and carrier volume was at least 19% greater than for the lower rate and volume at all evaluations. Rice injury 7 DAT decreased 34% when paraquat rate and carrier volume were reduced from 25 to 10%. The impacts on rice height and biomass were less with applications of paraquat at the lower rate and carrier volume.

Rice injury and the effects on height of simulated off-target paraquat applications were less when carrier volume and/or paraquat rate decreased. Rice biomass was different between carrier volumes only when both paraquat rate and volume decreased from 25 to 10% of the recommended volume. Simulated off-target applications of paraquat at any carrier volume severely injured rice and reduced height.

RESIDUAL HERBICIDES FOR PALMER AMARANTH CONTROL IN COTTON. M.C. Askew*[1], C.W. Cahoon[2], A.C. York[3]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech, Painter, VA, [3]North Carolina State University, Raleigh, NC (64)

ABSTRACT

Glyphosate-resistant Palmer amaranth (AMAPA) is controlled in cotton with well-timed glufosinate applications plus residual herbicides. PRE herbicides are essential components of management systems but they sometimes injure cotton. The objective of this research was to evaluate PRE herbicide combinations and rates as components of an overall management system to control AMAPA while minimizing cotton injury.

An experiment was conducted on sandy loam soils in North Carolina at three sites in 2015 and two sites in 2016. Three sites were in conventional tillage and two were planted no-till. No-till sites received glyphosate plus 2,4-D 3 to 4 wk ahead of planting and paraquat PRE. All sites were heavily infested with glyphosate-resistant AMAPA. Twelve PRE herbicide combinations included the following: Warrant + Reflex at 840 + 140, 840 + 210, and 1260 + 280 g ai ha^{-1}; Warrant + Direx at 840 + 560 and 1260 + 560 g ai ha^{-1}; Warrant + Cotoran at 1260 + 1120 g ai ha^{-1}; Reflex + Direx at 140 + 560, 210 + 560, and 280 + 560 g ai ha^{-1}; Reflex + Cotoran at 210 + 1120 g ai ha^{-1}; Brake F16 at 378 g ai ha^{-1}; and Cotoran + Caparol at 840 + 840 g ha^{-1}. A no-PRE treatment was included. Full use rates (g ha^{-1}) of PRE herbicides on the soils in this experiment include the following: Brake F16 (fluridone + fomesafen), 378; Cotoran (fluometuron), 1120; Direx (diuron), 560 if in a combination; Reflex (fomesafen), 280; and Warrant (acetochlor), 1260.

Roundup PowerMax (glyphosate) 1260 g ae ha^{-1} + Liberty (glufosinate-amonium) 660 g ai ha^{-1} were applied POST 18 to 35 d after planting when GR-AMAPA averaged 10 cm tall and again 18 to 25 d later. Direx + MSMA at 1120 + 1680 g ai ha^{-1} were directed at layby 14 d after the second POST application. The experimental design was a RCB with three or four replications. The combination of Reflex 280 g ha^{-1} + Warrant 1260 g ha^{-1}, hereafter referred to as the grower standard, controlled AMAPA 99 to 100% at all locations at time of the first POST application. Most PRE combinations and rates controlled AMAPA similar to the standard treatment. Exceptions included Cotoran + Caparol, Reflex 140 g ha^{-1} + Direx 560 g ha^{-1}, and Warrant 840 g ha^{-1} + Direx 560 g ha^{-1}. At 3 of 5 locations prior to POST application, Cotoran + Caparol was 22% less effective than the standard. At 2 of 5 locations, Reflex 140 g ha^{-1} +Direx 560 g ha^{-1} was 17% less effective than the standard. And, at 1 of 5 locations, Warrant 840 g ha^{-1} + Direx 560 g ha^{-1} was 21% less effective than the standard.

Following the two POST applications of glyphosate + glufosinate and prior to layby, the standard controlled AMAPA 90 to 100% and averaged 96%. At 4 of 5 locations, AMAPA control averaged 37% less with the no PRE treatment compared with the standard. At 2 of 5 locations, Cotoran + Caparol was 13% less effective than the standard. The layby application masked previously observed differences among the PRE herbicides. All treatments that included a PRE herbicide controlled AMAPA at least 95% after the layby application. However, the value of a PRE herbicide was still evident. Relative to the standard treatment, control in the treatment without PRE herbicides was reduced at all locations by an average of 25%.

Injury 14 d after PRE application was usually 10% or less. Injury was most likely to be observed in plots receiving Brake F16 (which contains fomesafen) and Reflex, and injury generally increased as the Reflex rate increased. Seedcotton yield with treatments containing a PRE herbicide did not differ from that of the standard. Yield in treatments without a PRE herbicide was reduced an average of 25%.

TIMING OF PALMER AMARANTH REMOVAL ON SWEETPOTATO YIELD AND QUALITY. S.C. Smith*[1], K.M. Jennings[2], D.W. Monks[3]; [1]North Carolina State University, Hendersonville, NC, [2]North Carolina State University, Raleigh, NC, [3]NC State University, Raleigh, NC (65)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*), the most common and troublesome weed in NC sweetpotato, reduces storage root yield and quality. A study was conducted to determine how timing of Palmer amaranth control impacts storage root yield and quality of 'Covington' sweetpotato. Treatments included hand removal of Palmer amaranth at 2, 3, 4, 5, 6, 7, 8, and 9 weeks after transplanting (WAT) sweetpotato. Plots were arranged in a randomized complete block design with 5 replications. Following weed removal, plots were maintained weed-free until harvest. Palmer amaranth control timing had a significant effect on sweetpotato foliage biomass dry weight, and sweetpotato storage root yield and quality. The earliest removal timing, 2 WAT, had the greatest sweetpotato storage root yield and quality. As removal timing was delayed foliage biomass dry weight, and storage root yield and quality decreased.

EFFICACY OF SEQUENTIAL GLUFOSINATE AND DICAMBA APPLICATIONS ON PALMER AMARANTH (*AMARANTHUS PALMERI*). M.W. Durham*[1], K. Thomason[1], J. Ferrell[1], R. Leon[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL (66)

ABSTRACT

Reliance on glyphosate resistant (GR) cotton (*Gossypium* hirsutum L.) cultivars has led to resistant biotypes of many weed species. GR resistant Palmer amaranth (*Amaranthus palmeri* S. Wats.) is one of the most problematic weeds in cotton production in the southern United States. Recently released dicamba and glufosinate resistant cotton cultivars may aid farmers in controlling GR Palmer amaranth. Labeling for the use of dicamba on cotton is still in the regulatory process. While dicamba alone may be applied to cotton, it is unclear if tank mixes with other herbicides will be allowed. The objective of this study was to compare the efficacy of different sequential timings of dicamba (561 g ha^{-1}) and glufosinate (593 g ha^{-1}) on control of Palmer amaranth. A nine treatment, four replicate, randomized complete block design experiment was conducted on 15-20 cm tall Palmer amaranth to test this objective. Three treatments received both herbicides on the same day: 1) glufosinate + dicamba applied at noon 2) glufosinate applied at noon followed by (fb) dicamba 7 hours later and 3) dicamba at noon fb glufosinate 7 hours later. The remaining 6 treatments all had either glufosinate, or dicamba applied alone followed by the other herbicide either at 24, 48, or 72 hours later. Ratings of % control, where 0 % indicates no control and 100 % means complete mortality, were taken at 1, 2 and 3 weeks after initial treatment (WAT). No differences were noted at 1 WAT and all treatments resulted in > 90% control of Palmer amaranth. At 2 WAT, greater control was achieved in the sequential applications when dicamba was applied first fb glufosinate at 24, 48, or 72 hours later than the single combination application. At 3 WAT control was still greater in the sequential applications when dicamba was applied first fb glufosinate 24 hours or more later and in the glufosinate fb dicamba application with a 72 hour delay between applications. These data indicate that for large weeds, split applications with dicamba applied first,fb glufosinate, may be more beneficial than a single application of the two herbicides combined. These data also indicate that waiting to make the second application by at least 24 hours may increase the efficacy of the application.

PRE-EMERGENCE HERBICIDE LONGEVITY ON PALMER AMARANTH CONTROL IN COTTON. J.L. Reeves*, S. Steckel, L.E. Steckel; University of Tennessee, Jackson, TN (67)

ABSTRACT

Longevity of herbicides is one key goal to long-term sustainability for a farmer. In 2016 fomesafen in numerous cases did not provide the length of residual Palmer amaranth control seen in previous years. More weed control diversity is clearly needed which makes necessary that new herbicides and different approaches be utilized in the years ahead. Applications of burndown, pre-emergence, and post emergence choices are necessary to survive a cotton season. Stretching out these applications can be risky business, but with the right herbicide choices could this be possible?

Fluridone + fluometuron has the potential to be a new choice for consistent pre-emergence control of Palmer in cotton. This group 12 & 7 herbicide needs at least 0.5 inch of rain or irrigation to be activated. It is also suggested to make a post herbicide application of choice 12-16 days after planting. The longevity of this pre-emergence herbicide was assessed in comparison to other commonly used pre-emergence herbicides in hopes it will eventually be a good option for cotton farmers.

A field study was conducted in 2016 at the West TN Research and Education Center in Jackson, TN. The objective of this trial was to compare the residual activity of the pre-mix herbicide fluridone + fluometuron to five other commonly used pre-emergence herbicides in cotton for the control of Palmer amaranth. Multiple visual ratings were taken to determine crop safety and the control of Palmer amaranth.

Two rates of fluridone + fluometuron were applied as a pre; a 1x rate (32 oz/a) and a tank mixture of .5 x rate (16 oz/a) + 16 oz/a of dicamba. Both treatments provided longer residual control of Palmer amaranth and caused similar or less injury to cotton when compared to local standards. This showed that fluridone + fluometuron can have a longer lasting residual and the potential to be a good option as a pre-emergence herbicide.

RESURRECTION OF GLYPHOSATE RESISTANT PALMER AMARANTH CONTROL IN CONSERVATION TILLAGE DICAMBA TOLERANT COTTON; SOIL HEALTH SALVATION USING HERBICIDE TECHNOLOGY. A.J. Price*[1], J.A. Tredaway[2], G.S. Stapleton[3]; [1]USDA, Auburn, AL, [2]Auburn University, Auburn, AL, [3]BASF, Dyersburg, TN (68)

ABSTRACT

Conservation agriculture hecterage in the mid-south and southeastern US has decreased because of herbicide resistant and other hard to control weeds. Producers have increasingly utilized tillage, the majority either using a moldboard plow to deeply bury weed seed and decrease emergence, or 'vertical tillage' to decrease surface residue in an effort to increase soil active herbicide placement and subsequent activity; soil health consequences be damned. However, high residue cover crops integrated with efficacious herbicide systems could protect yield, and preserve conservation agriculture practices and salvation for associated soil health indicators. Two nearly identical, four year conservation tillage cotton experiments, were established in fall 2012 at Auburn University's EV Smith Research and Extension Center, near Shorter, AL. Plots were maintained with the same treatment each subsequent year until experiment completion. Both experimental fields contained majority glyphosate susceptible Palmer amaranth, among other weeds, at initiation. In both experiments, cereal rye (*Secale cereale* L.) was established in half of the plots and managed for maximum biomass, while the remainder was managed herbicide fallow. In the glyphosate tolerant cotton experiment, for the first three years of the experiment, the factorial herbicide treatments included: 1) glyphosate applied at 1.12 kg ae/ha plus metolachlor applied at 1.12 kg ai/ha EPOST at cotton 2-leaf growth stage, 2) glyphosate applied at 1.12 kg ae/ha plus metolachlor applied at 1.12 kg ai/ha POST at cotton 8-leaf growth stage, or 3) flumioxazin 0.071 kg ai/ha applied as a PDS when cotton reached 45 cm height. In the glufosinate tolerant cotton experiment, for the first three years of the experiment, the factorial herbicide treatments included: 1) glufosinate applied at 0.59 kg ai/ha plus metolachlor applied at 1.12 kg ai/ha EPOST at cotton 2-leaf growth stage, 2) glufosinate applied at 0.59 kg ai/ha plus metolachlor applied at 1.12 kg ai/ha POST at cotton 8-leaf growth stage, or 3) flumioxazin 0.071 kg ai/ha applied as a PDS again when cotton reached 45 cm height. A non-treated control was included in both studies for comparison. In the fourth year, dicamba (applied at 0.56 kg ai/ha) replaced glyphosate or glufosinate in all treatments in each respective experiment. In 2013, in both experiments, early Palmer amaranth control exceeded 95% in rye and fallow systems following glyphosate or glufosinate EPOST. However by late season, glyphosate applied EPOST fb POST fb flumioxazin provided 83% in plots containing a rye cover crop, and control was substantially lower in all other treatments. In 2013 in the glufosinate experiment, sequential glufosinate applications EPOST fb POST or glufosinate applied EPOST followed by flumioxazin PDS when a rye cover was present, provided 99% late season control. However, in the winter fallow system, glufosinate EPOST fb POST fb flumioxazin PDS was needed to attain 99% control Palmer amaranth full season. Following decreasing Palmer control in 2014, in 2015 in the glyphosate experiment, no herbicide treatment provided >80% early control in cereal rye containing plots, and plots without three herbicide applications resulted in $\leq$ 67% control in all plots. Control late season never exceeded 30% in the glyphosate experiment. In the glufosinate system, 95% or 93% late season control was attainable only in rye or fallow containing plots, respectively, when glufosinate was applied EPOST fb POST fb flumioxazin PDS. In 2016, Palmer amaranth control with dicamba was

increased across all treatments following both glufosinate and glyphosate experiments, levels observed at the initiation of this experiment or higher late season. Cotton yield followed observed weed control; averaged over herbicide treatments, cereal rye containing plots yielded higher one out of three comparisons in the glufosinate treatments, and were equal following glyphosate in all three years of comparison. In 2016, averaged over dicamba herbicide treatments, yields were again equivalent between cereal rye plots and winter fallow, following either glufosinate or glyphosate experiments. One notable observation: when glyphosate resistance in the glyphosate experiment increased, control in the adjoining glufosinate experiment decreased, likely due to weed seedbank additions, and loss of control due to sheer population size attributes.

EFFICACY OF HERBICIDE PROGRAMS IN BALANCE™ GT*LL SOYBEAN. J.D. Peeples*[1], H.M. Edwards[1], T.L. Phillips[1], J.A. Bond[1], S. Garris[2]; [1]Mississippi State University, Stoneville, MS, [2]Bayer CropScience, Bentonia, MS (69)

ABSTRACT

Soybean [*Glycine max* (L.) Merr.] cultivars with resistance to glyphosate, glufosinate, and isoxaflutole have been co-developed by MS Technologies and Bayer CropScience. This herbicide-resistant soybean technology will be marketed as the Balance™ GT*LL system with the isoxaflutole-containing herbicide sold as Balance Bean®. Balance GT*LL soybean are currently awaiting export approval and the herbicide label for Balance Bean has not yet been approved by the U.S. Environmental Protection Agency. As the incidence of glyphosate-resistant (GR) Palmer amaranth [*Amaranthus palmeri* (S.) Wats.] increases, alternative weed management systems such as Balance GT*LL soybean are needed to diversify herbicide programs. Research was conducted to evaluate the efficacy of soybean weed management programs containing Balance Bean applied PRE alone and in combination with other residual herbicides in a Balance GT*LL system.

Research was conducted during 2016 at the Delta Research and Extension Center in Stoneville, MS, at a site known to be infested with GR Palmer amaranth and other common weed species. Soil was a Newellton silty clay with a pH of 6.85 and 1.57% organic matter. Individual plots were four 40-inch rows measuring 30 feet in length. An experimental Balance GT*LL soybean cultivar was planted at 140,000 seeds/A on June 13, 2016. The experimental design was a randomized complete block with four replications. Preemergence treatments were applied day of planting and included mixtures of Balance Bean plus TriCor®, Dual Magnum®, or Zidua® and compared with local standard treatments such as Fierce®, Authority MTZ®, and Canopy DF® plus Dual Magnum. All plots were treated with Liberty® 280 plus Prefix® at the V3 soybean growth stage. A nontreated control was included for comparison. Visual estimates of soybean injury and control of barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], Palmer amaranth, and pitted morningglory (*Ipomoea lacunosa* L.) were recorded 21 and 35 d after planting (DAP). Following the final visual evaluation, the experiment was terminated. Data were subjected to ANOVA with means separated by Duncan's new multiple range test at P=0.05

Soybean injury with all PRE treatments containing Balance Bean was ≤3% 21 DAP, and injury was <10% for all PRE followed by POST herbicide programs 35 DAP. Regardless of herbicide mixture, all PRE treatments containing Balance Bean at 0.094 lb ai/A provided similar barnyardgrass control (91 to 95%) 21 DAP. Barnyardgrass control 21 DAP with Fierce, Authority MTZ, or Balance Bean at 0.065 lb/A plus TriCor, was less than that with all treatments containing Balance Bean 0.094 lb/A. At 35 DAP and following application of POST treatments, barnyardgrass control for all herbicide programs was similar and ≥95%. Palmer amaranth control was similar and ≥95% 21 DAP following Canopy DF plus Dual Magnum and all PRE treatments containing Balance Bean. However, Balance Bean at 0.094 lb/A applied in mixtures with TriCor, Dual Magnum, or Boundary controlled more Palmer amaranth 21 DAP than Fierce and Authority MTZ. Following POST treatments, no differences were observed for Palmer amaranth control with PRE followed by POST herbicide programs. At 21 DAP, Balance Bean at 0.094 lb/A plus Boundary PRE controlled pitted morningglory greater than Balance Bean at

0.065 lb/A plus TriCor. When Balance Bean was applied at 0.094 lb/A, pitted morningglory control 21 DAP was similar regardless of PRE herbicide mixture. Canopy DF plus Dual Magnum controlled more pitted morningglory than either rate of Balance Bean mixed with TriCor. Differences in control with PRE treatments in all PRE followed by POST herbicide programs were mitigated 35 DAP when pitted morningglory control was ≥97%.

Balance Bean at 0.094 lb/A plus Boundary at 1.63 lb/A PRE provided greater barnyardgrass and Palmer amaranth control 21 DAP than commercial standards of Fierce at 0.14 lb ai/A and Authority MTZ at 0.42 lb ai/A. Control of all species was ≥95% 35 DAP when PRE treatments were followed with Liberty 280 at 0.53 lb ai/A plus Prefix at 1.32 lb ai/A. This indicates that PRE followed by POST herbicide programs in Balance GT*LL soybean offer an alternative weed management system with a mode of action that is not currently available in soybean.

METSULFURON-INDUCED SYMPTOMOLOGY ON SELECT TREE SPECIES. S.W. Tillery*, J.S. McElroy, A.P. Boyd, W. Head; Auburn University, Auburn, AL (70)

ABSTRACT

Metsulfuron is an effective herbicide for general broadleaf weed control in turfgrass. It has a low use rate and is generally viewed as more environmentally safe than traditional auxin mimic herbicides used in turf. Generic formulations have driven down the cost of metsulfuron which has resulted in an increase in use, especially in the lawn and landscape market. Metsulfuron is commonly applied at 0.25 to 0.50 oz product/a (of Manor or MSM 60% WDG), rates at which adequate control can be achieved for many broadleaf weeds. We have observed use of 1.0 oz/a applied multiple times throughout a single year, as well as excessive rate misapplications. We attribute excessive rate misapplications primarily to the low cost (<$10/oz) and the novelty of WDG formulations not often utilized in lawn and landscape. With the increased use of metsulfuron we have observed an increased tree damage occurrence, most consistently to oak (*Quercus* spp.). Definitively attributing tree injury to metsulfuron has been difficult as tree species growing in urban landscapes often grow in non-optimal conditions, i.e., compacted soil with little surface horizon and low water infiltration. Our research objective was to determine if metsulfuron injury could be induced on select tree species when metsulfuron was applied to turfgrass adjacent to trees.

Research was conducted to attempt to induce three injury from metsulfuron and qualitatively describe the resulting injury. Three tree species, live oak (*Quercus giminata*), white oak (*Quercus alba*), and Chinese pistasche (*Pistacia chinensis*) were selected to evaluate response to turfgrass applied metsulfuron. Tree saplings were planted in January 2014 at the Alabama Agricultural Experiment Station E.V. Smith Research and Education Center- Plant Breeding Unit in Tallassee, Alabama. The trial was arranged as a randomized complete block design with ten replicates. For each replicate, two trees were planted per plot along the center line of each plot. Plots were 15 feet wide by 40 feet in length. Each tree was evenly spaced along the plot center line for the length of the plot. A piece of 40 cm corrugated pipe was placed around the base of each tree to prevent tree injury during routine maintenance and prevent spray drift onto trees.

Treatments were applied March 23, 2016 to coincide with a typical lawn care operator application for spring broadleaf weed control in managed turfgrass. Treatments included metsulfuron (Manor 60% WDG) at 0.5 oz/a (0.01875 lb ai/a) and 5.0 oz/a (0.1875 lb ai/a), and Trimec Classic (2,4-D, MCPP, Dicamba) at 4.0 pt/a. Metsulfuron at 5.0 oz/a was utilized to simulate a decimal place shift over application which has been observed by the authors. Further, it is obvious that metsulfuron damage to tree species is a rare event that likely requires specific edaphic, climatic, and herbicide application factors (over application likely being one factor). Thus the 5.0 oz/a rate was to avoid a false-negative by only utilizing a normal rate. Treatments were applied to the turfgrass surface approximately 30 cm away from each tree along both sides of the center line trees. Metsulfuron treatments included 0.25% v/v crop-oil concentrate. A solid piece of plywood was placed between the trees and sprayer during the time of application to prevent spray drift. Trees were monitored monthly following application in March. Trials were rated over a four-day period from July 30 to August 2, 2016. First a survey

was conducted of all symptomology to determine the most common type of symptoms occurring. Second, based on the major observed symptoms a rating scale was developed to quantify the observed symptoms. The two primary symptoms observed were chlorosis and adventitious leaf formation occurring along the base of the stem accompanied by stem dieback. A quantitative scale was developed on a 1 to 9 scale to rate both chlorosis and adventitious leaf formation where 1 is equivalent to no chlorosis or adventitious leaf formation and 9 is equivalent to maximum possible chlorosis or adventitious leaf formation.

Herbicide treatment main effect was significant (P= 0.05) for adventitious leaf formation visual ratings for both live oak and white oak. Following herbicide treatment in March, a qualitative and quantitative assessment was made in July 2016. We first documented the primarily symptomology that could be observed across all tree species, regardless of treatment. For white oak and live oak the primary symptomology was adventitious leaf formation at the base of stems accompanied by stem dieback. No adventitious leaf or shoot formation was observed on Chinese pistache, however yellowing or chlorosis was observed on some trees throughout the study area. Chlorosis was quantified for Chinese pistache, however adventitious leaf formation was not quantified. Analysis revealed however no separation among treatments with respect to leaf chlorosis. No difference was observed between non-treated, Trimec, and metsulfuron at 0.5 oz/a with respect to adventitious leaf formation and stem die back with none of these three treatments exceeding a 2 rating on the designed scaled. Metsulfuron at 5.0 oz/a induced adventitious basal leaf formation and stem dieback averaging >7 and >5 for live oak and white oak, respectively. Leaf formation typically occurred in clusters within the crotch angles of stem to trunk or along the primary trunk itself. We conclude that metsulfuron can induce symptomology of primarily adventitious leaf formation and stem die back to white oak and live oak similar to that observed in previous field observations. We also conclude that over applications are more likely to induce such injury but that does not exclude the possibility of injury occurring with label-rate application conditions.

EFFECT OF MOWING TIMING ON JOHNSONGRASS HERBICIDE EFFICACY: TWO YEAR SUMMARY. J. Omielan*, M. Barrett; University of Kentucky, Lexington, KY (71)

ABSTRACT

Johnsongrass (*Sorghum halepense*) is a perennial warm season grass, listed as a noxious weed, and a common problem on right-of-way sites. There are a number of herbicides labeled and available to control johnsongrass and most rely on translocation from the leaves to the rhizomes for greatest efficacy. However, mowing is part of roadside management and one question is how does the timing of mowing after herbicide application affect efficacy?

This study was initiated August 14, 2014 and repeated August 24, 2015 to answer the questions asked above at an interchange near Bardstown KY. Four herbicide treatments were applied to 10 ft x 60 ft strips at 337 L/ha. Six time of mowing treatments were applied as 10 ft x 40 ft strips across the herbicide treatments in a split block design, replicated three times (four times in 2015). The herbicide treatments were Outrider (sulfosulfuron), Fusilade II (fluazifop), Acclaim Extra (fenoxaprop), and Fusilade + Acclaim. The time of mowing treatments were as follows: no mowing, same day as herbicide application, as well as 1 day, 2 days, 1week, and 2 weeks after application. Visual assessments of percent johnsongrass control were done 34 (9/17/2014), 70 (10/23/2014), and 350 (7/30/2015) days after herbicide treatment (DAT) for the 2014 trial. Assessments were done 32 (9/25/2015), 45 (10/8/2015), 53 (10/16/2015), and 298 (6/17/2016) DAT for the 2015 trial.

In the 2014 trial, while Outrider had the lowest visual control (70%) without mowing 34 DAT it had the greatest control (83%) (compared to the other herbicide treatments) when mowed the same day as application. Outrider still had the greatest control (88%) when mowed the same day 70 DAT while the other herbicides ranged from 0 to 17% control. Control in the top set of treatment combinations ranged from 88 to 100% 70 DAT. Only the no mowing and 2 weeks after combinations with Acclaim Extra were in this top group. By 350 DAT control in the top set of treatment combinations ranged from 40 to 88%. Results from this trial suggest that mowing 1 or 2 days after application will not reduce the efficacy of Outrider, Fusilade, or Acclaim + Fusilade. However, one should wait 1 to 2 weeks before mowing if Acclaim Extra was applied.

Regrowth of johnsongrass after mowing was slower in 2015 than in 2014 with 89% control for the Outrider and Fusilade II treatments when mowed the same day 32 DAT and 81 to 85% control 53 DAT. Control for the other herbicide treatments mowed the same day ranged from 72 to 75% 53 DAT. At the final assessment in 2016 (298 DAT) the control varied considerably among the plots and ranged from 13 to 48% for those plots that were mowed the same day in 2015, with the least control for the Acclaim Extra treatment.

COMPETITIVE AND NON-COMPETITIVE ADSORPTION/DESORPTION OF DIURON, HEXAZINONE, AND SULFOMETURON IN FIVE TEXAS SOILS. F. Reis[1], K.H. Carson*[2], M. Bagavathiannan[2], V. Tornisielo[3], R. Filho[1]; [1]ESALQ, USP, Piracicaba, Brazil, [2]Texas A&M University, College Station, TX, [3]CENA, USP, Piracicaba, Brazil (72)

ABSTRACT

When herbicides are mixed in a spray solution, the interactions can affect weed control in an additive, synergistic, or antagonistic manner. However, those interactions could potentially promote changes in herbicide behavior in the soil. Thus, we evaluated the competitive sorption and desorption of diuron (DIU), hexazinone (HEX) and sulfometuron-methyl (SMM), alone and in mixture, in five soils: clay loam, two clay soil types with pH 7.8 (clay 1) and 6.5 (clay 2), loam, and sandy loam. In the mixture treatments, the herbicides evaluated was radiolabeled with ^{14}C and the others were not radiolabeled. An interaction between treatments (alone or in mixture) and soils types was detected in the Kd values of sorption and desorption of HEX. In the loam soil, the presence of DIU and SMM, individually and in mixtures, decreased the sorption of HEX. A higher desorption of HEX was observed in the loam soil when DIU and SMM was also present in the solution. In the case of DIU, an interaction between treatments and soils was observed in the Kd values of desorption. In clay 1 soil, the desorption coefficient Kd was lower when DIU was in the solution along with SMM. In the sandy loam soil, Kd was lower only when DIU was in mixture with HEX and SMM. The sorption was greater when DIU was alone in the solution, regardless of the soil. The different soil types affected the sorption of DIU, with a higher sorption in the soil with more organic matter (clay 2 soil). The sorption of SMM had a greater Kd value in the clay 2 soil, which had the lowest pH (pH 6.5). No interaction was observed between soil type and treatments. Results suggest that combined effects should be taken into account while assessing the fate of soil-applied herbicides in the environment.

WEED CONTROL SPECTRUM OF BENZOBICYCLON WHEN APPLIED AT DIFFERENT RATES. B.M. McKnight*, E.P. Webster, E.A. Bergeron, G. Mack Telo, S.Y. Rustom Jr; Louisiana State University AgCenter, Baton Rouge, LA (73)

ABSTRACT

Benzobicyclon is an HPPD inhibiting herbicide that has been used in Japan rice production since 2001. Typical symptoms on susceptible weed species are bleached plant tissue followed by necrosis and death. Past research indicates that benzobicyclon is primarily taken up by plant root and shoot tissue, and this product can be absorbed into the plant from the flood water. Field studies were conducted in 2015 and 2016 on two different soils at the Louisiana State University Agricultural Center H. Rouse Caffey Rice Research Station (RRS), near Crowley, LA and in 2015 at the LSU Agricultural Center Northeast Research Station (NERS), near St. Joseph, LA. The focus of this research was to evaluate benzobicyclon activity on several common rice weed species when applied at several different rates. Following soil preparation at each location, 91-cm diameter by 31-cm deep galvanized metal rings were randomly installed near the center of each 1.5 by 5.2 m^2 plot for benzobicyclon treatment containment. Experimental design was a randomized complete block design with four replications. No rice was planted in the study area in an effort to maximize growth of a naturally occurring weed population and water management in the research area mimicked that of a water-seeded production system in South Louisiana. Benzobicyclon treatments were applied following weed emergence and when ducksalad [*Heteranthera limosa* (Sw.) Willd.] reached the first elongated leaf growth stage. Benzobicyclon treatments consisted of nine different rates: 31, 62, 123, 185, 246, 492, 738, 984, and 1230 g ai ha^{-1}. Treatments were applied using a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1} spray solution. At the conclusion of the trial, 56 DAT, all weeds inside containment rings were hand-harvest and separated by species for fresh weight determination. Fresh weight biomass data from each location and year was subjected to ANOVA and means were separated using Fischer's protected LSD where $P< 0.05$. In 2015 trials, benzobicyclon applied at 246 and 185 g ai ha^{-1} reduced ducksalad biomass at the RRS on Crowley silt loam (RRS-C) and Midland silty clay loam (RRS-M) to 11 and 0% of the nontreated, respectively. Benzobicyclon applied at 986 ai ha^{-1} reduced ducksalad biomass to 14% of the nontreated at the NERS. There was no difference in barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv], Indian toothcup [*Rotala ramosior* (L.) Koehne], false pimpernel [*Lindernia dubia* (L.) Pennel], and purple ammannia (*Ammannia coccinea* Rottb.] fresh weight biomass in 2015 at the NERS. Benzobicyclon applied at 739, 986 and 1230 g ai ha^{-1} reduced yellow nutsedge (*Cyperus esculentus* L.) biomass to 13% of the nontreated or less at the RRS-C. Ducksalad fresh weight was reduced 21 and 12% of the nontreated with benzobicyclon applied at 185 and 62 g ai ha^{-1} in 2016 trials at the RRS-C and RRS-M, respectively. Rates of 492 g ai ha^{-1} and higher consistently reduced yellow nutsedge fresh weight compared to the nontreated at the RRS-C in 2016; however, there was no difference in barnyardgrass, false pimpernel, and Indian toothcup biomass. Complete control of Indian toothcup and purple ammannia with 492 g ai ha^{-1} and higher rates of benzobicyclon was observed at the RRS-M. Results from this research indicate that benzobicyclon has activity on common Louisiana rice weed species, and benzobicyclon has an excellent fit in a water-seeded production system for the control of ducksalad and other troublesome early-season aquatic weeds.

INDAZIFLAM FOR CLEAR ZONES ON MISSISSIPPI ROADSIDES. V.L. Maddox*[1], J.D. Byrd, Jr.[1], J. Belcher[2]; [1]Mississippi State University, Mississippi State, MS, [2]Bayer CropScience, Auburn, AL (74)

ABSTRACT

Roadside clear zones are important for the safety of motorist and pedestrians both on and off the highway. Keeping these zones vegetation free can be a difficult process which can require multiple herbicide applications per season and/or grading with heavy equipment. A thirteen treatment study was initiated May 12, 2015, along U. S. Highway 45 in Brooksville, MS to evaluate indaziflam alone and in combinations with other herbicides to control clear zone vegetation. Indaziflam was applied as 8 oz of Esplanade product A^{-1} in all treatments in which it was included. In addition to glyphosate, Esplanade, and mixtures of Esplanade plus Perspective (8 oz product A^{-1}) and Oust (3 oz product A^{-1}), Esplanade plus Perspective (8 oz product A^{-1}), Esplanade plus Streamline (8 oz product A^{-1}), Esplanade plus Method 240SL (12 oz product A^{-1}), Esplanade plus Viewpoint (12 oz product A^{-1}), Esplanade plus Telar (1.5 oz product A^{-1}), Esplanade plus Method 240SL (12 oz product A^{-1}) and Plateau (8 oz product A^{-1}), Esplanade plus Method 240SL (12 oz product A^{-1}) and Matrix (4 oz product A^{-1}), Esplanade plus Hyvar X (3 lb product A^{-1}), or Esplanade plus Opensite (3.3 oz product A^{-1}) were evaluated. All herbicide treatments included glyphosate (2 qts Razor Pro product A^{-1}) to control existing weeds the time of application and an NIS at 0.25% v/v. Herbicide treatments were applied with a CO_2 backpack sprayer that delivered 20 GPA at 25 PSI. Control ratings were recorded at 1, 2, 3, 4, and 12 months after treatment (MAT). Smooth crabgrass (*Digitaria ischaemum*) was the major weed species in the study area at initiation and ranged from 18 to 22 percent average cover. At 1 MAT there were no significant differences in smooth crabgrass control among treatments, except Esplanade plus Matrix and glyphosate alone which showed less control. At 2 MAT, only glyphosate alone showed significantly less control compared to all other herbicide treatments. Though not significant each month, this trend remained throughout the study. All treatments, except the check and glyphosate only, showed acceptable levels of smooth crabgrass control beyond 12 MAT. This study indicates that Esplanade in any of the herbicide combinations used in this study could reduce clear zone maintenance time at least where smooth crabgrass is the major weed species. More study is needed with Esplanade alone and its activity on different weed species that are problematic in clear zones.

ANTAGONISM OF QUIZALOFOP IN ACCASE-RESISTANT RICE. S.Y. Rustom*, E.P. Webster, B.M. McKnight, E.A. Bergeron, G. Mack Telo; Louisiana State University AgCenter, Baton Rouge, LA (75)

ABSTRACT

A current issue for rice producers in the southern United States is the management of imidazolinone-resisant (IR) weedy rice (*Oryza sativa* L.) and/or propanil- or quinclorac-resistant barnyardgrass (*Echinochloa crus-galli* L.). Weedy rice is a complex of volunteer hybrid rice, red rice outcrosses with IR hybrids or cultivars, and naturally occurring red rice. This complex is often resistant to imazethapyr and imazamox used in IR rice production. BASF and the LSU AgCenter are currently developing a new ACCase-resistant rice cultivar called 'Provisia'. The herbicide targeted for use is quizalofop. ACCase herbicide activity is often antagonized when mixed with broadleaf and/or sedge herbicides. In 2016, two separate studies were conducted at the LSU AgCenter H. Rouse Caffey Rice Research Station (RRS) on a Crowley silt loam soil to evaluate quizalofop activity when applied alone or in mixtures with herbicides containing auxin or contact activity. Applications for the contact study were applied when Provisia rice was at the three- to four-leaf growth stage with a CO_2-pressurized backpack sprayer calibrated to deliver 140 L/ha. Applications for the auxin study were applied postflood, when Provisia rice was four- to five-leaf. Plot size was 1.5 by 5.2 m with eight 19.5 cm drill-seeded rows containing 4 rows of Provisia, 2 rows of 'CL-111', 2 rows of 'CLXL-745'. Awnless red rice seed was also broadcast across the plot area. CL-111, CLXL-745, and red rice were planted to represent a weedy rice complex. The plot area was also naturally infested with barnyardgrass. Evaluations were recorded as percent control at 14 and 28 days after treatment (DAT), with 0 = no control and 100 = complete plant death.

The experimental design for each trial was a randomized complete block with a two-factor factorial arrangement of treatments replicated four times. Factor A for each study was no quizalofop or quizalofop applied at 120 g ai/ha. Factor B for the auxin study consisted of 2,4-D applied at 1330 g ai/ha, triclopyr applied at 280 g ai/ha, quinclorac applied at 420 g ai/ha, or no mixture herbicide. Factor B for the contact study consisted of carfentrazone applied at 17.5 g ai/ha, thiobencarb applied at 3360 g ai/ha, bentazon applied at 1050 g ai/ha, propanil applied at 3360 g ai/ha, saflufenacil applied at 25 g ai/ha, or no mixture herbicide. For the auxin study, quizalofop alone controlled barnyardgrass and CLXL-745 at least 97% at 14 and 28 DAT. Quizalofop activity was reduced most for both species when mixed with 2,4-D. At 14 DAT, quizalofop plus 2,4-D controlled barnyardgrass 26% and CLXL-745 74%. At 28 DAT, the same mixture controlled barnyardgrass 10% and CLXL-745 80%. For the contact study, quizalofop alone controlled barnyardgrass and CLXL-745 at least 91% at 14 and 28 DAT. Quizalofop activity was reduced most for both species when mixed with propanil. At 14 DAT, this mixture controlled barnyardgrass 26% and CLXL-745 66%. At 28 DAT, the same mixture controlled barnyardgrass 0% and CLXL-745 78%. In conclusion, these data indicate herbicides containing 2,4-D or propanil should be avoided when considering a mixture with quizalofop. Research conducted in Louisiana indicates a second application of quizalofop alone was able to overcome antagonism. Research in Louisiana also indicates quizalofop should be applied 1 to 3 days prior to broadleaf and/or sedge herbicides.

TISSUE-SPECIFIC DISTRIBUTION OF ANTHRAQUINONE COMPOUNDS IN SICKLEPOD PLANTS USING FLUORESCENCE MICROSCOPY. Z. Yue*, T.P. Tseng; Mississippi State University, Starkville, MS (76)

ABSTRACT

Deer browsing of soybean is a common problem in the southern US. It was proposed that the anti-herbivore property of sicklepod could be extracted and used to protect soybean from deer browsing. In a separate presentation, sicklepod anti-herbivore property, i.e., anthraquinone distribution in different plant parts was presented: root > fruit > stem > leaf. Tissue-scale distribution of anthraquinone in the sicklepod plant will provide more insight on how to apply the anti-herbivore property of sicklepod to protect soybean from deer damage. This study uses the Fluorescence Microscope, Olympus BX51 to study tissue-scale anthraquinone distribution in the plant. Under UV A (such as 350 nm) incident light, anthraquinone derivatives generally show yellow fluorescence (580-600 nm). Microscope observation combined with methanol extraction plus HPLC analyses of sicklepod stem parts showed the brighter yellow and therefore higher concentration of anthraquinone derivatives for adjacent tissues: stem core > woody stem > stem bark. The stem bark has lower anthraquinone concentration than cortex and pith. In leaf, the surface cell shows lower anthraquinone concentration than cells inside. There are two possible explanations for lower anthraquinone concentration on the sicklepod plant surface: light suppresses anthraquinone biosynthesis, or anthraquinone is unstable to light. The later will influence the field application of sicklepod extracts to protect soybean from deer browsing, thus requiring further investigation.

EFFECTS OF EMERGENCE DATE AND INTER-ROW PALMER AMARANTH DISTANCE ON ITS BIOLOGICAL AND PHENOLOGICAL CHARACTERISTICS. N.E. Korres*, J.K. Norsworthy; University of Arkansas, Fayetteville, AR (77)

ABSTRACT

Knowledge on Palmer amaranth emergence patterns and growth characteristics under field conditions can be proved a valuable tool for the effective control of the weed. A field experiment was conducted in Fayetteville, Arkansas during 2014 and 2015 to examine the effects of Palmer amaranth emergence date and interrow distance on Palmer amaranth biological, phenological characteristics, and population dynamics in wide-row soybean. Palmer amaranth seedlings grown under greenhouse conditions were transplanted to the field at the 2- to 4-leaf growth stage and at intervals of 0, 1, 2, 4, 6, and 8 weeks after crop emergence (WAE) at density of 1 plant m^{-2}. All other weed species were removed by hand from the experimental plots to avoid competition. A soybean rate at 260,000 seeds ha^{-1} was used for each treatment of Palmer amaranth emergence date and interrow planting distance (i.e. 0, 23, 46 cm from the soybean row).

The effects of emergence date and interrow distance on Palmer amaranth biomass and seed production were evident at 0 and 1 WAE for the first year and only at 0 WAE for the second year. Palmer amaranth emergence date had a significant effect on Palmer amaranth seed production through greater biomass production at earlier dates. Interrow distance affected Palmer amaranth height and biomass and consequently seed production. The greater the interrow distance from the soybean row the higher Palmer amaranth height, biomass, and seed production, at 0 and 1 WAE compared to other emergence dates. Decreased interrow distance is effective tools for integrated Palmer amaranth control.

CHARACTERIZING SOYBEAN (GLYCINE MAX) AND COTTON (GOSSYPIUM HIRSUTUM) PHYTOTOXIC RESPONSE TO COMMERCIAL TANK CLEANERS. Z.A. Carpenter*, D.B. Reynolds; Mississippi State University, Mississippi State, MS (78)

ABSTRACT

In accordance with label guidelines, rinsate from each sprayer cleanout should be sprayed over a tolerant crop. In the event that producers are cleaning dicamba or 2, 4-D from a sprayer, the rinsate should then be sprayed back over Enlist™ or Xtend® crops so that any residual herbicides will not affect them. In order for this to be accomplished, cleaners must not cause any phytotoxic injury that will affect yield.

The objective of this study is to determine if any commercial tank cleaners cause a phytotoxic response to both cotton and soybeans. Field experiments on soybeans were conducted in 2016 in Brooksville and Starkville, MS. Greenhouse experiments on cotton were conducted in Starkville, MS. Eight different cleaners were evaluated, household ammonia, Erase, Incide-Out, Innvictis Premium Tank Cleanser, Nutra-Sol, Valent Tank Cleaner, Wipeout, and Wetcit. Rhodamine dye was also applied to determine its effect on soybeans and cotton, as it will be used in future experiments.

Each cleaner was applied at the labeled rate alone and tank-mixed with glyphosate (Roundup Powermax II, Monsanto®). Applications were made during the R1 growth stage in soybeans and at the 3-leaf growth stage in cotton. All applications were made at a rate of 140 L ha^{-1} using Teejet XR 110015 nozzles. Visual ratings for phytotoxicity were taken at 7, 14, 21, and 28 DAT (days after treatment) and plant heights were taken 14, 21, and 28 DAT in soybeans. In cotton, visual ratings for phytotoxicity and plant heights were taken at 7 and 14 DAT. Cotton fresh and dry weights were recorded 14 DAT. Soybean yields were recorded at the end of the growing season (KG/HA).

In the cotton studies, the greatest visual injury (7%) was observed 7 days after treatment of; rhodamine dye and Roundup Powermax, as well as Nutra-Sol and Roundup Powermax. Injury symptoms were observed in all treatments excluding ammonia and the untreated check. By 14 DAT, injury levels declined and the highest injury was observed in the rhodamine dye and Roundup Powermax plots with an average injury level of 5%. No significant differences in plant heights were noted among all treatments when compared to the untreated check. In the soybean studies, no visual injury was observed at all timings. No significant plant height differences were noted at all timings when compared to the untreated check. All yields were statistically equal to the untreated check with an average yield of 3106 KG HA^{-1}.

SAFENING GRAIN SORGHUM TO POSTEMERGENCE APPLICATION OF MESOTRIONE. M.T. Bararpour*, J.K. Norsworthy, R.R. Hale, G.T. Jones; University of Arkansas, Fayetteville, AR (80)

ABSTRACT

Weed management programs are an essential component of grain sorghum production. A field study was conducted in 2016 at the Arkansas Agricultural Research and Extension Center in Fayetteville, Arkansas, to evaluate response of grain sorghum to Callisto (mesotrione) based herbicide applications. Grain sorghum (Pioneer 84P80) was planted on April 27, 2016. The experiment was designed as a randomized complete block with four replications. Treatments were as follows: 1) Callisto at 0.105 kg ai/ha; 2) Callisto + NIS (nonionic surfactant) at 0.25% v/v; 3) Callisto + COC (crop oil concentrate) at 1% v/v; 4) Callisto + Grandstand (triclopyr) at 0.281 kg ai/ha; 5) Callisto + Weedar (2,4-D) at 0.532 kg ae/ha; 6) Callisto + Clarity (dicamba) at 0.280 kg ae/ha; 7) Callisto + Grandstand + NIS; 8) Callisto + Weedar + NIS; 9) Callisto + Clarity + NIS; 10) Callisto + Aatrex (atrazine) at 1.120 kg ai/ha; 11) Callisto + Aatrex + COC. A nontreated check was included. The research area was oversprayed with Aatrex + Dual II Magnum (*S*-metolachlor) after planting. All treatments were applied to four-leaf grain sorghum.

There was significant grain sorghum injury from all herbicide applications compared with the nontreated check 1 week after application (WAA). Tank-mixed application of Callisto + Clarity injured grain sorghum least (29%). Callisto + Aatrex injured grain sorghum the most (54% without COC and 63% with COC) compared with all other herbicide applications. At 2 WAA, Callisto + Clarity produced lowest grain sorghum injury (23%). Callisto + Aatrex combinations caused the highest level of grain sorghum injury. The addition of COC to Callisto + Aatrex increased grain sorghum injury from 45% to 58%. Grain sorghum height was least and most effected with Callisto + Clarity and Callsito + Aatrex + COC compared with any other herbicide applications 2 WAA. There was grain sorghum recovery from injury by 4 WAA. The lowest and highest level of grain sorghum injury were 2 and 7% from the application of Callisto + Clarity and from Callisto + Aatrex + COC, respectively. There were no differences in grain sorghum yield among treatments 1, 2, 3, 4, 5, 6, 8, and 9 and the nontreated check. However, yields were reduced in plots treated with Callisto + Grandstand + NIS (Trt 7) and Callisto + Aatrex (Trt 10 & 11) compared with the nontreated check. The results indicate that adding Clarity to Callisto reduced the level of grain sorghum injury (safening grain sorghum) compared with the other tank-mix partners or Callisto alone.

NEALLEY'S SPRANGLETOP (*LEPTOCHLOA NEALLEYI*): INTERFERENCE AND MANAGEMENT IN LOUISIANA RICE PRODUCTION SYSTEMS. E.A. Bergeron*, E.P. Webster, B.M. McKnight, S.Y. Rustom Jr, G. Mack Telo; Louisiana State University AgCenter, Baton Rouge, LA (81)

ABSTRACT

A field study was conducted at the LSU AgCenter H. Rouse Caffey Rice Research Station (RRS) near Crowley, LA in 2014, 2015, and 2016 and a grower location near Estherwood, LA in 2015 to evaluate herbicide timing for Nealley's sprangletop (*Leptochloa nealleyi* Vasey) control. The study was a randomized complete block design with four replications. In 2014, Clearfield 'CL 151' rice was drill-seeded at 90 kg/ha and Clearfield 'CL 111' rice was planted at the same rate in 2015 and 2016. Previous research indicated quinclorac plus halosulfuron had no activity on Nealley's sprangletop; therefore, quinclorac at 420 g ai/ha plus halosulfuron at 53 g ai/ha was applied delayed preemergence (DPRE) to control grasses, sedges, and broadleaf weeds in the plot area. Herbicide treatments consisted of fenoxoprop at 122 g ai/ha at 1, 2, 3, 4, 5, and 6 weeks after emergence (WAE) in order to determine when control measures should be initialized to maximize Nealley's sprangletop control and rough rice yield. A weed-free plot was also added by employing herbicide application and hand-weeding for a comparison to treatment.

At harvest, rice treated with fenoxaprop 1 WAE compared with the nontreated yielded 8000 and 6090 kg/ha, respectively. By delaying the initial application of fenoxoprop, a sizeable reduction in rice yield was observed. Comparing rice yields of 1 WAE to 6 WAE applications resulted in a 1790 kg/ha decrease; which is a loss of 51 kg/ha loss per day by delaying fenoxaprop treatment. Delaying herbicide application from 1 WAE to 6 WAE resulted in a net return loss of $460/ha at current rice market price. This results in a $13/ha loss per day for every day the herbicide application is delayed. A field study was conducted at the RRS near Crowley, LA in 2014, 2015, and 2016 and a grower location near Estherwood, LA in 2015 to evaluate herbicide rate and timing for control of Nealley's sprangletop and Amazon sprangletop [*Leptochloa panicoides* (J. Presl) A.S. Hitchc.]. The study was a randomized complete block design with four replications. Rice was planted, and treated DPRE with quinclorac plus halosulfuron as previously described. Herbicide treatments consisted of cyhalofop at 271, 314, and 417 g/ha applied pre-flood and post-flood, fenoxaprop at 66, 86, and 122 g/ha applied pre-flood and post-flood, propanil at 3360 g/ha applied pre-flood, and propanil plus thiobencarb at 5040 g/ha applied pre-flood. Propanil, propanil plus thiobencarb, and a nontreated were added for comparison purposes.

At 35 DAT, regardless of rate or timing Nealley's sprangletop treated with cyhalofop resulted in increased control compared with Nealley's sprangletop treated with propanil plus thiobencarb. Nealley's sprangletop treated with fenoxaprop at 86 or 122 g/ha pre-flood, resulted in higher control of Nealley's sprangletop than propanil or propanil plus thiobencarb at 35 DAT. At 21 DA post-flood treatment, fenoxaprop at 66, 86, or 122 g/ha controlled Amazon sprangletop 72, 75, and 74%, respectively, with no difference compared with propanil or propanil plus thiobencarb treated Amazon sprangletop; however, cyhalofop applied at 271 g/ha pre-flood resulted in 88% control of Amazon sprangletop, compared with an application of propanil plus thiobencarb which resulted in 73% control. Rice treated pre-flood with cyhalofop at 417 g/ha yielded 6360 kg/ha, compared with the nontreated at 4570 kg ha^{-1}. Rice treated with fenoxaprop applied pre-

flood at 66 or 86 g/ha and postflood at 86 g/ha resulted in higher yields, compared with the nontreated.

Nealley’s sprangletop is a prolific seed producer with high seed viability. It is important to correctly identify this weed in order to select the appropriate weed management program. When managing an infestation of Nealley's sprangletop, an overall strategy should be employed; which includes tillage, burndown applications, and in-crop herbicide application.

INFLUENCE OF FORMULATION AND RATE ON RICE TOLERANCE TO EARLY SEASON APPLICATIONS OF ACETOCHLOR. M.E. Fogleman*, J.K. Norsworthy, J.A. Godwin Jr., M.L. Young; University of Arkansas, Fayetteville, AR (82)

ABSTRACT

A lack of effective options for controlling herbicide-resistant weeds such as barnyardgrass (*Echinochloa crus-galli*) has led to the exploration of alternative herbicide sites of action. (WSSA Group 15) very long-chain fatty acid-inhibiting herbicides are proven to provide high levels of control on grass weed species and could potentially be effective when used in a rice herbicide program. A field experiment was conducted in summer 2016 at the Pine Tree Research Station near Colt, Arkansas and at the University of Arkansas Pine Bluff Farm near Lonoke, Arkansas to determine the effects of acetochlor formulation and rate on rice tolerance. The experimental design was a three-factor randomized complete block with factors being A) formulation (microencapsulated as Warrant; emulsifiable concentrate as Harness), B) rate (1X and 2X, at 1050 and 2100 g ai ha^{-1}, respectively), and C) application timing (preemergence – PRE, delayed preemergence – DPRE, and early postemergence – EPOST). Overall, rice displayed a much higher tolerance to applications of Warrant than to Harness, likely due to the gradual release of acetochlor in Warrant and the immediate and total release of acetochlor in Harness. At both locations, applications of either herbicide at the PRE or DPRE timing resulted in the most significant injury. Differences in rainfall between the locations resulted in higher initial injury at Pine Tree and delayed, more severe injury at Lonoke. Though there were significant differences in yield response between the locations, a similar trend was observed at both. Warrant, even at the higher rate, resulted in < 5% crop injury at four weeks after flood when applied at the EPOST timing, indicating that applications should be delayed until this stage to minimize crop damage.

EFFECT OF TOPRAMEZONE AND SYNTHETIC AUXIN HERBICIDES ON SUGARCANE. R.M. Negrisoli*, D. Odero, J.V. Fernandez; University of Florida, Belle Glade, FL (83)

ABSTRACT

Topramezone is a hydroxyphenylpyruvate dioxygenase inhibitor herbicide that disrupts carotenoid biosynthesis in susceptible plants. It has been proposed for use in sugarcane for annual broadleaf, annual grass, and seedling bermudagrass control. Understanding chlorophyll and carotenoid fluctuations after topramezone application provides valuable insight for improving its use in sugarcane. Therefore, an outside container study was conducted to evaluate the effect of topramezone applied alone (25 and 50 g ai/ha) or in combination with 2,4-D amine (2240 g ai/ha), dicamba (840 g ai/ha), and triclopyr (1680 g ai/ha) on five sugarcane cultivars (CP 89-2143, CP 00-1101, CP 96-1252, CP 88-1762, and CPCL 02-0926). The experimental design was a completely randomized design with four replications for each cultivar. Chlorophyll a and b content, carotenoid pigment concentration, and percent visual bleaching were measured at 7, 14, 21, 28, and 42 days after treatment (DAT). Leaf tissues were sampled from the top visible dewlap leaf blade of sugarcane to assay for chlorophyll content and carotenoid pigment concentration. There was a differential response of sugarcane varieties to topramezone with respect to chlorophyll content, carotenoid pigment concentration, and leaf bleaching from 14 to 28 DAT. CP 89-2143 and CP 00-1101 were most susceptible to topramezone and tank-mix partners while CP 96-1252 was the least susceptible. The 2,4-D amine tank-mix resulted in the least reduction in chlorophyll and carotenoid content for all cultivars (<15%) at 21 DAT. Overall, all cultivars recovered from reduction in chlorophyll and carotenoid content by 28 DAT and no difference in aboveground dry biomass among treatments for all cultivars was observed at 42 DAT. This study shows that tank-mixing topramezone + 2, 4-D amine would provide the better option for mitigating phytotoxicity associated with topramezone. Also, it appears that sugarcane is able to metabolize topramezone (25 and 50 g/ha) by 28 DAT, implying that it would be safe to have a sequential application at least 28 days after the first application. The study will be repeated to corroborate the results.

SURVEYING HERBICIDE RESISTANCE IN PALMER AMARANTH AND WATERHEMP IN TEXAS. R.A. Garetson*[1], P.A. Dotray[2], M.V. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Research, Lubbock, TX (84)

ABSTRACT

A survey was conducted in five major farming regions of Texas (Rio Grande Valley, Coastal Bend, Upper Gulf Coast, Central Texas, and High Plains) to document resistance in Palmer amaranth and common waterhemp to glyphosate, atrazine, tembotrione, fomesafen, and dicamba. A total of 125 Palmer amaranth populations and 115 waterhemp populations were evaluated for resistance. Resistance levels were categorized as low (61 to 95% injury), moderate (31 to 60% injury), and high (<30% injury). For Palmer amaranth, about 2, 40 and 40% of the populations from the High Plains; 34, 14, and 7% from the Rio Grande Valley; 29, 29, and 4% from the Coastal Bend; and 6, 6, and 11% from Central Texas showed low, moderate, and high levels of glyphosate resistance, respectively. Resistance to atrazine was also common in Palmer amaranth, with 17, 19, and 22% of the populations from the High Plains; 13, 3, and 0 % from the Rio Grande Valley; and 9, 4, and 4% from the Coastal Bend showing low, moderate, and high resistance levels, respectively. Atrazine resistance was not found in samples collected from the Central Texas region. For waterhemp, 17, 49, and 27% of the populations from the Upper Gulf Coast and 9, 0, and 18% of the populations from the Blacklands showed low, moderate, and high levels of glyphosate resistance, respectively. Further, about 62, 18, and 5% of the populations from the Upper Gulf Coast and 0, 0, and 3% of the populations from Blacklands showed low, moderate, and high levels of resistance to atrazine, respectively. EPSPS gene copy number analysis showed that gene copy number and injury ratings of Palmer amaranth and waterhemp were highly correlated (r = - 0.96 and – 0.93, respectively), indicating that overexpression of the EPSPS enzyme is the primary cause of glyphosate resistance in tested populations. Further, EPSPS gene copy numbers were greater in Palmer amaranth, compared to waterhemp for similar resistance levels. Preliminary results of dose-response assays have revealed that the most resistant Palmer amaranth population showed survival to 16 and 32X field rates of glyphosate and atrazine, respectively. Evaluation of resistance for additional herbicides is currently underway. Findings obtained so far reveal that herbicide resistance is present at significant levels in Palmer amaranth and waterhemp populations across Texas and growers need to be proactive in implementing diversified weed management tactics to preserve the utility of available herbicide options.

EFFECT OF NOZZLE TYPE ON *PALMER AMARANTH* CONTROL. S.S. Davis*, D.M. Dodds, D.B. Denton; Mississippi State University, Starkville, MS (85)

ABSTRACT

An experiment was conducted at Hood Farms in Dundee, MS in 2015 to determine the effect of spray nozzle selection on Palmer amaranth control with glufosinate. The location was naturally infested with a high population of glyphosate-resistant Palmer amaranth. Glufosinate applications were made when Palmer amaranth plants were 10-15 cm in height. Glufosinate (Liberty 280 SL) was applied at a rate of 0.6 kg ai/ha using a Bowman MudMaster™ at a speed of 14.5 kph. Pressure was set at 345 kPa and the boom was 46 cm above the canopy. Nozzle types utilized in this experiment included: Turbo TeeJet® Induction 11003 (TTI11003), Greenleaf TurboDrop® Asymmetric Dual Fan 03 (TADF03), Greenleaf TurboDrop® Asymmetric Dual Fan D Version 03 (TADF03-D), Greenleaf TurboDrop® XL Medium Pressure D Version 03 (TDXL11003-D), and Hypro Guardian AIR™ Twin 03 (GAT11003). Water sensitive spray cards were placed in each plot to determine droplet patterns of nozzles. Visual weed control ratings (0-100) were taken at 7, 14, 21, and 28 days after application (DAA). Data were analyzed in SAS 9.4 using the PROC Glimmix procedure. Means were separated using Fischer's Protected LSD at α=0.05.

At 7, 14, and 21 DAA, applications made with the GAT11003 nozzle resulted in significantly greater Palmer amaranth control than TTI11003 nozzle. At 28 DAA, the GAT11003 nozzle resulted significantly greater Palmer amaranth control than both the TDXL11003-D and TTI11003 nozzles. At 7, 14, and 21 DAA, Palmer amaranth control from glufosinate applied with the GAT11003, TADF03, and TADF03-D nozzles were all similar. Over time, Palmer amaranth control decreased 15% following glufosinate application with GAT11003 nozzles. This is a smaller deficit than what was observed in Palmer amaranth treated with glufosinate using TADF03 (35%), TADF03-D (23%), TDXL11003-D (35%), and TTI11003 (31%) nozzles. Based on these data, the Hypro Guardian AIR™ Twin 03 nozzle provided the greatest Palmer amaranth control at each rating timing.

DOES THE ADDITION OF THIENCARBAZONE-METHYL TO SOIL-APPLIED HERBICIDES INCREASE LENGTH OF LENGTH OF RESIDUAL AND SPECTRUM OF CONTROL? Z.D. Lancaster*, J.K. Norsworthy, M.H. Moore, R.R. Hale; University of Arkansas, Fayetteville, AR (86)

ABSTRACT

With the spread of herbicide resistance across the Midsouth, growers are increasingly relying on residual herbicides to achieve season-long weed control. With the pressure that herbicide-resistant weeds place on current residual herbicides, new options are needed to effectively rotate herbicide modes of action, and slow the development of additional herbicide resistance. Bayer CropScience is currently evaluating thiencarbazone-methyl (TCM), an ALS herbicide, for preemergence and postemergence activity on many troublesome Midsouth weeds in soybean. A field experiment was conducted at the Agricultural Research and Extension Center in Fayetteville, Arkansas in the summer of 2016 to determine the residual activity of TCM compared to several common residual herbicides. The experiment was set up as a two factor, randomized complete block design with factor-A being TCM rate and factor-B being tank-mix partner. TCM treatments evaluated were no TCM, TCM at 33.5 g ai ha^{-1}, and TCM and 67 g ha^{-1}. Tank-mix partners evaluated were labeled rates of Dual Magnum, Valor, Zidua, Tricor, and Balance Bean along with a no tank-mix partner treatment. Herbicide applications were applied to freshly tilled bare ground field with a CO_2-backpack sprayer at 143 L ha^{-1}. Data were collected on Palmer amaranth (*Amaranthus palmeri*), entireleaf morningglory (*Ipomoea hederacea*), and broadleaf signalgrass (*Urochloa platyphylla*) control at 14, 28, 42, and 56 days after application (DAA). Overall, TCM provided excellent control of broadleaf signalgrass with 94% and 97% control at 33.5 and 67 g ha^{-1}, respectively, at 42 DAA. Control of the native ALS-resistant Palmer amaranth population was only 69% with TCM at 67 g ha^{-1} at 42 DAA. However, the addition of TCM at 67 g ha^{-1} to the labeled rate of Tricor resulted in 84% Palmer amaranth control from Tricor alone and 96% control from Tricor + TCM at 67 g ha^{-1}. Likewise, the addition of TCM at 67 g ha^{-1} to Dual Magnum increased entireleaf morningglory control from 75% alone to 100% with TCM. This research shows that TCM alone provides excellent residual weed control of broadleaf signalgrass and entireleaf morningglory, with some added Palmer amaranth control. Furthermore, the addition of TCM increases the spectrum of activity and length of residual control for many common residual herbicides.

QUANTIFICATION OF LATE-SEASON SEED PRODUCTION IN PALMER AMARANTH AND WATERHEMP PRIOR TO COTTON HARVEST IN DIFFERENT REGIONS OF TEXAS. K.M. Werner*[1], P.A. Dotray[2], K. Smith[3], R. Nichols[4], M.V. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Research, Lubbock, TX, [3]FMC Corporation, College Station, TX, [4]Cotton Incorporated, College Station, TX (87)

ABSTRACT

A major input of seedbank replenishment comes from weed escapes that persist at harvest, despite earlier weed management interventions. The present study was conducted in fall 2016 to estimate the amount of Palmer amaranth (*Amaranthus palmeri*) and common waterhemp (*A. tuberculatus*) seedbank addition potential prior to cotton harvest in four important cotton producing regions of Texas: High Plains, Blacklands, Central Texas, and Upper Gulf Coast. The survey was conducted following a semi-stratified methodology. At each survey field, seeds were harvested from three target species when present, Palmer amaranth, waterhemp, and junglerice (*Echinochloa colona*) from three random quadrats (1 m^2). Further, weed density/sampling quadrat, seed maturity (%), seed shattering (%), and approximate density of infestation of each target species for an average acre were documented in the survey field. Field observations revealed that there is enormous potential for seedbank addition from late-season weed escapes, especially from Palmer amaranth and waterhemp. Results also revealed that Palmer amaranth escapes were found at substantial densities in 81 (40 out of 50) and 41% (8/20) of the cotton fields in the High Plains and Blackland regions, respectively. Common waterhemp was present in 67 (8/12) and 67% (13/20) of cotton fields in the Central Texas and Upper Gulf Coast regions. Results emphasize the need for preventing seedbank addition from weed escapes. Results illustrate that weed management programs must focus beyond current season yield protection and emphasize on seedbank reduction to minimize the risk of herbicide resistance in weed populations.

THE EFFECT OF GRASP® (PENOXSULAM) AND REGIMENT® (BISPYRIBAC) CONCENTRATION ON BOLT™ SOYBEAN (*GLYCINE MAX*) GROWTH AND YIELD.

D.C. Walker*[1], D.B. Reynolds[2], J.A. Bond[3]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State University, Stoneville, MS (88)

ABSTRACT

In 2015, DuPont Pioneer released a new herbicide-tolerant soybean called BOLT™. This is a further development of their STS (sulfonylurea tolerant) soybean line and was developed from plants that were found to exhibit tolerance higher than STS soybean. This technology allows producers to spray LeadOff® (rimsulfuron, thifensulfuron) and Basis® Blend (rimsulfuron, thifensulfuron) on soybean crops. Both of these herbicides have active ingredients that are ALS inhibitors and therefore have the same mode of action as Grasp® and Regiment®.

Soybean are often grown in close proximity to rice. Off-target deposition of ALS inhibiting herbicides used in rice can result in severe soybean injury and yield loss. The increased tolerance to ALS herbicides by the BOLT™ soybean may provide protection to these off-target herbicides. Therefore, an overall evaluation of soybean with BOLT™ technology as a drift mitigation tool for off-target deposition of Grasp® and Regiment® herbicides on rice is necessary. If successful, BOLT™ soybean use could be widely adopted by local growers to provide a strong safety net for the protection of off-target herbicides.

The two main objectives of this study was to determine the tolerance level of BOLT™ soybean to titrated rates of Grasp® and Regiment® and their effects on yield. The study was conducted in 2016 in Brooksville, Starkville, and Stoneville, MS.

Six different concentrations of each herbicide (1x, 1/4x, 1/16x, 1/64x, 1/256x, 1/1024x of a full labeled rate) were applied to BOLT™ soybean at the three-leaf growth stage (V3). Each application also included a surfactant with Grasp® including MSO – premium blend at a rate of 2.33 L ha^{-1} and Regiment® including Dyne-a-Pack at a rate of 1% v/v. All applications were made at a delivery volume of 140 L ha^{-1} using Teejet AIXR 110015 nozzles.

These treatments were then compared to an untreated check and then visual ratings for phytotoxicity were recorded 7, 14, 21, and 28 DAT (days after treatment) and plant heights and node counts were recorded 14 and 28 DAT. Soybean yields were recorded at the conclusion of the growing season (KG ha^{-1}).

The results indicate that BOLT™ soybean had a relatively higher tolerance to Grasp® than Regiment® at the rates evaluated. Furthermore, if drift rates of Grasp® have a concentration of a.i. lower than 1/4x of the full rate, then BOLT™ soybean yield was not affected. If drift rates of Regiment® had a concentration of a.i. lower than 1/16x of the full rate, then BOLT™ soybean yield was not affected.

COTTON HARVEST AID PERFORMANCE WITH VARIOUS SPRAY TIPS. B. Wilson[1]*, D.M. Dodds[1], S.A. Byrd[2], A.S. Jones[3], T.B. Raper[4], G.D. Morgan[5], R.Norton[6], C. A. Samples[1], M. Plumblee[1], S.S. Davis[1], L.X. Franca[1]; [1]Mississippi State University, Mississippi State, MS; [2]Texas A&M University, Lubbock, TX; [3]University of Missouri, Portageville, MO; [4]University of Tennessee, Jackson, TN; [5]Texas A&M University, College Station, TX; [6]University of Arizona, Safford, AZ (89)

ABSTRACT

Chemical termination of cotton to facilitate harvest and preserve optimum fiber quality is often done through the use of harvest aids. Long-term exposure to weather can reduce lint yield and lead to degradation of fiber quality. Harvest aid products are not generally translocated through the plant, and coverage plays and important role in the process. Smaller droplet sizes tend to provide better coverage throughout the canopy, but it's prone to drift in windy conditions. Large spray droplets typically result in less drift, but less coverage throughout the canopy. Medium sized droplets are recommended in harvest aid applications. Therefore, the objective of this research was to determine the efficacy of various spray tips on cotton harvest aid performance.

An experiment was conducted in 2016 in six locations including Brooksville, MS Jackson, TN, Portageville, MO, Lubbock, TX, College Station, TX, and Safford, AZ to evaluate the performance of cotton harvest aids with various spray tips. Plots consisted of four rows with four replications. Experiments were conducted using a factorial arrangement of treatments in a randomized complete block design. Harvest aids applied were tribufos (Folex at 0.42 kg ai/ha), ethephon (Superboll at 1.2 kg ai/ha), and thidiazuron (Freefall at 0.06 kg ai/ha). Spray tips included TXR80053VK, TT11001, and TTI110015 at 47 L/ha spray volume, TXR80001VK, TT10015, and TTI110015 at 94 L/ha spray volume, TXR80015VK, TT110015, and TTI110015 at 141 L/ha spray volume, and TXR8002VK, TT11002, and TTI11002 at 187 L/ha spray volume. Data collected consisted of ratings of percent defoliation, desiccation, green leaf percentage, open bolls at 7, 14, 21 days after application, and seed cotton yield. Data were subjected to analysis of variance using PROC GLIMMIX procedure in SAS 9.4 and means were separated using Fishers protected LSD at $p = 0.05$.

Spray tip selection resulted in significant differences in defoliation ratings. Harvest aid application with TXR tips resulted in significantly higher defoliation ratings than those from turbo teejet induction tips. Regrowth ratings at 7 days after application indicated that the use of TXR, and, turbo teejet tips resulted significantly lower regrowth ratings than those following harvest aid applications with turbo teejet induction tips at 47 L/ha. Harvest aid application with turbo teejet inductions tips at 47 L/ha resulted in the highest regrowth ratings observed. Carrier volume had an impact and in most cases, defoliation was reduced as carrier volume was reduced. There was no impact of spray tip selection on fiber quality among treatments. Harvest aid application at 94 L/ha or greater with tips producing medium to fine droplets are still recommended.

EVALUATION OF PREEMERGENCE HERBICIDES APPLIED PRE- AND POST-CRIMP IN A RYE COVER CROP SYSTEM FOR CONTROL OF BROADLEAF WEEDS IN WATERMELONS. L.C. Hand*[1], T. Monday[2], W.G. Foshee[1], D. Wells[1]; [1]Auburn University, Auburn, AL, [2]Auburn University, Opelika, AL (90)

ABSTRACT

Field studies were conducted in the spring of 2016 at the Old Agronomy Farm (OAF) in Auburn, AL, and Plant Breeding Unit (PBU) in Tallassee, AL to evaluate the effect of preemergence herbicide applications pre- and post-crimp in a cereal rye cover crop for control of escape weeds in watermelons. Herbicides tested include ethalfluralin, halosulfuron, and fomesafen. Glyphosate was used in all treatments as a preplant burndown. A total of seven treatments were applied. Treatments included: nontreated (cover crop only); ethalfluralin at 1.3 lbs. a.i./A pre- and post-crimp; halosulfuron at 0.035 lbs. a.i./A pre- and post-crimp; fomesafen at 0.16 lbs. a.i./A pre- and post-crimp. Glyphosate was applied on all treatments at 1.0 lb. a.i./A. Preliminary analysis showed no differences in weed counts of broadleaf weeds (i.e. pigweed, morningglory and sicklepod) and yellow and purple nutsedge when herbicides were applied pre-crimp compared to post-crimp, regardless of the herbicide used. This study will be repeated during the 2017 season. Following completion of the 2017 study, data will be pooled and a full analysis will be completed.

REMOTE SENSING APPLICATIONS FOR PALMER AMARANTH DETECTION. J.T. Sanders*, W.J. Everman; North Carolina State University, Raleigh, NC (92)

ABSTRACT

The proliferation of unmanned aerial vehicles (UAVs) into the mainstream consumer market has generated questions about their utility in commercial agricultural production. Aerial imagery has been previously used to diagnose crop status with respect to such factors as nutrient and water availability as well as pathogen mapping, but the acquisition of this imagery has been subject to high cost, long revisit times and concerns about image resolution. Given their small size, ease of use and extraordinary maneuverability, UAVs may indeed provide a cost effective and efficient means to obtain aerial imagery from crop fields to aid in making management decisions. In 2015, a field study was established to examine the ability of a commercially available UAV equipped with an integrated RGB camera to distinguish *Amaranthus palmeri* (palmer amaranth) from a soybean crop at altitudes of 50, 100 and 150 feet throughout the growing season. Imagery was then subject to a supervised classification utilizing a maximum likelihood separation. Increasing altitude generally increased overall classification accuracy, while progression through the season resulted in a degradation of this metric.

WEED MANAGEMENT SYSTEMS IN BOLLGARD II XTENDFLEX™ COTTON ON THE TEXAS HIGH PLAINS. K.R. Russell[1]* P.A. Dotray[1,2], J.W. Keeling[2], S.L. Taylor[2], J.D. Everitt[3]; [1]Texas Tech University, Lubbock, TX; [2]Texas A&M AgriLife Research, Lubbock, TX; [3]Monsanto, Shallowater (93)

ABSTRACT

Herbicide resistant weeds are becoming an increasing problem and are likely present on every farm in the Texas Southern High Plains. With the recent federal registration and state approval of XtendiMax™ with VaporGrip™ Technology for use in Bollgard II XtendFlex™ cotton, producers have an additional mode of action that can be used preplant (PP), preemergence, and postemergence to control glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats) and other troublesome weeds. The XtendFlex™ technology also allows growers to apply glufosinate and glyphosate in-season. Prior to XtendFlex™ cotton, dicamba was not used PP in the Southern Texas High Plains due to rainfall limitations. The objective of this research was to evaluate season-long weed control in Bollgard II XtendFlex™ cotton using several weed management systems that include XtendiMax™. A field study was established in a randomized complete block design in a drip-irrigated field at New Deal, Texas using a variety of herbicides in different applications to determine herbicide efficacy of Palmer amaranth. Herbicides treatments used were; Gramoxone (paraquat) at 0.25 lb ai/a, Caparol 4L (prometryn) at 1 lb ai/a, Liberty 280 SL (glufosinate) at 0.53 lb ai/a, Warrant (acetochlor) at 1.13 lb ai/a, XtendiMax™ with VaporGrip™ (dicamba) at .5 lb ai/a, Roundup WeatherMax (glyphosate) at 1.13 lb ai/a, MON 76981 (dicamba + glyphosate) at 1.5 lb ai/a, and Trifluralin at 1 lb ai/a. The greatest weed control in early season was observed in weed management systems that included two or more residual modes of action. Mid-season weed management was greatest in systems that included MON 76981, XtendiMax™ or Roundup WeatherMax following residual treatments of Trifluralin or Caparol 4L. Late season weed management in systems that included MON 76981 had greater than 95% control of Palmer amaranth. Plot lint yield ranged from 0 to 1900 lb/a and were greatest following dicamba-based systems.

INFLUENCE OF CARRIER VOLUME AND NOZZLE SELECTION ON THE PERFORMANCE OF LIBERTY IN TANK-MIX COMBINATIONS. S.L. Taylor*[1,2], P.A. Dotray[1,2], J.W. Keeling[2], W.R. Perkins[3]; [1]Texas Tech University, Lubbock, TX, [2]Texas A&M AgriLife Research and Extension, Lubbock, TX, [3]Bayer CropScience, Idalou, TX (94)

ABSTRACT

Liberty® 280 SL (glufosinate-ammonium), 2,4-D Choline, and dicamba are critical components of two new weed management systems (Bollgard II XtendFlex™ and Enlist® cotton) that can improve control of many problematic weeds including glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats.). The associated labels to use in these new cotton genetics will have several specific application requirements including nozzle type and carrier volume to reduce off target movement. Herbicide performance of potential future tank mix combinations may be greatly influenced by both carrier volume and nozzle type. The objective of this research was to examine herbicide efficacy of Liberty, 2,4-D Amine, and Clarity (dicamba) applied alone and in tank-mix combinations when varying nozzle selection and carrier volume. The plots in both studies were 2 rows by 30 feet and arranged in randomized complete block design with 4 replications. In the nozzle selection study, herbicide treatments were applied using three different spray nozzles delivering 15 gallons per acre (GPA). Nozzles were selected based on the following droplet sizes: medium droplet = 236-340 microns (Turbo TeeJet 11002 at 27 PSI), very coarse droplet (VC) = 404-502 microns (Air Induction XR TeeJet 11002 at 27 PSI), and ultra-coarse droplet (UC) = >655 microns (Turbo TeeJet Induction 110015 at 37 PSI). In the carrier volume study, herbicide treatments were applied at three carrier volumes (10, 15, 20 GPA) using TTI UC nozzles. Herbicide rates included Liberty at 29 fl oz/A, Clarity at 16 fl oz/A, and 2,4-D Amine at 32 fl oz/A. In the nozzle selection study, Liberty tank-mixed with 2,4-D Amine or Clarity improved Palmer amaranth control compared to 2,4-D Amine and Clarity when applied alone at 7 days after application (DAA) regardless of nozzle selection; however, at 21 DAA, less control was observed when Liberty was tank-mixed with Clarity using the VC and UC nozzles, and when Liberty was tank-mixed with 2,4-D Amine using VC nozzles. In the carrier volume study, improved Palmer amaranth control was observed when Liberty tank-mixed with Clarity or 2,4-D Amine at 7 DAA regardless of carrier volume; however, at 21 DAA, reduced control was observed when Liberty was mixed with Clarity at 15 and 20 GPA and when Liberty was mixed with 2,4-D at all carrier volumes. The current Xtendimax™ with VaporGrip™ label and proposed Enlist™ Duo with Colex-D Technology label will prohibit tank mixing with other herbicides; however, future labels may allow certain herbicide tank mix partners.

DO INSECTICIDE SEED TREATMENTS LESSEN THE RISK FOR INJURY TO SOYBEAN FROM HERBICIDES? N.R. Steppig*[1], J.K. Norsworthy[1], R.C. Scott[2], R.R. Hale[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (95)

ABSTRACT

In 2016, over 300,000 acres of soybean were injured by off-target movement of dicamba. With the increasing prevalence of crops with resistance to drift-prone herbicides, such as dicamba, there is great interest in finding alternative methods of protecting sensitive plants. In rice production, the use of some insecticide seed treatments has shown to be an effective way of reducing crop injury following herbicide drift events. However, limited research has been conducted to explore a similar result in soybean. To determine whether insecticide seed treatments can effectively reduce injury to soybean, field trials were conducted across the state of Arkansas at the Lon Mann Cotton Research Center (2015 and 2016), the Northeast Arkansas Research and Extension Center (2016), and the PineTree Research and Extension Center (2016). Experiments consisted of randomized complete block designs with a two-factor factorial (insecticide x herbicide). Two insecticides seed treatments (thiamethoxam and clothianidin) were evaluated in combination with eight herbicides (dicamba, 2,4-D, glyphosate, glufosinate, halosulfuron, mesotrione, tembotrione and propanil). Herbicides applications were made 3 weeks after planting using a CO_2-pressurized backpack sprayer, calibrated to deliver 143 L/ha. Each herbicide was applied at 1/10x of its labeled use rate. Visual crop injury ratings were taken at 1, 2, and 4 weeks after herbicide application and yield data was collected at the end of the season. Results from these experiments showed that soybean injury from halosulfuron drift was significantly reduced at the Lon Mann Cotton Research Center in in both years. The safenening effect seen indicates that insecticide seed treatments may provide additional benefits beyond protecting soybean against early season insect pests, and presents additional evidence supporting their use, particularly in situations where halosulfuron drift may be a concern.

THIFENSULFURON RESISTANT MOUSE-EAR CRESS (*ARABIDOPSIS THALIANA*) CONTROL WITH PRE- AND POST-EMERGENCE HERBICIDES IN WINTER WHEAT. R.S. Randhawa*[1], M.L. Flessner[1], J.H. Westwood[1], C.W. Cahoon[2]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech, Painter, VA (96)

ABSTRACT

Thifensulfuron resistant mouse-ear cress was recently reported in production wheat fields in Virginia. Currently, there is little information regarding alternative herbicides for mouse-ear cress control. Two field trails were conducted in 2015 on farmers' field in Essex County, Virginia to assess the pre- and post-emergence alternative control options for thifensulfuron resistant mouse-ear cress (*Arabidopsis thaliana* L.). Pre- and post-emergence studies consisted of 7 and 11 treatments, respectively, including a nontreated check. Studies were arranged in randomized complete block with four replications per treatment and were duplicated in space. For the pre-emergence study, herbicide treatments included thifensulfuron (Harmony) at 17.5 g ai ha^{-1}, metribuzin (Tricor) at 105 g ai ha^{-1}, flumioxazin (Valor) at 71.5 g ai ha^{-1}, saflufenacil (Sharpen) at 50 g ai ha^{-1}, pyroxasulfone (Zidua) at 119 g ai ha^{-1} and pendimethalin (Prowl H_2O) at 1600 g ai ha^{-1}. Flumioxazin and saflufenacil were applied a week before wheat planting followed by pyroxasulfone and pendimethalin that were applied (at spiking) a week after planting. Thifensulfuron and metribuzin were applied at three weeks after planting. For the post-emergence study, herbicides treatments included thifensulfuron at 17.5 g ai ha^{-1}, thifensulfuron + tribenuron (Harmony Extra) at 26.6 g ai ha^{-1}, 2,4-D (2,4-D LVE) at 1060 g ae ha^{-1}, dicamba (Banvel) at 560 g ae ha^{-1}, metribuzin at 105 g ai ha^{-1}, bromoxynil + pyrasulfotole (Huskie) at 244 g ai ha^{-1} + ammonium sulfate at 1120 g ai ha^{-1}, bromoxynil (Buctril) at 420 g ai ha^{-1}, fluroxypyr (Starane Ultra) at 157 g ai ha^{-1}, pyroxsulam (Poweflex HL) + ammonium sulfate at 18.4 + 3360 g ai ha^{-1} and nitrogen (Urea) at 56.8 Kg ai ha^{-1}. All post treatments included non-ionic surfactant (NIS) (Activator 90) at 0.25% v v^{-1}. Herbicide application was made using a handheld spray boom equipped with four AIXR nozzles spaced at 47 cm and calibrated to deliver 140 L ha^{-1} at 207 kPa. For pre-control study visible control and crop injury were assessed on 0 (no control/injury) to 100 (complete necrosis) scale at 6, 11, and 15 and 11, 15 and 20 weeks after initial treatment (WAIT) for both sites respectively, for the post-emergence study visible control was assessed 3, 5, and 7 weeks after treatment (WAT) followed by yield data for both studies. Data were analyzed using JMP 1.1.0. ANOVA was performed followed by multiple comparison test using Fisher's protected LSD at significance level of $P < 0.05$.

In the pre-emergence study, flumioxazin, pyroxasulfone and metribuzin resulted in >75% control 15 weeks after treatment (WAT) at both sites. No crop injury was observed in the pre-emergence study and no differences in yield were observed. In the post-emergence study, 2,4-D, dicamba and metribuzin resulted in >75% control 5 WAT at both sites. Dicamba and pyroxsulam resulted in 20% crop injury 3 WAT. However, none of the treatments resulted in increased yield relative to the non-treated check except dicamba at site 1. The results indicate that flumioxazin and pyroxasulfone can be applied as pre-emergence herbicides to control thifensulfuron resistant mouse-ear cress. Metribuzin is equally effective when applied either pre- or post-emergence. 2,4-D and dicamba can be used as post-emergence alternatives. Future research should focus on evaluating the density at which mouse-ear cress results in a yield loss and determine the critical weed free period, if any, to avoid yield loss.

EFFICACY OF TANK-MIXES CONTAINING TOPRAMEZONE FOR BARNYARDGRASS CONTROL IN RICE. M.H. Moore*[1], R.C. Scott[2], J.K. Norsworthy[1], J.A. Godwin[1], R.R. Hale[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (97)

ABSTRACT

Every year, rice (*Oryza sativa*) producers all across the United States struggle to control herbicide-resistant weeds. Barnyardgrass (*Echinochloa crus-galli*) is especially difficult to control due to its competitiveness, similarity to rice, and large risk for developing resistance. This combined with limited options of chemistries available for use in rice lead to repetitive use of the same sites of action which increases the probability of barnyardgrass developing resistance. New sites of action are needed to effectively rotate herbicides and slow the advancement of resistant weeds. Topramezone, an HPPD inhibitor (Group 27), is currently used in US corn (*Zea mays*) for control of broadleaves and some annual grasses including barnyardgrass. A field experiment was conducted in 2016 to evaluate the efficacy of topramezone, formulated as Armezon® 2.8L, when applied alone and in combination with other common rice herbicides. Treatments were arranged in a randomized complete block design as a two-factor factorial. Factor A included six rice herbicides (clomazone, imazethapyr, fenoxaprop, propanil, quinclorac, and saflufenacil) applied at their respective labeled rates; factor B consisted of three rates of topramezone (0, 12, and 24 g ai ha^{-1}). All treatments were applied at the 3- to 4-leaf growth stage, preflood. Results from this study varied among treatments. In some cases, the addition of topramezone significantly increased the amount of weed control whereas in others the difference was either not significant or was significantly lowered. For example at 28 DAA, a significant increase in control was observed for topramezone (24 g ha^{-1}) + clomazone which controlled barnyardgrass effectively at 97% compared to topramezone (79%) or clomazone (52%) alone. Inversely, a significant decrease in control was occurred for topramezone (24 g ha^{-1}) + saflufencil (65%), likely because of antagonism from the contact activity of saflufenacil. This research indicates that it is possible to control barnyardgrass with topramezone-containing tank-mixes.

EMERGENCE OF 6 GRASS SPECIES IN NORTH CAROLINA. M.T. Schroeder*, W.J. Everman, D. Copeland, J. T. Sanders, B. W. Schrage, L. Vincent, A. M. Growe; North Carolina State University, Raleigh, NC (98)

ABSTRACT

Knowing which weed species are problematic and when they emerge are necessary in order to set up an effective weed management plan. This data is especially important when applying herbicides with no residual. In this study barnyard grass, broadleaf signal grass, fall panicum, goosegrass, large crabgrass, and texas panicum were all sown into 36-inch sorghum rows. Emergence timing as well as end of season heights, tiller count, and seed count were taken to document biomass differences in large verses small populations. Peak emergence was at similar timings for all species except fall panicum, which had peak germination one week later. The preliminary data showed that barnyardgrass, broadleaf signal grass, and large crabgrass have the ability to germinate many seedlings over a 3-week period.

PREEMERGENCE AND POSTEMERGENCE TOLERANCE OF NEW SOYBEAN TECHNOLOGIES TO AUXIN HERBICIDES. J.S. Rose*[1], T. Barber[2], J.K. Norsworthy[1], H.D. Bowman[1], M.M. Houston[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (99)

ABSTRACT

In 2016, Roundup Ready 2 Xtend® soybean was released for planting, while Enlist™ soybean has not yet been released to the market. At the time of release, there was no formulation of dicamba labeled for use on Roundup Ready 2 Xtend® soybean; however, recently Engenia™ and XtendiMax™ with Vaporgrip™ have received a federal label for in-crop use. Many questions have come up as to what will happen if auxinic herbicides, from other families, are applied either preemergence or postemergence to these two new herbicide tolerance technologies. To determine if cross-resistance to other auxin herbicides exists, tests were conducted in 2016 at the Lon Mann Cotton Research Station near Marianna, AR and in 2015 and 2016 at the Rohwer Research Station near Rohwer, Arkansas. The objective of these studies was to investigate how these new technologies will react following a preemergence and an over-the-top application. This experiment was conducted using Enlist™, Roundup Ready 2 Xtend®, and Roundup Ready 2 Yield® cultivars and was arranged as a split-split-plot design. Treatments consisted of a single application at a 1x and 1/16x rate of auxin herbicides representing each of the five families within WSSA site of action Group 4. This included 2,4-D, dicamba, quinclorac, triclopyr, aminopyralid, fluroxypyr, and clopyralid. The application was either made immediately after planting for the preemergence (PRE) trial or to V6 soybean in the postemergence (POST) trial. Treatments were applied to the center two rows of four-row plots at 276 kPa using a TTI 110015 nozzle on a 48 cm spacing at the rate of 112 L/ha gallons from a tractor-mounted sprayer. Visual crop injury, relative to the nontreated, was recorded at 14 and 21 (PRE) and 14, 21, and 28 (POST) days after application (DAA). At 21 DAA (POST) and 28 DAA (PRE), aboveground biomass was collected from 1 meter of row from each cultivar, in each treatment, dried, and recorded as a percent of the corresponding nontreated check. In the PRE trial, at 14 DAA, Enlist soybean exhibited some tolerance when both triclopyr or fluroxypyr was applied, less injury was seen in comparison to the other technologies with the most injury being seen when aminopyralid, clopryalid, or dicamba, was applied at the 1x rate. In the POST trial, Enlist™ exhibited tolerance to 2,4-D and increased tolerance to triclopyr (<5% injury) and fluroxypyr (<20% injury). In either trial, the Xtend® soybean only exhibited tolerance to dicamba with all other treatments resulting in >20% (PRE) and >50% injury (POST). All auxin herbicide treatments significantly injured the Roundup Ready cultivar. The biomass collected from the POST trial was generally consistent with the injury rating, the less injury observed resulted in greater biomass production. Similar results were seen where the 1/16x rate was applied, with a general reduction in injury consistent with the reduced rate. Based on this research the misuse of a synthetic auxin herbicide to these new technologies is likely to cause a high level of injury to the crop.

GERMINATION BEHAVIOR OF ECHINOCHLOA WITH DIFFERENT RESISTANT PATTERNS UNDER VARIOUS ENVIRONMENTAL CONDITIONS AND SEED BURIAL DEPTHS. T.M. Penka*, N.R. Burgos; University of Arkansas, Fayetteville, AR (100)

ABSTRACT

Echinochloa infestations can cause substantial financial losses for rice producers. In Arkansas, resistance to multiple herbicide modes of action has evolved among *Echinochloa* populations, reducing chemical weed control options. Herbicide resistance has been associated with reduced fitness in some species. This is important because if fitness penalty is associated with certain herbicide resistance profiles, then producers may have better alternatives for integrated weed management. Experiments were conducted at the Arkansas Agricultural Research and Extension Center (AAREC), Fayetteville to evaluate the effects of temperature (15- , 20-, 30-, and 40°C) and seed burial depth (0- , 1.2-, 2.5-, and 5.0 cm) on the germination behavior of *Echinochloa colona* accessions with different resistance profiles. The temperature study included eight accessions, represented by sensitive (S) and tolerant (T) biotypes selected from within each accession to determine if any fitness penalty can be associated with the resistant phenotype in terms of germination. Fifty to fifty-five seeds of each sample were placed in a Petri plate lined with paper towel, in four replicates, moistened with DI water, and incubated at the designated temperatures in 12 hour day/night with no temperature fluctuation in the for four weeks. Germinated seeds were counted every other day and water was replenished. The seed burial experiment was conducted using two accessions from the temperature study (ECO45 and ECO76), each with the respective S and R biotypes, and planted in pots filled with field soil at the designated depths. Each pot was marked to indicate seed placement at each depth and filled with a firm layer of soil to each level. Thirty seeds were spread evenly on top of the soil and covered with a firm layer of soil up to the 0-cm mark. Seeds on the 0 cm depth were not covered with soil. The treatments were replicated four times and arranged in a randomized complete block design. Emergence data were recorded as in the temperature study. One plant was maintained per pot to evaluate growth rate. The interaction effect of temperature, accession, and biotype on germination was significant. Both accessions germinated faster, and had higher germination capacities, at 30°C and 40°C regardless of biotype. At 40°C ECO45-S had the highest germination rate and total germination within the first week (72%); ECO45-R had lower germination capacity (62%). After 28 days, ECO45-S had 86% total germination while ECO45-R had 97% at 15°C. The germination between biotypes differed at lower temperatures in both accessions. The R and S biotypes also did not differ in emergence and growth rate across seeding depths, regardless of accession. The main effects of seeding depth and accession were significant. Averaged across biotypes, and seeding depths, ECO-45 had higher emergence than ECO76. The former germinated 90% on the soil surface and the latter had <10% germination. Emergence was reduced to <20% overall at 1.25-cm depth and was close to zero at 2.5-cm depth. Averaged across biotypes, the seedling growth of ECO76 was reduced more by seeding depth than that of ECO45. ECO76 was about 80 cm tall 4 WAP when planted at 0 cm depth and was only about 30 cm tall when planted at 2.5-cm depth. The height of ECO45 was similar (around 50 cm) whether planted at 0-cm or 2.5-cm depth. In conclusion, a fitness penalty was observed with respect to germination capacity at lower temperature, but there was no fitness penalty with respect to emergence at various seeding depths and seedling growth.

EVALUATION OF HPPD-INHIBITING HERBICIDES FOR MORNINGGLORY SPECIES CONTROL IN CORN. W.C. Greene*[1], J.A. Tredaway[1], A.J. Price[2], T. Cutts[1], W.B. Greer[1]; [1]Auburn University, Auburn, AL, [2]USDA, Auburn, AL (101)

ABSTRACT

Field studies were conducted at the E.V. Smith Research and Extension Centers, Plant Breeding Unit in Tallassee, Alabama in 2016 to compare the residual control of *Ipomea* spp. using HPPD inhibiting herbicides in corn. Eleven herbicides were applied early-POST including: Acuron, Armezon Pro, Balance Flexx, Callisto, Capreno, Corvus, Halex GT, Laudis, Lexar EZ, and Revulin Q per the labeled rate, as well as with the recommended surfactant if needed. Herbicides that did not already contain atrazine were separated into two treatments, including with and without atrazine, applied at 1 qt/A at planting. Herbicide treatments were applied in mid-May at the V4 stage of corn. Control ratings of *Ipomoea* spp, primarily *Ipomoea hederacea* and *Ipomoea lacunosa*. were taken at 30, 60, and 90 days after treatment. Control was evaluated on a scale of 0-100% with 0 = no control and 100% total control. There were differences among treatments at all three rating timings. Halex GT, applied with atrazine, provided 97% control of *Ipomoea* spp. at 30 DAT. Callisto, applied with atrazine, provided 96% control of *Ipomoea* spp. at 60DAT. Treatments of Revulin Q and Callisto, both applied with atrazine, provided 80% control of *Ipomoea* spp. at 90 DAT. There were no differences in yields with any treatment. These results indicate that the use of any common HPPD-inhibiting herbicide will provide good season long control of *Ipomoea* species. Based on the results from 2016, the inclusion of atrazine did significantly increase the level of residual control of *Ipomoea* spp.

THE EFFECTS OF MULCHING, TILLAGE, AND HERBICIDES ON WEED CONTROL AND WATERMELON YIELD. J.P. Williams*[1], A.J. Price[2], J.S. McElroy[1], S. Li[1], E. Guertal[1]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL (102)

ABSTRACT

Currently few producers in the Southeast US have adopted conservation tillage practices in specialty crop production. The lack of conservation adoption is likely due to the added challenges in producing vegetables in cover crop residues, especially high biomass cover crop systems. The objective of this experiment was to determine if conservation tillage practices could be incorporated into watermelon production (*Citrullus lanatus* (Thunb.) Matsum. & Nakai). A three-year watermelon experiment was established in fall 2013 at Auburn University's Plant Breeding Unit, near Shorter, AL. Four agronomic systems were evaluated: 1) conventional tillage with no polyethylene mulch, 2) conservation tillage with a cereal rye cover crop, 3) conventional tillage with polyethylene mulch, 4) conservation tillage with a rye cover crop integrated with polyethylene mulch. Within each system, herbicide treatments included 1) halosulfuron applied at 26.3 grams ai ha^{-1} PRE, 2) halosulfuron applied at 26.3 grams ai ha^{-1} POST, 3) halosulfuron applied sequentially at 26.3 grams ai ha^{-1} PRE and POST, and 4) a non-treated control. Results revealed that the agronomic system was the most important factor in determining yield, likely due to adequate herbicide control in most systems. Both polyethylene mulch treatments consistently yielded higher than treatments without polyethylene, regardless of the herbicide system used. Polyethylene use resulted in yields was significantly higher than all other mulching systems in 2014 (30,661 kg ha^{-1}) and 2015 (61,223 kg ha^{-1}). In 2016, polyethylene and polyethylene integrated with rye were not different (36,275 kg ha^{-1} polyethylene and 31657 kg ha^{-1} polyethylene over rye, respectively), and yielded significantly higher than treatments without polyethylene (10,938 kg ha^{-1} conventional tillage and 5,311 kg ha^{-1} conservation tillage). In all years, there was no interaction between yields by herbicide system. The effect of the polyethylene was again apparent in the yield interaction between mulching system and herbicide. Increasing herbicide intensity did not increase yield, and polyethylene use was still the most important effect in increasing yield. Crabgrass weed control was difficult regardless of agronomic system or herbicide system. Utilizing sequential PRE and POST applications did not significantly affect weed control in the interaction between herbicide and mulching system for any of the weeds rated. The results of this experiment show that progress still needs to be made in developing integrated conservation systems for watermelon production. However, the results of the polyethylene integrated with rye reveal that this mulching system could have potential in conservation specialty crop production.

TOLERANCE OF CONVENTIONAL AND INZEN™ GRAIN SORGHUM TO SOIL APPLIED ALS-INHIBITING HERBICIDES. H.D. Bowman[1], T.Barber[2], J.K. Norsworthy[1], J.Rose[1], N.Steppig[1], R.R. Hale[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas Research and Extension Service, Lonoke, AR (103)

ABSTRACT

In Arkansas, 2015 was a significant year for grain sorghum (*Sorghum bicolor*) production, with 430,000 acres being harvested. The total acreage quickly declined in 2016 due to commodity prices and lack of effective weed control programs, with grass control being the most lacking in the crop. In 2016, only 40,000 acres were harvested in the state. To solve the issue of effective weedy grass control, DuPont™ has proposed the opportunity to use liquid based nicosulfuron, labeled as Zest™, with the development of a new non-GMO trait called Inzen™. This new trait provides resistance to acetolactate (ALS) synthase-inhibiting herbicides. A field study was conducted in 2016 on the the Arkansas Agriculture Research & Extension Center in Fayetteville; Lon Mann Cotton Research Station in Marianna; and Pine Tree Research Station near Colt to evaluate the tolerance of conventional and Inzen™ cultivars to nicosulfuron-based Zest™, along with twenty-two other ALS-inhibiting herbicides encompassing all five ALS-inhibiting families. Plots were arranged using a split-plot design with ALS herbicide representing the main plot factor and grain sorghum cultivar representing the sub-plot. Herbicide treatments were arranged in a randomized complete block design for each cultivar across four replications, all applications were made using a pressurized CO_2-backpack sprayer calibrated to deliver 140L/ha at 5 kph. The Inzen™ cultivar only displayed injury symptoms from 2 of the 22 herbicides tested. These were chlorimuron causing 7% injury and imazaquin causing 2.5% injury. Halosulfuorn, which is currently labeled in conventional grain sorghum, was the only ALS herbicide that did not cause injury to the conventional line. Nicosulfuron as expected had 0% injury on Inzen™, while the convetional cultivar exhibited 54% injury. Another common herbicide used in Arkansas, pyrithiobac sodium also had 0% injury on Inzen™, whereas the conventional cultivar was injured at 83%. The highest injury at 99% on the conventional cultivar occurred when applying thiencarbazone-methyl and rimsulfuron. These results demonstrate that herbicide injury on conventional sorghum cultivars varies depending on which ALS-inhibiting herbicide is used. However, the Inzen™ cultivar displayed strong tolerance to most ALS-inhibiting herbicides. The Inzen™ technology offers promising new alternatives for weed control in grain sorghum.

CONSIDERATIONS WITH HARVEST AID USE IN THE MID-SOUTH. J.W. Smith*[1], J.M. Orlowski[1], T. Irby[2], H.A. Sullivan[1]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Mississippi State, MS (104)

ABSTRACT

Harvest aid use in soybean production in Mississippi is fast becoming a standard production practice for a number of growers. However, there are a number of considerations with the use of soybean harvest aids that need to be investigated. The commonly used compounds for use as harvest aids in soybeans are paraquat (Gramoxone), saflufenacil (Sharpen) and sodium chlorate. Each chemical recommends or requires the use of different adjuvants (Crop oil concentrate, methylated seed oil, non-ionic surfactant). Research is needed to investigate the effects of different adjuvants not only on individual harvest aids but common mixtures of harvest aids. Studies have been established at the Delta Research and Extension Center in Stoneville, MS. Paraquat (Gramoxone), saflufenacil (Sharpen), sodium chlorate, paraquat with saflufenacil, and paraquat with sodium chlorate will be applied to soybean with the recommended amount of crop oil concentrate (COC), methylated seed oil (MSO), and non-ionic surfactant (NIS). Plots will be evaluated for yield, moisture, greenstem, remaining leaf area, and shattering.

The label of harvest aids also specified a pre-harvest interval (PHI) which is the minimum amount of time that must elapse between chemical application and soybean harvest. Different harvest aids have different PHI requirements affecting the amount of time a soybean crop is in the field after harvest aid application. Similarly, wet fall conditions can prevent equipment from getting into the field to harvest the soybean crop. Research needs to be conducted to evaluate how various harvest aids and harvest aid combinations affect soybean moisture content and shattering at various harvest timings after harvest aid application. In another separate study, paraquat, saflufenacil, sodium chlorate, paraquat with saflufenacil, and paraquat with sodium chlorate will be applied to soybean prior to harvest. Plots will then be harvested at 7, 15, and 30 days after application to determine how harvest aid and harvest timing affect soybean seed yield, moisture, and shattering.

One of the most popular harvest aids is paraquat (Gramoxone). Aside from being used as a harvest aid, paraquat is used extensively as a burndown herbicide in Mississippi soybean production. Given that soybean planting (April- June) and harvest (August-November) can be spread out over a number of months, multiple opportunities exist for misapplication of paraquat when used both as a burndown and harvest aid. Paraquat has the potential to drift onto a young soybean crop or be applied accidentally to a soybean crop via tank contamination when paraquat is being sprayed as a burndown. Similarly, paraquat can drift onto a soybean crop during reproductive growth when harvest aids are being applied to an adjacent field or through tank contamination. Research is being conducted to help determine the effect of multiple rates of paraquat on soybean at different growth stages. In this study, paraquat will be applied at 1x, 0.5x, 0.25x, 0.125x, and 0.0625x rates to soybean at the V1, V5, R1, R3, and R5 growth stages. Injury and yield will be evaluated to determine the effect of multiple rates of paraquat on soybean at multiple growth stages.

INFLUENCE OF TIMING OF WEED MANAGEMENT ON WEED CONTROL AND YIELD OF FIVE AGRONOMIC CROPS. A.T. Hare*, D.L. Jordan, M.D. Inman, A.C. York; North Carolina State University, Raleigh, NC (105)

ABSTRACT

Timing of weed control is important in determining crop yield. Research in this area of study is often conducted for a single crop. Research was conducted during 2016 at two locations in North Carolina to determine weed control and yield of corn, cotton, grain sorghum, peanut, and soybean in the same experiment when various herbicides were applied postemergence within six weeks after planting. Commercially-available herbicides were applied to each crop at 2 or 6 weeks after planting (WAP) only; 2 and 4 WAP; 4 and 6 WAP; 2,4, and 6 WAP. A non-treated control was also included. No PRE herbicides were applied at planting. Clethodim was applied to the peanut plots to control grasses at Lewiston 50 days after planting and at Rocky Mount 57 days after planting. To allow comparison across crops, the percentage of maximum yield was calculated based on the highest yield of each crop in each replication.

In absence of herbicides, percent yield was higher for corn than all other crops at both locations. At Lewiston-Woodville, where common ragweed was present, grain sorghum yield was higher than peanut, cotton, and soybean. At Rocky Mount, where Palmer amaranth was present, percent yield of grain sorghum and peanut was similar and exceeded yield of cotton and soybean. At Lewiston-Woodville, when only one herbicide application was made, yield for corn, cotton, grain sorghum, peanut, and soybean ranged from 81-95%, 41-71%, 50-95%, 37-62%, and 64-72%, respectively. At Rocky Mount, for these respective crops, ranges were 67-94%, 1-34%, 29-70%, 53-56%, and 72-77%. When herbicides were applied twice, the ranges in percent yield for these respective crops were 89-97%, 80-94%, 48-96%, 52-94%, and 87-98%. For the same crops at Rocky Mount, the ranges were 77-94%, 84-97%, 52-92%, 74-78%, and 88-95%. With the exception of corn and grain sorghum, applying herbicides three times resulted in yields of at least 86% of the maximum. Yield of corn and grain sorghum was 93% at Lewiston-Woodville but only 59 and 77%, respectively, at Rocky Mount with three applications. Lower yields of the given crops may be a reflection of herbicide injury with these applications.

In some instances, a single herbicide application 2 WAP was more effective than a single application 6 WAP. This was noted at Lewiston-Woodville in grain sorghum and at Rocky Mount in corn, cotton, and grain sorghum. The opposite occurred at Lewiston-Woodville where a single application made 6 WAP was more effective than a single application made 2 WAP in cotton and peanut. Likewise, for two applications beginning early, 2 and 4 WAP, yields were similar at Lewiston for corn, cotton, and soybean, while at Rocky Mount yields were similar for cotton and soybean. In some cases, crop yield for the two earlier applications was higher than the following two later applications. This occurred at Lewiston in grain sorghum and at Rocky Mount in corn and grain sorghum. The opposite was noted with yield following the latter two applications higher than yield following the earlier two applications. This was only case at Lewiston-Woodville for peanut.

Although theses experiments do not constitute a true time of weed removal or duration of weed interference study, results do inform practitioners of the relative importance of timing and duration of weed management for major agronomic crops in North Carolina.

EXPLORING ALLELOPATHIC POTENTIAL OF WEEDY RICE: STEP TOWARDS BREEDING WEED SUPPRESSIVE RICE CULTIVAR. S. Shrestha*, T. Tseng; Mississippi State University, Starkville, MS (106)

ABSTRACT

Weedy red rice (*Oryza sativa* L.) has been identified as one of the most aggressive and persistent weed of cultivated rice. Key weedy traits in weedy red rice like high dormancy, high shattering, variable emergence, rapid growth, asynchronous maturation, enhanced ability to uptake nutrients, make weedy red rice superior and competitive than cultivated rice. Weedy red rice has higher genotypic and phenotypic diversity because of longer period of selection in the local environment. The study was undertaken to evaluate the weed suppressive potential of 54 different weedy red rice biotypes collected from Arkansas, USA. Eight of the fifty-four weedy rice biotypes inhibited the growth of barnyardgrass seedlings by more than 50 %. A blackhull accession, B81, caused 67%, 70%, and 75% reduction in height, biomass, and root length, respectively, in barnyardgrass. Blackhull biotypes showed higher suppression of barnyardgrass seedling growth, than compared to strawhull biotypes and the cultivated rice variety (CL163), thus suggesting blackhull biotypes to be more competitive than strawhull biotypes. Results indicate that different biotypes of weedy rice differ in their weed suppressive potential. The genetic characterization of the blackhull accessions can be explored at the molecular level to identify markers associated with the weed suppressive trait. Since weedy rice and rice belong to the same species, this information can be used to diversify the rice gene pool for rice improvement.

FIELD PERFORMANCE OF A NOVEL 2,4-D TOLERANT RED CLOVER (*TRIFOLIUM PRATENSE*). L.P. Araujo*, M. Barrett, L.D. Williams, G.L. Olson; University of Kentucky, Lexington, KY (107)

ABSTRACT

Incorporation of a legume, such as red clover (*Trifolium pratense*), into grass-based pasture systems offers many benefits. However, available red clover lines are highly susceptible to herbicides, in particular 2,4-D (2,4-dichlorophenoxyacetic acid), which has been widely used for broadleaf weed management in pastures. A novel red clover line, UK2014, was developed at University of Kentucky through conventional breeding and expresses higher tolerance to 2,4-D than Kenland, a common variety used by Kentucky's forage producers. Adopting this new tolerant line would broaden weed management options in a legume-grass mixed pasture. The main objective for this study was to assess the field performance of UK2014, in terms of yield and 2,4-D tolerance level, compared to Kenland in Kentucky's environment. To accomplish this, both UK2014 and Kenland were seeded in April of 2016 and 2,4-D (both the 1.12 and 2.24 kg/ha rates) was applied either early (June 29, 2016), mid (August 8, 2016) or late (October 3, 2016) season. Each plot received only one 2,4-D treatment and treated plots were compared to those that were not treated with 2,4-D. Visual herbicide injury was evaluated one week after spraying and one week after harvest. The red clover was harvested approximately one week after the 2,4-D applications were made. Both individual harvest and total season yield (dry matter ton/ha) were determined. Data was subjected to analysis of variance and means were separated using Fisher's Protected LSD at $\alpha = 0.05$. Visual injury one week after 2,4-D treatment to UK2014 was less than that of Kenland, especially at the 2.24 kg/ha 2,4-D rate. Similarly, in plots treated earlier with 2.24 kg/ha 2,4-D, visual estimates of regrowth one week after harvest were higher for UK2014 than Kenland. However, there were no differences in yield between UK2014 and Kenland at individual harvests or in the season total. While this indicated that the performance of UK2014 is equal to Kenland in terms of yield, it also indicated that the 2,4-D injury to Kenland was not enough to reduce its yield. Future research will follow the effects of 2,4-D on the persistence of these two lines in both monoculture and mixed species pastures.

TOLERANCE OF GLYTOL®/LIBERTYLINK® COTTON TO VARIOUS HERBICIDE TANK MIX COMBINATIONS. M.T. Plumblee*, D.M. Dodds, C.A. Samples, D.B. Denton, S.S. Davis, L. Franca, B.R. Wilson; Mississippi State University, Starkville, MS (108)

ABSTRACT

Glufosinate-resistant cotton (LibertyLink®) was commercialized in 2004 by Bayer Crop Science. LibertyLink® cotton was developed through the insertion of the bialaphos resistance (BAR) gene, which provides resistance to glufosinate. In 2011 GlyTol® was commercialized by Bayer Crop Sciences which provided season-long, in plant tolerance to glyphosate herbicide which is the first Roundup Ready® alternative to be commercialized. Due to the popularity of cotton varieties with these traits and the ongoing battle with resistant weed species, applications of single post-emergence herbicides are becoming uncommon. Therefore, the objective of this research was to evaluate the effects of various herbicide tank mix combinations on a commercially available GlyTol®/LibertyLink® cotton.

This experiment was conducted in 2016 at the R.R. Foil Plant Science Research Center in Starkville, MS and the Black Belt Experiment Station in Brooksville, MS to evaluate GlyTol® /LibertyLink® cotton tolerance to glufosinate and glufosinate tank mix combinations. Stoneville 4946 GLB2 was planted May 7, 2016 in Starkville and May 11, 2016 in Brooksville in 4-row plots 3.86 m wide x 12.2 m long. Applications of glufosinate (Liberty) at 0.65 kg ai ha^{-1}, glyphosate (Roundup PowerMax) at 1.26 kg ae ha^{-1}, S-metolachlor (Dual Magnum) at 2.13 kg ai ha^{-1}, glyphosate + S-metolachlor (Sequence) at 0.3 kg ae ha^{-1} glyphosate and 0.42 kg ai ha^{-1} S-metolachlor, glufosinate (Liberty) at 0.65 kg ai ha^{-1} + S-metolachlor (Dual Magnum) at 2.13 kg ai ha^{-1}, glyphosate (Roundup PowerMax) at 1.26 kg ae ha^{-1} + glufosinate (Liberty) at 0.65 kg ai ha^{-1}, and glyphosate (Roundup PowerMax) at 1.26 kg ae ha^{-1} + glufosinate (Liberty) at 0.65 kg ai ha^{-1} + S-metolachlor (Dual Magnum) at 2.13 kg ai ha^{-1} were made to 4-leaf cotton on June 7, 2016. Visual injury ratings consisting of chlorosis, necrosis, and stunting data were collected at 7, 14, and 28 days after application. End of season data collected included plant height, total nodes, and node above cracked boll, and lint yield. Data were subjected to analysis of variance using PROC Mixed procedure in SAS 9.2 and means were separated using Fishers protected LSD at $p = 0.05$.

The greatest visual injury 7 days after application occurred when S-metolachlor (Dual magnum) (13% injury) was applied and the lowest total injury was where glyphosate (Roundup PowerMax) (6% injury) was applied. Visual injury at 14 days after application was greatest from glufosinate (Liberty) + S-metolachlor (Dual Magnum) and glyphosate (Roundup PowerMax) + glufosinate (Liberty) + S-metolachlor (Dual Magnum) (3.6% injury) and glyphosate (Roundup PowerMax) and S-metolachlor (Dual Magnum) (2.3% injury) treatments having the lowest injury. At 28 days after application visual injury was not significant among treatments. Plant heights were significantly different at 1st bloom where S-metolachlor (Dual Magnum) treated plots had significantly taller plants than plots treated with glufosinate (Liberty) or glyphosate + S-metolachlor (Sequence). Plant heights were not significantly different at defoliation. Total nodes were not significantly different at 1st bloom but were different at defoliation where plots treated with glufosinate (Liberty) and glyphosate + S-metolachlor (Sequence) had more nodes than plots treated with glufosinate (Liberty) + S-metolachlor (Dual Magnum). No significant

differences were observed in nodes above white flower. Plots treated with glyphosate (Roundup PowerMax) + glufosinate (Liberty) and S-metolachlor (Dual Magnum) had more nodes above cracked boll than plots treated with glufosinate (Liberty). Lint yield was significant is greater when glyphosate (Roundup PowerMax), glyphosate + S-metolachlor (Sequence), and glyphosate (Roundup PowerMax) + glufosinate (Liberty) was applied compared to glyphosate (Roundup PowerMax) + glufosinate (Liberty) + S-metolachlor (Dual Magnum).

DEVELOPMENT OF A MODEL TO PREDICT SOYBEAN YIELD LOSS FOLLOWING DICAMBA EXPOSURE. M.R. Foster*, J.L. Griffin, D.C. Blouin, J.T. Copes, D.K. Miller, A.J. Orgeron; School of Plant, Environmental, and Soil Sciences and Department of Experimental Statistics, Louisiana State University Agricultural Center, Baton Rouge, LA 70803 (109).

ABSTRACT

In preliminary research conducted over three years using indeterminate MG 4.8 to 5.1 soybean cultivars, specific injury criteria associated with dicamba rate and application timing were identified. Dicamba (Clarity diglycolamine salt) at 0.6, 1.1, 2.2, 4.4, 8.8, 17.5, 35, 70, 140, and 280 g ae/ha (1/1034 to 1/2 of the use rate of 560 g/ha) was applied at V3/V4 (third/fourth node with 2/3 fully expanded trifoliates) and R1/R2 (open flower at any node on main stem/open flower at one of the two uppermost nodes on main stem). A nonionic surfactant at 0.25% v/v was added to all treatments and a nontreated was included for comparison. Fourteen injury criteria were identified to include: upper canopy leaf cupping, terminal leaf cupping, upper canopy leaf surface crinkling, upper canopy pale leaf margins, upper canopy leaf rollover/inversion, lower leaf soil contact, leaf petiole droop, leaf petiole base swelling, terminal leaf chlorosis, terminal leaf necrosis, terminal leaf epinasty, stem epinasty, lower stem base swelling, and lower stem lesions/cracking. Visual ratings for each injury criterion were made 7 and 15 d after application (DAA) using a scale of 0 to 5 with 0= no injury; 1= slight; 2= slight to moderate (producer concern); 3= moderate; 4= moderate to severe; and 5= severe. These data along with a visual assessment of overall soybean injury and plant height reduction using a scale of 0 to 100% with 0= none and 100%= plants dead/height reduction and canopy height were analyzed to determine their relationship to yield using multiple regression with a forward selection procedure. Variables for regression equations were selected based on R^2 values and Mallow's criteria (Mallow's C_P). For each of the models (V3/V4 and R1/R2 for 7 and 15 DAA), only six of the seventeen variables were included.

In 2016, experiments were conducted in Baton Rouge and St. Joseph, LA to validate the models. An indeterminate MG 4.8 soybean cultivar was used and dicamba rates and application timings were the same as those used to develop the models. Data were collected for the variables specified by the model to include: overall visual height reduction, lower leaf soil contact, lower stem lesions/cracking, canopy height, overall visual injury, and upper canopy leaf surface crinkling for V3/V4 at 7 DAA; lower stem lesions/cracking, overall visual height reduction, terminal leaf epinasty, leaf petiole droop, leaf petiole base swelling, and stem epinasty for V3/V4 at 15 DAA; overall visual height reduction, lower stem lesions/cracking, leaf petiole droop, upper canopy leaf rollover/inversion, leaf petiole base swelling, and stem epinasty for R1/R2 at 7 DAA; and lower stem lesions/cracking, terminal leaf chlorosis, leaf petiole base swelling, stem epinasty, terminal leaf necrosis, and terminal leaf cupping for R1/R2 at 15 DAA. Plots at each location were harvested to determine yield. Nontreated yields were 67.1 bu/A at Baton Rouge and 81.5 bu/A at St. Joseph. For each rate of dicamba and application timing, actual soybean yield and predicted soybean yield based on the models were each compared to the yield of the respective nontreated and percent yield reduction was calculated.

For the validation experiments, the ability of the models to predict soybean yield loss was greater at 15 DAA compared with 7 DAA and was greater for soybean exposure at the reproductive

growth stage compared with vegetative. For the V3/V4 application averaged across locations, predicted percent yield reduction using the model for 15 DAA for dicamba at 0.6 to 8.8 g/ha ranged from 12 to 37% and was either underestimated by 2 percentage points or overestimated by 1 to 8 percentage points when compared to actual percent yield reduction. For dicamba at 17.5 to 70 g/ha, average predicted percent yield reduction ranged from 52 to 89% and was overestimated by 14 to 28 percentage points when compared to average actual percent yield reduction. For the R1/R2 application averaged across locations, predicted percent yield reduction using the model for 15 DAA for dicamba at 0.6 to 8.8 g/ha ranged from 16 to 36% and was either overestimated by 2 to 6 percentage points or underestimated by 7 percentage points when compared to actual percent yield reduction. For dicamba at 17.5 to 280 g/ha, average predicted percent yield reduction ranged from 60 to 97% and was either overestimated by as much as 4 percentage points or underestimated by as much as 3 percentage points when compared to average actual percent yield reduction. A mobile App for use in predicting yield loss associated with soybean exposure to dicamba is currently under development. The ability to forecast the effect of dicamba on crop yield could be helpful in decisions regarding replanting, additional crop inputs, crop insurance claims, and liability issues.

CROP SAFETY AND WEED CONTROL FOLLOWING DICAMBA AND ACETOCHLOR APPLICATIONS IN XTENDFLEX™ COTTON. L. X. Franca*[1], D. M. Dodds[1], C. A. Samples[1], D. B. Denton[1], D. B. Reynolds[1], J. A. Bond[1], A. Mills[2]; [1]Mississippi State University, Mississippi State, MS, [2]Monsanto Company, Saint Louis, MO (110)

ABSTRACT

Given the proliferation of glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats) and tall waterhemp [*Amaranthus tuberculatus* (Moq.) Sauer] throughout the United States, efficacious and cost-effective means of control are needed. XtendFlex™ Technology from Monsanto allows postemergene application of dicamba, glyphosate, and glufosinate to cotton containing this technology. Herbicide programs with multiple site of actions (SOAs) generally have the greatest effect in delaying herbicide resistance yet optimizing weed control. Research was conducted to evaluate herbicide efficacy and crop injury of acetochlor (Warrant™) and dicamba (XtendiMax™) applied PRE and POST for Palmer amaranth and tall waterhemp control in XtendFlex™ cotton.

Experiments were conducted at Hood Farms in Dundee, MS, the Delta Research and Extension Center in Stoneville, MS, and the R. R. Foil Plant Science Research Center in Starkville, MS. The following PRE and POST herbicide programs were evaluated for Palmer amaranth and tall waterhemp control: 1) dicamba at 0.56 kg ae/ha + acetochlor at 1.26 kg ai/ha (PRE) fb dicamba + glyphosate at 1.68 kg ae/ha + acetochlor at 1.26 kg ai/ha (3-4 leaf cotton) fb dicamba + glyphosate at 1.68 kg ae/ha (6-8 leaf cotton); 2) dicamba at 0.56 kg ae/ha + acetochlor at 1.26 kg ai/ha (PRE) fb dicamba + glyphosate at 1.68 kg ae/ha (3-4 leaf cotton) fb dicamba + glyphosate at 1.68 kg ae/ha + acetochlor at 1.26 kg ai/ha (6-8 leaf cotton); 3) dicamba at 0.56 kg ae/ha + acetochlor at 1.26 kg ai/ha (PRE) fb dicamba + glyphosate at 1.68 kg ae/ha (3-4 and 6-8 leaf cotton); 4) dicamba at 0.56 kg ae/ha (PRE) fb dicamba + glyphosate at 1.68 kg ae/ha + acetochlor at 1.26 kg ai/ha (3-4 leaf cotton) fb dicamba + glyphosate at 1.68 kg ae/ha (6-8 leaf cotton); 5) dicamba at 0.56 kg ae/ha (PRE) fb dicamba + glyphosate at 1.68 kg ae/ha (3-4 leaf cotton) fb dicamba + glyphosate at 1.68 kg ae/ha + acetochlor at 1.26 kg ai/ha (6-8 leaf cotton); 6) dicamba at 0.56 kg ae/ha (PRE) fb dicamba + glyphosate at 1.68 kg ae/ha + acetochlor at 1.26 kg ai/ha (3-4 and 6-8 leaf cotton); 7) dicamba at 0.56 kg ae/ha (PRE) fb dicamba + glyphosate at 1.68 kg ae/ha (3-4 and 6-8 leaf cotton). The PRE application was applied immediately after planting followed by a 3-4 leaf cotton application two weeks after, followed by a 6-8 leaf cotton application two weeks after the first post application. DP 1522 B2XF was planted in Dundee, MS and Stoneville, MS, and DP1646 B2XF was planted in Starkville, MS. Visual control ratings and cotton injury were taken two weeks after each application. Cotton yield data were also collected from all locations. Data were subjected to analysis of variance and means were separated using Fischer's Protected LSD at $\alpha = 0.05$.

Treatments containing dicamba + acetochlor (PRE) provided greater Palmer amaranth control at mid-post application. Conversely, dicamba + acetochlor (PRE) and dicamba only (PRE) did not significantly differ with respect to tall waterhemp control prior to 14 days after mid-post application. At 14 days after 6-8 leaf cotton application treatments containing acetochlor provided significantly greater Palmer amaranth control, regardless of application timing. Treatments with acetochlor applied PRE and 3-4 leaf cotton, and 6-8 leaf cotton only, provided

the greatest Palmer amaranth control at 28 days after 6-8 leaf cotton application. In addition, applications of acetochlor PRE and 6-8 leaf cotton, and 3-4 and 6-8 leaf cotton, resulted in the greatest tall waterhemp control 28 days after 6-8 leaf cotton application. Cotton injury was significantly greater from treatments containing acetochlor. However, no injury was observed 28 days after 6-8 leaf cotton application. Yield differences were not observed on DP 1522 B2XF. Nevertheless, DP 1646 B2XF had significantly greater seed cotton yield on treatments containing two applications of acetochlor, regardless of application timing. The use of acetochlor as part of the XtendFlex™ resulted in effective Palmer amaranth and tall waterhemp control in Mississippi.

INVESTIGATING PALMER AMARANTH RESPONSE TO GLUFOSINATE IN A NORTH CAROLINA POPULATION. D. Copeland*, W.J. Everman, A.C. York; North Carolina State University, Raleigh, NC (111)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) is the most problematic weed in row-cropping systems in the southern United States. The summer annual has evolved resistance to herbicides from six different mechanisms of action in the U.S. In this study, a population of putative glufosinate-resistant Palmer amaranth from McFarlan, NC in 2015 was collected and screened for glufosinate resistance against a susceptible population. Four seed lots (seed from individual females) from the putative glufosinate-resistant population (A19, CG6, CG8 and CG16) were tested versus the glufosinate-susceptible population (GS). Each population was treated with glufosinate at 10, 20, 40, 60, 90, 120, 180, 240, 480, 720, 960, 1200 g a.i. ha^{-1}. A nontreated check was included. Percent mortality and shoot dry biomass were recorded 21 DAT (days after treatment). Treatments were replicated 5 times and repeated in time.

Little to no difference was observed between CG6, CG8, CG16 and the GS population, with respect to mortality or dry weight biomass 21 DAT. However, A19 (680 g) had a significantly greater LD90 (lethal dose, 90%) than GS (250 g). Differences in GI50 (growth inhibition, 50%), with respect to dry biomass, were observed between A19 (162 g) and GS (62 g).

Further experiments were conducted at the field site in McFarlan, NC. Plots were 4-96 cm rows, 6 m in length. Palmer amaranth were treated when plants were 5-8cm in height with glufosinate at 595, 660, 880, 1190, 1310, 1475, 1760 and 2355 g a.i. ha^{-1}. Treatments of glufosinate followed by (fb) sequential applications of glufosinate 7 days after the initial (DAI) were utilized and included: 660 fb 660 g, 880 fb 660 g and 880 fb 880 g. A nontreated check was included. Percent control and mortality were recorded 7 DAT. Treatments were replicated 4 times and repeated in time.

In the first run, control of Palmer amaranth was greater than 93 % for all treatments that included a single application. However in the second run, single applications only provided 90 % or greater control with rates 1475, 1760 and 2355 g of glufosinate. Palmer amaranth was controlled in both runs when sequential applications of glufosinate at 660 or 880 g where made 7 DAI of 660 or 880 g of glufosinate. Research is ongoing to determine why this biotype survived rates of glufosinate known to be lethal to glufosinate-susceptible Palmer amaranth.

SELECTIVE GOOSEGRASS CONTROL IN BERMUDAGRASS USING TOPRAMEZONE AND CHELATED IRON. A.P. Boyd*, J.S. McElroy, W.B. Head; Auburn University, Auburn, AL (112)

ABSTRACT

Goosegrass (*Eleusine indica*) is one of the most problematic grassy weeds of turfgrass. Management can be very difficult, due to the ability of goosegrass to thrive in extreme environments and the lack of herbicides available offering acceptable control. Monosodium methanearsonate (MSMA) was a primary herbicide used for goosegrass control in warm season turfgrasses until 2009, when the EPA heavily restricted its use in the turfgrass industry. Previous research has shown that topramezone (Pylex, BASF, Research Triangle Park, NC), a HPPD inhibitor, offers excellent control of goosegrass, and other weeds. Just as with other HPPD inhibitors, turfgrass injury can be an issue. Topramezone affects the carotenoid biosynthesis pathway causing symptoms of bleaching and injury to occur on various warm season turfgrasses. Our previous research from 2015 indicates that topramezone used in combination with chelated iron (Sprint 330, BASF, Research Triangle Park, NC) significantly reduced the bleaching effects associated with topramezone use on bermudagrass. Greenhouse trials were conducted in order to determine whether the addition of chelated iron to the mixture affected herbicide efficacy of goosegrass. Two rates of topramezone (6.15 and 12.3 g ai/ha), five rates of chelated iron (0.1525, 0.305, 0.610, 1.22, 2.44 kg ai/ha), and MSO (0.5% v/v) were applied sequentially (initial, 3 weeks after initial) to two goosegrass biotypes. Bleaching symptoms and goosegrass control were visually rated on a 0 to 100% scale. The treatments were arranged as a randomized complete block design with 3 replications and repeated in time. All data was analyzed using PROC GLM, and the Fisher's Protected LSD (P<0.05) for means separation.

The results of the trials performed showed that both rates of topramezone, with or without the addition of chelated iron, yielded complete control of both goosegrass populations for all topramezone treatments. Complete control was achieved in both runs, however, complete control occurred 45 days after initial (DAI) for trial one, and 26 DAI for trial two, respectively. Our data suggests that the addition of chelated iron to combinations of topramezone and MSO may offer another herbicide option for goosegrass control in bermudagrass.

INCLUDING HERBICIDES IN SUNN HEMP (*CROTOLARIA JUNCEA* L.) COVER CROP FOR WEED CONTROL. T.M. Batts*, P.J. Dittmar; University of Florida, Gainesville, FL (113)

ABSTRACT

Sunn hemp is planted during Florida's summer fallow period as a cover crop has many advantages including weed suppression, nematode control, and nutrient management. Herbicide application during the summer fallow period can also reduce the number of weeds in the subsequent fall planted crop. The experimental objectives were to establish the cover crop tolerance and weed control of herbicide application in sunn hemp. Experiments were conducted in 2016 at the Plant Sciences Research and Education Unit, Citra, FL and Hastings Agricultural Extension Center, Hastings, FL. Treatments were a factorial design with 6 herbicides x 2 application timings and a nontreated arranged in a randomized complete block design with 4 replications. The herbicide treatments were 2,4-DB (0.25 kg ae ha^{-1}), S-metolachlor (1.08 kg ha^{-1}), imazethapyr (0.07 kg ha^{-1}), pendimethalin (0.45 kg ha^{-1}), halosulfuron (0.04 kg ha^{-1}), and fomesafen (0.28 kg ha^{-1}). The two application timings were PRE (d of planting) and POST (21 d after planting). Fomesafen PRE had greater sunn hemp injury at 21 d after treatment (DAT) compared to the other herbicides PRE and the nontreated control at both locations. At Citra, fomesafen PRE continued to have greater injury than the other herbicides at subsequent rating dates, however, sunn hemp injury at 28 DAT at Hastings was similar across all herbicides PRE and the nontreated control. Sunn hemp biomass at 56 DAT followed the same trend as the 28 DAT rating with fomesafen PRE having a lower biomass than other herbicides at Citra and no differences in biomass among herbicide treatments at Hastings. The predominate weed species at Citra were purple and yellow nutsedge (*Cyperus rotundus* and *C. esculentus*. At Hastings, the predominant species were eclipta (*Eclipta prostrata*), goosegrass (*Eleusine indica*), and smooth pigweed (*Amaranthus hybridus*). Halosulfuron PRE had the greatest weed control at 21 DAT at Citra and was similar to imazethapyr PRE and s-metolachlor PRE. Halosulfuron PRE, imazethapyr PRE, and s-metolachlor PRE had the lowest weed biomass at 56 DAT, whereas, fomesafen PRE had the greatest weed biomass due to the lack of shading from the sunn hemp. At Hastings, all the herbicides PRE had greater control than the nontreated, however, 2,4-DB had less control than the other herbicides PRE. Fomesafen POST had greater crop injury at 21 DAT than the other herbicides POST and the nontreated. At Citra, imazethapyr POST had greater sunn hemp injury at 21 DAT than the nontreated and was similar to halosulfuron POST; at Hastings, halosulfuron POST had greater injury than the nontreated and was similar to imazethapyr POST, pendimethalin POST, and 2,4-DB POST. By 56 DAT, crop biomass at both locations was lowest after treated by fomesafen POST and was different than all other treatments. The lower sunn hemp stand in fomesafen POST allowed weed biomass to be greatest in fomesafen treatments. Fomesafen PRE and POST is unsuitable in sunn hemp because crop injury and weed control were unsuitable. The other PRE herbicides had excellent crop tolerance. Herbicides PRE provided early weed control regardless of weed species. But by the end of the season, fields with high nutsedge populations were not different, but late season weed control was improved in fields with annual weed pressure. POST applications cause more injury, however, the weed control was greater than a PRE application. The use of herbicides may have a utility in summer cover crops dependent on weed species and carryover restrictions to the fall crop.

SEED SHATTERING OF SIX PREVALENT WEED SPECIES IN NORTH CAROLINA.
T.A. Reinhardt*[1], W.J. Everman[2]; [1]North Carolina State University, Raleigh, IL, [2]North Carolina State University, Raleigh, NC (114)

ABSTRACT

As herbicide resistant weeds become more common, harvest weed seed control has gained interest as part of a weed resistance management plan. However, the success of these methods for control require weeds retain seed until harvest in order for seeds to be removed with the crop. In this study, we examine the timing of seed dispersal of six prevalent weed species in North Carolina: Palmer amaranth, common ragweed, sicklepod, common cocklebur, broadleaf signalgrass, and Texas panicum. Four trays 51.4cm x 40cm x 6.3cm were anchored around each plant in October. Fallen seeds were vacuumed from the trays and collected for counting each week until the end of typical soybean harvest in North Carolina. At the last collection, plants were cut at the soil surface, threshed, and seeds counted.

Both grass species dropped over 50% of seed by November 11, where *A. artemisiifolia* barely reached 50% by the end of November. *X.strumarium*, *S. obtusifolia*, and *A. palmeri* had dropped less than 30% at termination. The first reported frost occurred November 8 during the week that had significantly higher drop in *X.strumarium*, *U. platyphylla*, *A. artemisiifolia*, and *P. texanum*. The highest number of seeds collected from one A. palmeri plant over all 6 weeks was 200 seeds- still less than 1% of total seeds estimated on one mature plant. *U. platyphylla* dropped 50% by November 11, but average plants produce around 250 seeds.

Based on this one year of data, harvest weed seed control may work better to control some species if harvest occurs before first frost, but not for all species. *S. obtusifolia*, *X. strumarium*, and *A. palmeri* retained a majority of their seeds throughout the fall despite the frost patterns. The hypothesis is only supported by observed patterns in *X. strumarium* and *A. palmeri*, but will depend on actual harvest timing. This data will help determine which species have the best chance to be controlled by harvest weed seed control.

RELATIVE ACTIVITY OF FOUR TRICLOPYR FORMULATIONS. J. Carvalho de Souza Dias*[1], A. Banu[2], S.F. Enloe[3], J. Ferrell[3], B.A. Sellers[4]; [1]University of Florida, Ona, FL, [2]University of Florida, Gainesville, India, [3]University of Florida, Gainesville, FL, [4]University of Florida, Wachula, FL (115)

ABSTRACT

The formulation of an herbicide can have a profound influence on the efficiency of herbicide delivery to the target plant, as well as uptake across the cuticle, translocation within the plant, and subsequent biological performance. At present, there are four basic formulations of triclopyr; a triethyamine salt (triclopyr amine), a butoxyethyl ester (triclopyr ester), a pyridinyloxyacetic acid (triclopyr acid) and a recently released choline salt (triclopyr choline). Though these formulations have a similar activity spectrum, they differ in other aspects such as cuticle permeability, signal words, application sites, volatility potential and water solubility. However, dose-response data illustrating the differences in efficacy of these formulations when foliar applied are limited. Greenhouse dose-response studies were conducted at the University of Florida Gainesville campus in 2015. The four formulations were applied at rates ranging from 17 to 1,121 g ae ha^{-1} triclopyr on seedlings of soybean, sunflower, tomato and cotton. In general, all formulations performed fairly similarly. Even though there were significant differences in ED_{50} values among formulations in soybean, tomato and sunflower, their dose-response curves were fairly similar. These data indicate that choosing a product due to formulations differences, in an attempt to improve efficacy against plants of the same family as the plants tested, may be unfounded. Rather, the choice of the best formulation for a specific site at a specific time might be based on other important management factors such as handling characteristics, volatility potential, and cost.

PHYSIOLOGICAL IMPACT OF CO_2 LEVELS ON MULTIPLE HERBICIDE-RESISTANT *ECHINOCHLOA COLONA*. C. Oliveira*[1], L. Piveta[1], J. Refatti[1], D. Agostinetto[1], N.R. Burgos[2]; [1]Universidade Federal de Pelotas, Pelotas, Brazil, [2]University of Arkansas, Fayetteville, AR (116)

ABSTRACT

Echinochloa colona is a serious weed of rice worldwide, especially with the evolution of resistance to multiple herbicides in this species. Acquiring resistance may affect plant fitness, and this has been documented in some cases such as with resistance to triazines involving target site mutation. Understanding which biological and physiological attributes primarily contribute to plant fitness and how these interact with environmental factors such as climate change are essential in predicting the impact of herbicide resistance on weed populations. This experiment aimed to evaluate the effect of CO_2 levels on multiple herbicide-resistant *E. colona*. A growth-chamber study was conducted from August to December 2016. The experiment was setup in a randomized complete block design with two factors: Factor A was CO_2 concentration (400 mL L^{-1} or 700 mL L^{-1}); Factor B, was *E. colona* biotype (susceptible or resistant) in three replications. The susceptible line was derived from the same seed lot as the resistant line. Seeds were planted in pots with field soil. Seedlings were thinned to one per pot. The data collected were: height and tiller number (every 7 d until seed maturity); photosynthesis rate, substomatal CO_2 concentration, stomatal conductance, transpiration, water use efficiency, carboxylation efficiency; leaf area, shoot dry matter and root dry matter (80 d after emergence); and number of panicles per plant, seeds per panicle and seed yield per plant (123 d after emergence). Both resistant (R) and susceptible (S) plants showed increased height, leaf area, shoot biomass, root biomass, photosynthesis rate, water use efficiency, and carboxylation efficiency when grown in 700 mL L^{-1} CO_2 compared to 400 mL L^{-1}. At 400 mL L^{-1} CO_2, the S plants had more panicles per plant than the R plants, but were shorter and had less photosynthesis rate, water use efficiency, carboxylation efficiency, and seed yield than the R plants. When grown at 700 mL L^{-1} CO_2, the S plants had more tillers and higher photosynthesis rate, water use efficiency and carboxylation efficiency than resistant accession. The S plants then were more productive (more seeds per panicle and seed yield) than R plants at high CO_2 level. In conclusion, increasing atmospheric CO_2 levels may benefit C3 crops such as rice, but would also make C4 weeds such as *E. colona* more competitive. The multiple-resistant *E. colona* did not show fitness disadvantage at normal CO_2 level, but was less productive than S plants at high CO_2 concentration.

COTTON AND WEED RESPONSE TO TIMING OF HERBICIDE APPLICATION. M.D. Inman*, D.L. Jordan, D.T. Hare, A.C. York, M.C. Vann; North Carolina State University, Raleigh, NC (117)

ABSTRACT

Early season management of Palmer amaranth is critical for cotton production. Timely herbicide applications can be difficult to accomplish which can result in inadequate weed control. Palmer amaranth that escape early control efforts can significantly reduce cotton yields. The objective of this study was to evaluate Palmer amaranth and annual grass control and cotton yields as influenced by various timing sequences of postemergence (POST) herbicides.

Research was conducted during 2015 and 2016 across eight environments in North Carolina. No preemergence herbicides were used at planting. Treatments consisted of herbicide application timings of: 2, 3, 4, and 5 weeks after planting (WAP); 3, 4, and 5 WAP; 4 and 5 WAP; and 5 WAP only. Additional treatments included herbicides applied 2 WAP only, 2 and 3 WAP; and 2, 3, and 4 WAP. The POST herbicide applied at 2 and 3 WAP included glufosinate (543 g ai ha^{-1}) alone and application timings at 4 and 5 WAP included glyphosate plus dicamba (946 g ae ha^{-1} + 560 g ae ha^{-1}). A non-treated control was included. Cotton was planted in a conventional-tillage system. Cotton was machined harvested with a spindle picker and seedcotton weight was recorded. Visible estimates of percent weed control were recorded 3, 4, 5, 6, 7, and 8 WAP using a scale of 0 to 100 where 0 = no control and 100 = complete control. Fresh weight of weeds from 1 m^2 area of each plot was determined in late season.

Palmer amaranth was controlled at least 99% 8 WAP when three or more herbicide applications were utilized; regardless of timing sequence. Control declined to 94, 81, 77, and 67% with the 4 and 5, 2 and 3, 5, and 2 WAP application timings; respectively. Annual grass was controlled greater than 99% when all four herbicide timings were used. At least 96% control and no greater than 99% was observed with three herbicide applications or with the 4 and 5 WAP timing. Control declined to 87, 80, and 64% with the 2 and 3, 5, and 2 WAP application timings; respectively. Yield reductions of 23, 43, 53, and 84% were observed with the 4 and 5, 2 and 3, 5, and 2 WAP timing sequences; respectively. Similar to trends with Palmer amaranth control, when three or more herbicide applications were utilized, no difference in yield was observed. This research demonstrates that even when adequate weed control is obtained with larger weeds, early season weed interference can still hinder yield potential.

EFFECT OF IN-ROW VEGETATION-FREE STRIP WIDTH ON GROWTH, YIELD, AND FRUIT QUALITY OF 'NAVAHO' BLACKBERRY. N.T. Basinger*[1], K.M. Jennings[1], D.W. Monks[2], W.E. Mitchem[2]; [1]North Carolina State University, Raleigh, NC, [2]NC State University, Raleigh, NC (118)

ABSTRACT

The cost of establishing blackberry fields is very expensive and growers have an interest in increasing fruit yield and quality of their established fields to avoid the cost of instituting new plantings. Modification of cultural practices in established plantings could improve plant growth, increase fruit yield and fruit quality components such as soluble solids concentration (SSC), titratable acidity (TA) and pH, which greatly contribute to blackberry flavor. Blackberry is a shallow rooted plant and may be susceptible to competition from weeds and/or between-row vegetation commonly established between crop rows. Vegetation-free strip width (VFSW) in commercial plantings are often inconsistent and vary in width. A field study was conducted from 2013-2015 in an established 5-year-old blackberry planting located on farm to determine the influence of VFSW on ’Navaho’ blackberry growth, yield and fruit quality. The planting had a tall fescue (*Festuca arundinacea*) cover crop growing between blackberry rows and a VFSW strip in the crop row, a common practice in commercial blackberry plantings. In Fall 2012 tall fescue (*Festuca arundinacea* var. ‘Kentucky 31’) was seeded in-row and allowed to establish. VFSW treatments consisted of 0, 0.6, 0.9, 1.2, and 1.8 m and were established in Spring 2013. Primocane and floricane number increased with increasing VFSW. Primocane diameter decreased with increasing VFSW in 2014 but had a quadratic response in 2015. Primocane length increased with increasing VFSW in 2014, but was unaffected in 2015. Berry size increased with increasing VFSW both years. Yield and number of berries per plant increased with increasing VFSW at a p=0.1 level. Berry quality components were also affected by VFSW. SSC increased and pH decreased with increasing VFSW, while TA was unaffected by VFSW. Results indicate that widening the VFSW from the current recommendation of 1.2 m, to a VFSW of 1.8 m, increases plant growth, improves fruit quality parameters and can moderately increase yield.

SWSS 2016 ENDOWMENT ENRICHMENT SCHOLARSHIP PRESENTATION - N.T. Basinger*; North Carolina State University, Raleigh, NC

ABSTRACT

The aim of this scholarship program is to allow students to participate in a week-long experience of their choice, in an academic or industry setting. I received a Southern Weed Science Society's Endowment Enrichment Scholarship in 2016 with the goal of my experience being to learn more about the intersection of technology and agriculture, and to gain more exposure to agronomic cropping systems. In August 2016, I traveled to Starkville, MS to visit with Dr. Darrin Dodds, Associate Extension/Research Professor at Mississippi State University (MSU), who specializes in cotton production. During my visit I participated in the collection and analysis of multispectral UAV images, toured the MSU supercomputer and virtual reality cave with Dr. Joby Czarnecki of the MSU Geosystems Research Institute. I spent a day learning the successes and challenges of growing cotton in MS at a cotton growers' field day, and toured cotton gins. I met with Dr. Trey Koger, Agronomist with Silent Shade Planting Company, to learn how he has integrated precision agriculture systems and online farm management tools into his company's decision-making process. I toured the Monsanto Learning Center in Scott, MS with Jay Mahaffey, and visited with Dr. Jason Krutz at the Delta Research and Extension Center to learn about new irrigation methods for water conservation in peanuts and rice. I visited the facilities at the North MS Research and Extension Center in Pontotoc with Dr. Steven Meyers, and learned about the MSU virus testing lab for sweetpotato, as well as viewed sweetpotato research studies on the station. Finally, I was able to attend a faculty senate meeting and learn about some of the responsibilities of being a faculty member at a land grant university. This entire experience was incredible, and gave me a real perspective of how new technology is being integrated into agriculture, and a new understanding of field crop production. My perspective on building and running a successful research and extension program including some of the responsibilities of being a university faculty member was broadened. Exposure to a research program outside of fruit and vegetable crops, was an exciting and humbling experience. I would like to thank the Southern Weed Science Society for providing funding for educational opportunities like the Endowment Enrichment Scholarship, and Dr. Darrin Dodds for ensuring that every day was filled with new experiences. I would also like to thank Chase Samples, Michael Plumblee, Drew Denton, and Shane Carver for their company, willingness to answer my questions, and making sure I made it to each educational activity to meet many of the incredible people that were part of this experience. I believe that the SWSS Endowment Enrichment Scholarship is an incredibly unique experience that provided me with a multitude of new perspectives, and connections in weed science, and allowed me to surpass the objectives of my experience.

SWSS 2016 ENDOWMENT ENRICHMENT SCHOLARSHIP PRESENTATION - R.A. Atwell*; North Carolina State University, Raleigh, NC

ABSTRACT

The SWSS Endowment Enrichment Scholarship experience was invaluable in my professional development as a graduate student. This scholarship experience is focused on providing an educational experience to graduate students in the weed science discipline. I spent a delightful week at the University of Georgia-Tifton campus visiting the programs of Drs. Stanley Culpepper and Eric Prostko for this scholarship experience. Dr. Culpepper works with weed control in cotton, small grains, and vegetables while Dr. Prostko works with weed control in corn, soybeans, peanuts, grain sorghum, canola, and sesame. Both Dr. Culpepper and Dr. Prostko have research and extension appointments, and it was a true pleasure to be exposed to both elements of their programs. As a Midwest girl originally, I was excited to learn about large-scale vegetable production and the weed science challenges that these producers face. During my time in Georgia, we set up several fumigation trails, planted vegetable trials into plastic, worked on carry-over studies in vegetables, and visited several large production farms and greenhouse operations, giving me the exposure to vegetable production I had hoped for! I was amazed at the scale and efficiency of these vegetable farms. It was inspirational to see Dr. Culpepper have such a large impact in the vegetable industry when his training was primarily in row crop production. In addition to the exposure I received to weed control in the vegetable industry in Georgia, I was also able to learn more about Dr. Culpepper's work using cover crops for weed control in conventional cotton production. It was incredible to learn more about cover crop adoption in Georgia to manage Palmer amaranth. Dr. Prostko presented his weed science work in peanuts, soybeans, corn, sesame, and even pecan production! It was so interesting to see 2,4-D and dicamba drift work in a pecan orchard and how this research was conducted. I was also exposed to a faculty interview process and an extension presentation at the Georgia Farm Bureau meeting which expanded the benefits of this trip beyond obtaining new research and extension experiences in the field. This scholarship experience gave me exposure to a new research program and new set of commodities, provided me with career advice and inspiration, and expanded my professional network. It was a true privilege to receive this scholarship and I am thankful to Drs. Culpepper and Prostko for the time they invested in my scholarship experience as well as the other stakeholders who make this scholarship experience possible. I would highly recommend that SWSS graduate students apply for this scholarship as it proved extremely valuable for professional development and was a very enjoyable experience.

SWSS 2016 ENDOWMENT ENRICHMENT SCHOLARSHIP PRESENTATION - M.R. Miller*; University of Arkansas, Fayetteville, AR

ABSTRACT

As an SWSS Endowment Enrichment Scholarship Award recipient, I believe with abolute confidence that it is an incredible opportunity that allows graduate students to gain real world insight into careers in academics and the private industry. Initially, when given this opportunity, I had hoped to gain experience in agricultural research that would better round me as a leader in the agircultural community. During my experience, I feel confident I was able to do this. For my scholarship, I chose to learn about Dow AgroSciences by spending a week with there Field Scientist and Station Leaders located in Louisiana and Mississippi. This scholarship not only allowed me to network, but I was also fortunate to closely observe each employee's daily activites and responsibilities. These experiences contributed greatly to my understanding of the companies values and also provided me with invaluable skills working with people possessing diverse skill sets. After participating in this weeklong enrichment experience, I believe it should be the goal of every weed science graduate student to recieve this scholarship. Furthermore, I firmly believe it can open the students mind to career possiblities and potentially lead towards job opportunities in student's area of interest.

GLYPHOSATE- AND ALS-RESISTANT COMMON RAGWEED (*AMBROSIA ARTEMISIIFOLIA*) MANAGEMENT IN COTTON (*GOSSYPIUM HIRSUTUM*). C.W. Cahoon*[1], M.L. Flessner[2], T. Hines[1]; [1]Virginia Tech, Painter, VA, [2]Virginia Tech, Blacksburg, VA (119)

ABSTRACT

Glyphosate once provided excellent control of common ragweed and growers relied heavily on glyphosate while reducing the use of other herbicides. Unfortunately, excessive reliance on glyphosate and the reduction in use of other herbicides led to selection for resistant biotypes. The first confirmation of resistance to glyphosate in common ragweed occurred in Missouri in 2004. Glyphosate-resistant common ragweed currently plagues 15 states. Although not confirmed in Virginia, glyphosate performance on common ragweed has been reported to be poor. Biotypes resistant to the ALS-inhibiting herbicides are also suspected in the Commonwealth. The objectives of this research were to 1) evaluate fluridone combinations applied preemergence for control of common ragweed (PRE Experiment) and 2) evaluate control of small and large common ragweed by combinations of dicamba and glufosinate and sequential applications of these herbicides (POST Experiment).

For the PRE experiment, trials were established on a Suffolk loamy sand soil at the Tidewater Agriculture Research and Extension Center (AREC) near Suffolk, VA and a Bojac sandy loam soil at the Eastern Shore AREC near Painter, VA. A BollGard II® XtendFlex® cotton cultivar was planted at both locations. Residual herbicides were applied immediately after planting. Treatments included no residual herbicide, fluridone, fluometuron, prometryn, fomesafen, fluridone + fomesafen, fluridone + fluometuron, fluridone + prometryn, fluometuron + prometryn, fluometuron + fomesafen, prometryn + fomesafen, fluridone + fomesafen + fluometuron, fluridone + fomesafen + prometryn, and fluridone + fluometuron + prometryn. Fluridone, fluometuron, prometryn, fomesafen alone, and fomesafen in combinations were applied at rates of 0.15, 0.75, 0.75, 0.25, and 0.188 lb active ingredient per acre, respectively. A non-treated check was included for comparison. Eight weeks after planting (WAP), all plots received glufosinate + glyphosate over-the-top. Data for cotton injury, common ragweed control, and seed cotton yield were subjected to ANOVA using the PROC GLIMMIX procedure in SAS and means separated using Fisher's Protected LSD at $p = 0.05$. Two WAP, control of common ragweed was 100% by all residual herbicide treatments except prometryn alone (73%). A similar trend was observed 4 WAP. At this time, prometryn controlled common ragweed 43% whereas all other treatment controlled the weed 93% or greater. At 8 WAP, prometryn alone, fluometuron alone, fomesafen alone, and fluridone alone controlled common ragweed 28, 83, 82, and 93%, respectively. Combinations that included fluridone controlled common ragweed 100% at the same timing. Comparatively, residual combinations that did not include fluridone controlled common ragweed 86 to 98% 8 WAP. Glufosinate + glyphosate applied 8 WAP controlled ragweed well and late in the season ragweed control was near 100% for all treatments. Additional studies are needed to determine if fluridone has utility in common ragweed management.

The POST experiment was conducted at the Eastern Shore AREC near Painter, VA in a field naturally infested with common ragweed. Postemergence 1 (POST 1) applications were initiated

at common ragweed heights of 6 and 12 inches. Postemergence 2 applications were made 2 weeks after the first POST applications. Herbicide treatments included dicamba POST 1, dicamba POST 1 followed by (fb) dicamba POST 2, glufosinate POST 1, glufosinate POST 1 fb glufosinate POST 2, glufosinate + dicamba POST 1, glufosinate + dicamba POST 1 fb glufosinate + dicamba POST 2, glufosinate POST 1 fb dicamba POST 2, and dicamba POST 1 fb glufosinate POST 2. Small common ragweed (6 inches) was easily controlled by glufosinate. When targeting small common ragweed, glufosinate controlled ragweed 100% just prior to POST 2. Dicamba was less effective at this time. However, at 2 weeks after POST 2, common ragweed control by dicamba was equivalent to glufosinate. When targeting large common ragweed (12 inches), dicamba and glufosinate applied alone were less effective. Two weeks after POST 2 applications made to large common ragweed, dicamba and glufosinate applied POST 1 controlled ragweed 73 and 83%, respectively. Glufosinate + dicamba was more effective, controlling the weed 100%. Sequential programs that included glufosinate controlled ragweed 98% or greater. Similar to Palmer amaranth, growers planting XtendFlex® cotton will find utility in combinations of glufosinate and dicamba for control of large common ragweed.

DEMONSTRATING THE BENEFIT OF ADDING COBRA TO LIBERTY IN A LIBERTY LINK SYSTEM TO CONTROL COMMON RAGWEED AND HORSEWEED IN SOYBEAN. G.T. Cundiff*[1], E.J. Ott[2], D.E. Refsell[3], L.D. Sandell[4], R.E. Estes[5], T.D. Israel[6], J.A. Pawlak[7]; [1]Valent USA Corporation, Leland, MS, [2]Valent USA Corporation, Greenfield, IN, [3]Valent USA Corporation, Lathrop, MO, [4]Valent USA Corporation, Lincoln, NE, [5]Valent USA Corporation, Champaign, IL, [6]Valent USA Corporation, Sioux Fs, SD, [7]Valent USA Corporation, Lansing, MI (120)

ABSTRACT

Herbicide-resistant weeds continue to be a problem in soybean production. Glyphosate resistance has been identified in several important weed species, and continues to increase across major soybean growing regions. In response, growers have adopted or are considering adopting different herbicide resistant trait technologies, such as glufosinate tolerant soybean. Glufosinate-tolerant soybean production has dramatically increased in the past several years due to the need to control glyphosate resistant weeds. However, very little is known about glufosinate tank-mixtures with PPO inhibiting herbicides. Trials were initiated across the major soybean growing regions in the Midwest and Mid-south in 2016. In these trials glufosinate resistant soybeans were utilized. Weeds were allowed to grow to approximately 15 cm in height and then treated with different glufosinate and PPO herbicide tank-mixtures. These treatments included; a non-treated check, glufosinate 594 g a.i.ha^{-1}, glufosinate 594 g a.i. ha^{-1} + lactofen 140 g a.i. ha^{-1} +/- COC 0.83% v v^{-1}, glufosinate 594 g a.i. ha^{-1} + lactofen 175 g a.i. ha^{-1}, glufosinate 594 g a.i. ha^{-1} + lactofen 219 g a.i. ha^{-1}, glufosinate 594 g a.i. ha^{-1} + fomesafen 263 g a.i. ha^{-1} + COC 0.83% v v^{-1}, and glufosinate 594 g a.i. ha^{-1} + acifluorfen 280 g a.i. ha^{-1} + COC 0.83% v v^{-1}. Herbicide treatments included AMS 3.35 kg ha^{-1} per the glufosinate label. Crop phytotoxicity was visually evaluated at 7 DAT and between 14 and 21 DAT. Weed control was also visually evaluated between 14 and 21 DAT and 21 to 35 DAT. Adding lactofen to glufosinate did increase control of common ragweed, giant ragweed, common waterhemp, horseweed and Palmer amaranth. In these trials, tank-mixtures of glufosinate and PPO-inhibiting herbicides did not result in a reduction of grass control relative to glufosinate alone. Typical phytotoxic responses were observed in treatments that included PPO-inhibiting herbicides. However, at 21 DAT glufosinate + PPO-inhibiting herbicides exhibited <5% crop phytotoxicity. These trials indicate that including lactofen in tank-mixtures with glufosinate does increase weed control on certain problematic weeds compared to glufosinate 594 g a.i.ha^{-1} alone.

TIME OF DAY AND TEMPERATURE INFLUENCE PALMER AMARANTH EFFICACY WITH GLUFOSINATE. D. Copeland*, W.J. Everman; North Carolina State University, Raleigh, NC (121)

ABSTRACT

Time of glufosinate application has a large impact on weed control. Previous researchers have documented that both temperature and relative humidity also affect the activity of glufosinate. However, research is lacking on the role relative humidity has on time of day (TOD) effect of glufosinate efficacy on Palmer amaranth. Experiments were established to determine how relative humidity impacts the TOD effect of glufosinate at different temperature regimes.

Studies were conducted at the North Carolina State University Phytotron. Plants were grown in a growth chamber with 14-hour photoperiod ending at 9:30 pm light was set at 26/22 C with ambient relative humidity and transferred to a growth chamber 3 days prior to glufosinate application. Plants were transferred to growth chambers with 14-hour photoperiod ending at 9:30 pm set at 14, 26 or 34 C. Each temperature regime was split with two levels of relative humidity; 30 or 90%. A CO_2 powered backpack sprayer, calibrated to deliver 140 L ha^{-1} was used to apply glufosinate at 160 g a.i. ha^{-1} to 8 cm tall plants at 2 and 10 pm. Treatments were arranged in a factorial arrangement and were replicated six times Percent control and plant heights were recorded both 4 and 7 days after treatments (DAT). Fresh shoot biomass was recorded 7 DAT.

Control of Palmer amaranth 4 DAT of glufosinate at the 2 pm application timing in 26C, 90%RH conditions (92%) resulted in significantly greater control than all other treatments. The TOD effect was observed for all treatments, with respect to control 4 DAT, with the exception of 26C, 30%RH condition where no difference in control was observed between 2 (24%) or 10 pm (20%) application timings. Plant height reductions 4 DAT were greater when glufosinate was applied in 26 and 34 C, 90% RH conditions compared to both 26 and 34C at 30% RH conditions (29 and 39% versus 14 and 11%, respectively). However, height reductions 4 DAT when glufosinate was applied in 14 C, 90% RH condition (15%) were similar to 14 C, 30% RH condition (9%). The time of day effect was observed for both 14C and 34C, regardless of relative humidity level, where control 7 DAT was greater when glufosinate was applied at 2 pm versus 10 pm. However, control 7 DAT was similar in 26C, 90% RH conditions when glufosinate was applied at 2 pm (99%) and 10 pm (93%). It may be possible that the TOD effect on glufosinate efficacy can be minimized if relative humidity is at an elevated level at a suitable temperature. This will be investigated in further experiments.

CRITICAL PERIOD OF GRASS WEED CONTROL IN SORGHUM. W.J. Everman*, M.T. Schroeder, D. Copeland, J.T. Sanders, B.W. Schrage, L. Vincent, A.M. Growe; North Carolina State University, Raleigh, NC (122)

ABSTRACT

In North Carolina grass weed control in sorghum production is a significant issue, and is due to the limited POST herbicide options for grass control. To create an effective weed management plan for sorghum both the critical weed-free period as well as the critical time of weed removal need to be assessed. Two field studies were conducted near Clayton and Rocky Mount, NC to determine the effects of grass weed species on sorghum yield by allowing grasses to grow and compete with sorghum for various intervals of time. Hand weeding as well as herbicides applied to terminate the growth of grass species. This study is focused strictly on grass weeds so all broadleaf weeds were removed.

There were twelve treatments included in this study. 1) A pre-emergence only application was applied of atrazine and s-metolachlor 2&3) Weed free all season by hand removal as well as an added treatment where a herbicide was used 4) weedy all season 5-8) these treatments were left weedy until weeks 2,3,5, and 7, respectively and then weeds were removed for the entirety of the season 9-12) treatments were maintained weed-free until weeks 2,3,5, and 7, respectfully, and then weeds were allowed to grow throughout the entirety of the season. Grass weed species were then counted, collected, and documented at the end of each time interval. At harvest, biomass was taken from a meter of rows two and three of each treatment and both fresh and dry biomass was taken to document differences in growth from grass weed competition.

PRE treatment showed differences in control depending on grass type that was present. Large seeded grasses, such as Texas Panicum (*Panicum Texanum*), that tend to emerge later in the season, broke through the PRE application and affected the final biomass of the sorghum crop. These studies consistently showed stunting and reduction of final biomass in sorghum after week 5 and 7 of weed removal.

CONTROLLING PPO-RESISTANT PALMER AMARANTH USING PREEMERGENCE HERBICIDES. T.A. Reinhardt*[1], D. Copeland[2], W.J. Everman[2]; [1]North Carolina State University, Raleigh, IL, [2]North Carolina State University, Raleigh, NC (123)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) is a troublesome weed for soybean growers in North Carolina. In effort to manage resistant or potentially resistant populations of weeds, soybean growers have been reconsidering residual preemergence herbicides. Several options are available from various companies, and while general efficacy evaluations are available for these herbicides, few studies have offered quantitative measurements comparing these products side by side. At two locations with similar soil type but with different levels of Palmer amaranth infestation, 17 herbicides, including 8 unique modes of action and 7 common premixes, were evaluated for crop injury and herbicide efficacy at 4, 6, and 8 weeks after planting. At the site with lower level of Palmer amaranth at 6 and 8 weeks after planting, all tested herbicides had control similar to weed-free plot except Prowl, Scepter, and Clarity. At the site with high level of Palmer amaranth, products containing a single mode of action resulted in higher number of plants and dry biomass than premix products. While this is only one year of data reporting currently, these results support the use of multiple mode of action products and will aid in grower decisions when comparing efficacy of different modes of action and combination products on Palmer amaranth in the future.

TIME OF DAY EFFECTS ON PEANUT WEED CONTROL PROGRAMS. O.W. Carter*, E.P. Prostk[2]; The University of Georgia, Tifton, GA (124)

ABSTRACT

Reductions in weed control performance at the farm level have caused extension weed science programs to focus on potential causes of the differences observed between small-plot research and commercial applications. One possible explanation for these differences in control may be related to the application time of day (TOD). Generally, herbicide recommendations made by weed scientists are based on research conducted during the working hours of 6 am to 10 am. However, growers very typically spray as early as 6 am and as late as 10 pm. Recent research with glufosinate and several PPO-inhibiting herbicides has shown that TOD can have a significant impact on performance. Consequently, research was conducted in Tifton and Attapulgus, GA in 2015 and 2016 to determine if TOD has an influence on the performance of peanut weed control programs. Two recommended weed control programs were chosen and the entire program was sprayed at the four timings of 7 am, 12 pm, 5 pm, and 10 pm. The herbicide programs consisted of the following: paraquat (0.21 kg ai/ha) + acifluorfen (0.19 kg ai/ha) + bentazon (0.37 kg ai/ha) + *s*-metolachlor (1.1 kg ai/ha) EPOST followed by either imazapic (0.07 kg ai/ha) + *s*-metolachlor (1.1 kg ai/ha + 2,4-DB (0.25 kg ai/ha) or lactofen (0.22 kg ai/ha) + *s*-metolachlor (1.1 kg ai/ha) + 2,4-DB (0.25 kg ai/ha). All programs also including a PRE application of pendimethalin which was applied immediately after peanut planting but was not part of the timing test. EPOST and POST treatments were applied 14 and 35 (WHAT are these days please?) days after planting (DAP) and when weed species were approximately 5-7 cm tall. All herbicides were applied with a CO_2-powered backpack sprayer calibrated to deliver 140 l/ha at 241 kPa using DG11002 nozzles. Peanut injury was significantly lower at 10 pm when compared to the other timings after both EPOST and POST herbicide applications. Peanut injury from the herbicide program containing lactofen was significantly greater than that seen from imazapic. Palmer amaranth control was slightly reduced (1-2%) at the 10 pm timing. Herbicide program did not influence Palmer amaranth control. Annual grass control was significantly reduced (0-5%) at the 7 am application timing when compared to the other timings. However, there was no difference in annual grass control at the end of the season when timings were compared. Annual grass control was also lower with the lactofen program. A significant reduction in control of sicklepod was observed at the 10 pm timing (2-4%) and with the lactofen program (3%). While TOD did influence the control of several weed species, peanut yield was not negatively affected.

TOLERANCE OF ENLIST™ COTTON TO VARIOUS GLUFOSINATE FORMULATIONS. J.S. Richburg*[1], L.B. Braxton, D. H. Perry[2] and L. C. Walton[2]; [1]Dow AgroSciences, Headland, AL, [2]Dow AgroSciences, Indianapolis, IN (176)

ABSTRACT

The Enlist™ weed control system by Dow AgroSciences is a new weed control tool incorporating unique herbicide tolerance traits conferring tolerance to 2,4-D, glyphosate and glufosinate. Use of glufosinate continues to increase as growers seek solutions for control of glyphosate-resistant weeds. Liberty has historically been the glufosinate formulation used in glufosinate-tolerant cotton, but additional formulations of glufosinate have entered the market. The primary objective of this research was tolerance characterization of Enlist cotton to various glufosinate formulations (Liberty, Interline, Kong, Cheetah). Data collected included visual percent injury, necrosis, chlorosis, growth inhibition and cotton yield. Glufosinate rates evaluated included the typical 1X rate of 29 fl oz product per acre and the 2X rate of 58 fl oz product per acre. Sequential postemergence glufosinate applications were made to 2 to 4 leaf cotton and about 14 days later to 6 to 8 leaf cotton. Enlist cotton tolerance was robust to all glufosinate formulations with minor differences and no negative impacts on yield. Enlist cotton weed management programs utilizing 2,4-D, glyphosate and glufosinate will provide growers an additional tool to achieve greater control of economically-important and herbicide-resistant weed biotypes.

DUPONT HERBICIDE PROGRAMS FOR WATERHEMP AND PALMER AMARANTH CONTROL IN DICAMBA-TOLERANT SOYBEANS. D. Johnson*[1], R. Rupp[2], R. Edmund[3], D. Smith[4], E. Castner[5], J. Krumm[6], B. Steward[7], M. Meyer[8], K. Backscheider[9], V. Klecsewski[10]; [1]DuPont Crop Protection, Des Moines, IA, [2]DuPont Crop Protection, Edmund, OK, [3]DuPont Crop Protection, Little Rock, AR, [4]DuPont Crop Protection, Madison, MS, [5]DuPont Crop Protection, Weatherford, TX, [6]DuPont Crop Protection, Hastings, NE, [7]DuPont Crop Protection, Overland Park, KS, [8]DuPont Crop Protection, Norwalk, IA, [9]DuPont Crop Protection, Franklin, IN, [10]DuPont Crop Protection, Middletown, DE (177)

ABSTRACT

Glyphosate-resistant weeds continue to present control challenges to growers, and dicamba-tolerant soybeans will provide a new tool for in-crop weed control in soybeans. DuPont is working to develop multiple-mode-of-action, residual weed control programs that include dicamba. In this presentation we will show that various combinations of DuPont soybean herbicides provide growers with excellent common waterhemp (Amaranthus rudis) and Palmer amaranth (Amaranthus palmeri) control in dicamba-tolerant soybeans.

LOYANT™ HERBICIDE UTILIZATION IN U.S. MID-SOUTH RICE WEED CONTROL PROGRAMS. H. Perry*[1], J. Ellis[2], B. Haygood[2], M. Lovelace[2], M. Morell[2], L.C. Walton[2]; [1]Dow AgroSciences, Greenville, MS, [2]Dow AgroSciences, Indianapolis, IN (178)

ABSTRACT

Loyant™ herbicide with Rinskor™ active is a new postemergence herbicide from Dow AgroSciences for use in U.S. direct- and water-seeded rice. Loyant is a member of the new arylpicolinate class of auxin herbicides that exhibit unique sites of action within susceptible grass, sedge, and broadleaf weed species. Due to its unique binding affinity to auxin receptors, Loyant will control quinclorac-, ALS-, propanil-, ACCase and glyphosate-target-site resistant biotypes of susceptible weeds. Loyant's alternative mode-of-action will introduce a new herbicide resistance management tool for rice growers in a region where resistance is common. In 2015 and 2016, 15 trials were conducted across the Mid-South U.S. (AR, LA, MO, MS and TX) to determine Loyant's fit in full-season rice weed management programs. In 2015, program treatments consisted of various combinations of Loyant and herbicides applied preemergence (PRE), early postemergence (EPOST), preflood and postflood while trials in 2016 did not contain postflood applications. Due to lack of residual herbicide efficacy, Loyant was not applied in the PRE segment. Loyant was applied at 1 pint/acre (30 g ai/ha) and commercial herbicides were applied at recommended label rates. Weeds evaluated included barnyardgrass, broadleaf signalgrass (*Urochloa platyphylla*), sprangletop spp. (*Leptochloa* spp.), rice flatsedge (*Cyperus iria*), yellow nutsedge (*Cyperus esculentus*), hemp sesbania (*Sesbania herbacea*), ducksalad (*Heteranthera limosa*) and palmer amaranth (*Amaranthus palmeri*), and others. In 2015 and 2016 Loyant controlled key weeds in all postemergence segments. EPOST Loyant applications controlled weeds more consistently when tank-mixed with a residual herbicide with POST activity such as quinclorac or penoxsulam. Although not significant in all cases, Loyant programs containing preflood applications controlled weeds more effectively when EPOST applications were included. Loyant effectively controlled barnyardgrass and broadleaf signalgrass; however, tank-mixtures with graminicides improved control of other grass species such as crabgrass (*Digitaria* spp.) and sprangletop. When pooled across all broadleaf species, Loyant-containing programs controlled all weeds >98% both years. Loyant will be an effective broad-spectrum weed management tool for inclusion in full-season rice weed control programs. Loyant U.S. registration is expected in the 2017-2018 timeframe.

Neither Loyant nor Rinskor active is registered with the U.S. EPA. Federal registration is pending. This material is intended to provide technical information only and is not an offer for sale. Always read and follow label directions.

TOLERANCE OF CONVENTIONAL AND INZEN™ GRAIN SORGHUM TO SOIL APPLIED ALS-INHIBITING HERBICIDES. H.D. Bowman*[1], T. Barber[2], J.K. Norsworthy[1], J. Rose[1], N. Steppig[1], R.R. Hale[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (179)

ABSTRACT

In Arkansas, 2015 was a significant year for grain sorghum (*sorghum bicolor*) production, with 430,000 acres being harvested. The total acreage quickly declined in 2016 due to commodity prices and lack of effective weed control programs, with grass control being the most lacking in the crop. In 2016, only 40,000 acres were harvested in the state. To solve the issue of effective weedy grass control, DuPont™ has proposed the opportunity to use liquid based nicosulfuron, labeled as Zest™, with the development of a new non-GMO trait called Inzen™. This new trait provides resistance to acetolactate (ALS) synthase-inhibiting herbicides. A field study was conducted in 2016 on the the Arkansas Agriculture Research & Extension Center in Fayetteville; Lon Mann Cotton Research Station in Marianna; and Pine Tree Research Station near Colt to evaluate the tolerance of conventional and Inzen™ cultivars to nicosulfuron-based Zest™, along with twenty-two other ALS-inhibiting herbicides encompassing all five ALS-inhibiting families. Plots were arranged using a split-plot design with grain sorghum cultivar representing the main plot and were 1.9 meters by 7.62 meters. Herbicide treatments were arranged in a randomized complete block design for each cultivar across four replications, all applications were made using a pressurized CO_2-backpack sprayer calibrated to deliver 140L/ha at 5 kph. Results averaged across all three locations show injury to the conventional cultivar, to all herbicides at three weeks after application, ranging from 0% to 99% injury, Inzen™ cultivar only received injury from 2 of the 22 herbicides tested. These were chlorimuron causing 7% injury and imazaquin causing 2.5% injury. The lowest injury on the conventional cultivar was observed with halosulfuron causing 0%. Nicosulfuron as expected had 0% injury on Inzen™, while the convetional cultivar received 54% injury. Another common herbicide used in Arkansas, pyrithiobac acid also had 0% injury on Inzen™, whereas the convetional cultivar was injured at 83%. The highest injury at 99% on the conventional cultivar occurred when applying thiencarbazone-methyl and rimsulfuron. These results demonstrate that herbicide injury on conventional sorghum cultivars varies depending on which ALS-inhibiting herbicide is used. However, the Inzen™ cultivar displayed strong tolerance to most ALS-inhibiting herbicides. The Inzen™ technology offers promising new alternatives for weed control in grain sorghum.

EVALUATING THE FIT FOR TOPRAMEZONE IN RICE. M.H. Moore*[1], R.C. Scott[2], J.K. Norsworthy[1], M.E. Fogleman[1], B.M. Davis[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (180)

ABSTRACT

Rice (*Oryza sativa*) producers in the United States are rapidly running out of options to effectively control several key weeds that have evolved herbicide resistance. New sites of action are needed to help slow this evolution. Topramezone, a Group 27 or 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibiting herbicide, has been shown to control several of these herbicide-resistant weeds, most notably barnyardgrass (*Echinochloa crus-gali*). However, there are currently no HPPD-inhibiting herbicides labeled for use in rice. In 2016, two field experiments were conducted at the University of Arkansas Pine Bluff Research Farm near Lonoke, Arkansas assessing tank-mix crop tolerance and level of weed control to determine if topramezone could have a fit in rice production. Treatments of both studies included topramezone applied alone at 12 or 24 g ai ha^{-1} and in combination with six common rice herbicides including clomazone, imazethapyr, fenoxaprop, propanil, quinclorac, and saflufenacil applied at the 3- to 4-leaf growth stage. In the tolerance trial, visual crop injury was less than 10% and yield was not reduced in any of the treatments. The tank-mix efficacy experiment resulted in varying results. It was observed that barnyardgrass control was best achieved when topramezone was tank mixed with preemergence herbicides such as clomazone in which the combination of the two herbicides (97%) provided greater control than topramezone at 24 g ai ha^{-1} (79%) or clomazone (52%) alone 28 days after application (DAA). However, tank-mixes with contact herbicides such as saflufenacil decreased control of topramezone applied alone. Results from these trials suggest that topramezone can be safely and effectively incorporated into rice weed control programs as a tank-mix option.

PLANNED COMMERCIAL FORMULATIONS CONTAINING VAPORGRIP TECHNOLOGY FOR USE IN THE ROUNDUP READY 2 XTEND CROP SYSTEM. A. MacInnes*; Monsanto, St. Louis, MO (181)

ABSTRACT

Monsanto Company has developed formulations containing dicamba for use in the Roundup Ready® Xtend™ Crop System. XtendiMax™ with VaporGrip™ technology is a dicamba standalone formulation based on the diglycolamine (DGA) dicamba salt. Roundup Xtend™ with VaporGrip™ technology is a premix formulation containing DGA dicamba and monoethanolamine (EA) glyphosate delivering a 2 to 1 ratio of glyphosate to dicamba. Both formulations contain proprietary VaporGrip™ technology that reduces the potential of dicamba volatility compared to current commercial dicamba formulations. XtendiMax™ with VaporGrip™ technology and Roundup Xtend™ with VaporGrip™ technology show commercially acceptable physical/ chemical properties consistent with Roundup® agricultural herbicide formulations and are pending regulatory approval for in crop use.

EVALUATION OF ENGENIA SYSTEMS ON DGT COTTON IN ALABAMA, GEORGIA, AND TENNESSEE. J.A. Tredaway*[1], A.S. Culpepper[2], L. Steckel[3]; [1]Auburn University, Auburn, AL, [2]University of Georgia, Tifton, GA, [3]The University of Tennessee, Jackson, TN (182)

ABSTRACT

Field studies were at four locations Alabama, Georgia, and Tennessee covering loamy sand, sandy loam, silty clay loam, and silt loam soils to determine the efficacy of Engenia systems. The first location was in Central Alabama at the E.V.Smith Research Center's Field Crops Unit in Shorter, Alabama. Americot NG 3406 B2XF was conventionally planted on May 11, 2016. The second location was in Ideal, Georgia conventionally planted with two varieties, DP 1553 B2XF and DP 1522 B2XF planted on April 25, 2016. The first two sites had similar soil types. The third location was at the Tennessee Valley Research and Extension Center (TVREC) in Belle Mina, AL planted no-till May 9, 2016 in Americot NG 3406 B2XF. The last location was at West Tennessee Research and Education Center (WTREC) in Jackson, TN was no-till planted on April 25, 2016 in DP 1522 B2XF. Treatments for the first two tests were similar and last two were similar. Treatments for the Shorter, AL and Ideal, GA locations include glyphosate PRE fb and MPOST applications of Liberty at 29 fl. oz./A plus Dual Magnum at 21 fl. oz./A plus glyphosate at 32 fl. oz./A; Prowl H2O at 32 fl. oz./A plus Reflex at 16 fl.oz./A PRE fb Engenia at 12.8 fl.oz./A plus Outlook at 12 fl. oz/A plus glyphosate at 32 fl. oz/A EPOST fb Engenia at 12.8 fl. oz/A plus glyphosate at 32 fl. oz./A MPOST; Prowl H2O at 32 fl. oz./A plus Reflex at 16 fl.oz./A PRE fb Engenia at 12.8 fl.oz./A plus Outlook at 12 fl. oz/A plus glyphosate at 32 fl. oz/A EPOST fb Zidua at 1.5 oz/A plus Liberty at 29 fl. oz./A LAYBY; Prowl H2O at 32 fl. oz./A plus Reflex at 16 fl.oz./A PRE fb Engenia at 12.8 fl. oz/A fb glyphosate 32 fl. oz/A EPOST and MPOST; Prowl H2O at 32 fl. oz./A plus Reflex at 16 fl.oz./A PRE fb Engenia at 12.8 fl.oz./A plus Outlook at 12 fl. oz/A plus glyphosate at 32 fl. oz/A EPOST fb Liberty at 29 fl. oz/A fb Dual Magnum MPOST. The treatments for the Belle Mina, AL and Jackson, TN include glyphosate at 32 fl. oz./A plus AMS at 20.4 oz/A PRE and POST; Gramoxone SL at 48 fl. oz./A plus Cotoran at 32 fl. oz./A plus NIS at 0.25% v/v PRE fb Liberty at 29 fl. oz./A plus Dual Magnum at 21 fl. oz./A plus glyphosate at 32 fl. oz./A plus AMS at 20.14 oz/A EPOST and MPOST; Engenia at 12.8 fl. oz./A plus Prowl H2O at 32 fl. oz./A plus Cotoran at 32 fl. oz./A plus glyphosate at 32 fl. oz./A PRE fb Engenia at 12.8 fl.oz./A plus Outlook at 12 fl. oz/A plus glyphosate at 32 fl. oz/A EPOST fb Liberty at 29 fl. oz./A plus Dual Magnum at 21 fl. oz./A plus AMS at 20.4 fl. oz./A MPOST; Engenia at 12.8 fl. oz./A plus Prowl H2O at 32 fl. oz./A plus Cotoran at 32 fl. oz./A plus glyphosate at 32 fl. oz./A PRE fb Engenia at 12.8 fl.oz./A plus Outlook at 12 fl. oz/A plus glyphosate at 32 fl. oz/A EPOST fb Zidua at 1.5 oz/A plus Liberty at 29 fl. oz./A plus AMS at 20.4 fl. oz./A LAYBY; Engenia at 12.8 fl. oz./A plus Prowl H2O at 32 fl. oz./A plus Cotoran at 32 fl. oz./A plus glyphosate at 32 fl. oz./A PRE fb an EPOST and MPOST application of Engenia at 12.8 fl. oz./A plus glyphosate at 32 fl. oz./A; Engenia at 12.8 fl. oz./A plus Prowl H2O at 32 fl. oz./A plus Cotoran at 32 fl. oz./A plus glyphosate at 32 fl. oz./A PRE fb Liberty at 29 fl. oz./A plus Outlook at 16 fl. oz./A plus AMS at 20.4 fl. oz./A EPOST fb Engenia at 12.8 fl. oz./A plus Dual Magnum at 21 fl. oz./A plus glyphosate at 32 fl. oz./A MPOST. Similar results were found at the Shorter, AL and Ideal, GA locations. At 24 dat of treatments B and C, control did not differ between any of the treatments except the glyphosate fb glyphosate with all other treatments providing 99% or greater control of

Palmer amaranth (*Amaranthus palmeri*). The early ratings at Belle Mina, AL and Jackson, TN were consistent with each other, all providing at least 92% Palmer amaranth control with the exception of glyphosate fb glyphosate. Palmer amaranth control at Belle Mina, AL was maintained above 96% control with all treatments except glyphosate fb glyphosate. In Jackson, TN, the same was true however, Palmer amaranth control dropped to 76 and 78% for the Engenia plus Prowl H2O plus Cotoran plus glyphosate PRE fb an EPOST and MPOST application of Engenia at 12.8 fl. oz./A plus glyphosate at 32 fl. oz./A and Engenia plus Prowl H2O plus Cotoran plus glyphosate PRE fb plus Outlook plus AMS EPOST fb Engenia plus Dual Magnum plus glyphosate MPOST. This research supports the recommendation that a PRE should be included in all cotton herbicide systems for season-long control. The optimum systems include a PRE, EPOST, and MPOST or LAYBY for Palmer Amaranth control. In addition, using multiple modes-of-action will help to decrease the chances for additional weed resistance.

UTILITY OF ELEVORE™ HERBICIDE WITH ARYLEX™ ACTIVE FOR PREPLANT BURNDOWN APPLICATIONS. J.M. Ellis*[1], L.C. Walton[2], J.S. Richburg[2], B.A. Haygood[2], R.M. Huckaba[2], M.L. Lovelace[2], D.H. Perry[2], M.A. Peterson[2]; [1]Dow AgroSciences, Smithville, MO, [2]Dow AgroSciences, Indianapolis, IN (183)

ABSTRACT

Elevore is a new herbicide being developed for the U.S. pre-plant burndown market segment for control of horseweed [*Conyza canadensis(L.) Cronq]* and other problematic broadleaf weeds. It contains Arylex™ active (halauxifen-methyl), a novel synthetic auxin (WSSA group 4) herbicide from the new "arylpicolinate" chemical class. Elevore is a SC formulation with a use rate of 1.0 fl oz product/acre [Arylex (halauxifen-methyl 5.0 g ae/ha)] and will be labeled for use prior to soybean, corn and cotton planting. Initial labeling will allow application up to 14 days prior to planting of soybean and corn. Field research was conducted from 2013 to 2016 at 30 locations across the U.S. to determine the efficacy of Elevore applied in the spring to horseweed, including glyphosate-resistant biotypes, and other common weeds prior to planting soybean and corn. Elevore was compared to competitive standards when applied with glyphosate and in tank mixes with glyphosate + 2,4-D low volatile ester (LVE) herbicide. Applied at 5.0 g ae/ha in combination with glyphosate at 1120 g ae/ha, Elevore demonstrated similar to or better control of horseweed when compared to Liberty (glufosinate) at 542 g ae/ha, Clarity (dicamba) at 280 g ae/ha + glyphosate 1120 g ae/ha, and Sharpen (saflufenacil) at 37.5 g ai/ha + glyphosate at 1120 g ae/ha.

Crop injury was evaluated in efficacy trials as well as dedicated weed-free crop tolerance trials. Soybean and corn can be planted 14 days after application of Elevore without significant injury. Elevore will provide growers with an alternative mode of action for many difficult to control pre-plant burndown broadleaf weeds such as horseweed and henbit (*Lamium amplexicaule L)*.

A NEW S-METOLACHLOR PLUS DICAMBA PREMIX AS AN EFFECTIVE TOOL IN AN INTEGRATED MANAGEMENT PROGRAM IN DICAMBA TOLERANT SOYBEANS. J.C. Holloway*[1], S.R. Moore[2], H.S. McLean[3], B.D. Black[4], D.J. Porter[5], B.R. Miller[6]; [1]Syngenta Crop Protection, Jackson, TN, [2]Syngenta Crop Protection, LLC, Monroe, LA, [3]Syngenta Crop Protection, LLC, Perry, GA, [4]Syngenta Crop Protection, LLC, Searcy, AR, [5]Syngenta Crop Protection, LLC, Greensboro, NC, [6]Syngenta Crop Protection, LLC, Fargo, ND (184)

ABSTRACT

A new low volatility premix formulation of *S*-metolachlor plus dicamba is under development by Syngenta Crop Protection for weed control in dicamba-tolerant soybeans and cotton. The dual site-of-action herbicide is designed to deliver pre- and post-emergence activity as a burndown, pre-emergence or early post-emergence application. Field trials were conducted in 2015 and 2016 to evaluate weed control efficacy and crop safety of this new herbicide as part of an integrated weed management program in dicamba-tolerant soybeans.

The *S*-metolachlor plus dicamba formulation provides post-emergence control of many important weed species including horseweed, common and giant ragweed and common lambsquarters. It also provides post-emergence and residual control of *Amaranthus* species and residual control of many annual grass weeds. Successful and consistent weed control in dicamba-tolerant soybeans are targeted with programs that include an effective burndown, pre-emergence residuals and post-emergence herbicides with multiple, overlapping sites of action. *S*-metolachlor plus dicamba will be an important herbicide tool as part of an integrated weed management program for dicamba-tolerant soybeans.

PREEMERGENCE AND POSTEMERGENCE TOLERANCE OF NEW COTTON TECHNOLOGIES TO AUXIN HERBICIDES. J.S. Rose*[1], T. Barber[2], J.K. Norsworthy[1], H.D. Bowman[1], M.M. Houston[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (185)

ABSTRACT

Enlist™ cotton was released for planting on limited acres in 2016 whereas Bollgard II® XtendFlex® cotton was fully released for planting in 2015. At time of release, there was no labeled dicamba formulation for use in these crops; however, this has since changed with Engenia™ and XtendiMax™ with Vaporgrip™ receiving a federal label for in-crop use on Bollgard II® XtendFlex® cotton. Though labeled for in-season use, there have been many questions as to what will happen if other auxinic herbicides are applied either in a preemergence or postemergence situation to these new technologies. To determine if cross-resistance to other auxin herbicides does exist in these technologies, tests were conducted in 2015 and 2016 at the Lon Mann Cotton Research Station near Marianna, and at the Rohwer Research Station near Rohwer, Arkansas. The objective of this research was to determine whether these new cotton technologies possess resistance to other auxin herbicides following a preemergence and an over-the-top application. These experiments were conducted using Enlist™, Bollgard II® XtendFlex®, and Glytol/LibertyLink® cotton cultivars and were arranged using a split-split-plot design. Treatments consisted of a single application of each herbicide at a 1x and 1/16x rate. Timings for preemergence (PRE) applications were immediately after planting and postemergence (POST) were made at the 7-leaf cotton stage. Treatments were applied with a tractor-mounted sprayer to the center two rows of four-row plots at 276 kPa PSI using a TTI 110015 nozzle on a 48 cm spacing at the rate of 112.2 L/ha. Percent crop injury relative to the nontreated was recorded at 3, 7, 14, and 21 days after application (DAA) for the POST trial and each week for 28 DAA on the PRE trial. At 21 DAA (POST) and 28 DAA (PRE), aboveground biomass was collected from 1 meter of row from each cultivar in each treatment, dried, and recorded as a percent of the corresponding nontreated check. In the POST application, Enlist™ cotton exhibited reduced sensitivity to the 1x application of fluroxypyr and triclopyr. However in the PRE trial Enlist, 2,4-D was the only treatment where commercial tolerance was seen. No significant reduction in biomass was seen with the Enlist cotton where fluroxypyr was applied PRE or POST as well as when triclopyr was applied POST. The Xtend cotton was only resistant to the applications of dicamba, PRE or POST. The Glytol/LibertyLink® was injured by all treatments with >50% injury. In either trial (PRE and POST), the 1/16x treatments resulted in a general reduction of injury, consistent with a reduced rate. Overall, biomass data followed similar trends to the injury ratings for most herbicides. Based on this research, it appears that Enlist technology may also have at least partial resistance to a POST application of triclopyr or fluroxypyr, at either rate, but considerable injury was observed to the other cultivars. Additionally, the off-label application of most synthetic auxin herbicides to cotton will cause severe injury or plant stand failure.

EVALUATION OF NEW TECHNOLOGIES IN OKLAHOMA COTTON AND SOYBEAN. T.A. Baughman*, R.W. Peterson, D.L. Teeter; Oklahoma State University, Ardmore, OK (186)

ABSTRACT

Weed resistance has become an increasing issue in Oklahoma crop production. These have included Italian ryegrass (Lolium multiflorum), marestail (Conyza Canadensis), and giant ragweed (Ambrosia trifida). However, the recent increasing spread of glyphosate resistant of Palmer amaranth (Amaranthus palmeri) has brought about a real recognition of problems that can occur when trying to manage resistance weeds. New technologies are currently being developed to assist in controlling these weeds along with traditional problematic and troublesome weeds in Oklahoma cotton and soybean. These technologies include Roundup Ready Xtend (tolerant to dicamba), Balance GT (tolerant to isoxaflutole) and Enlist (tolerant to 2,4-D).

Balance GT soybean (Bixby), Roundup Ready 2 Xtend soybean (Bixby and Chickasha), Bollgard II XtendFlex cotton (Altus and Tipton), and Enlist cotton (Altus) were planted during the 2016 growing season in Oklahoma to evaluate each system for crop response and weed efficacy. Each of these systems was evaluated in combination with various preemergence and postemergence herbicide combinations. Each trial was visually evaluated throughout the growing season for stand reduction, crop injury and weed efficacy. Weeds evaluated included ivyleaf morningglory (IPOHE), large crabgrass (DIGSA), Palmer amaranth (AMAPA), red sprangletop (LEFFI), and tumble pigweed (AMAAL).

Cotton injury was less than 6% early season in the XtendFlex cotton trials and was transient in nature. Cotton injury was also less than 6% in the Enlist trial except where Liberty was applied in combination with Dual Magnum. This injury was not observed late season. AMAPA control was at least 99% regardless of PRE program when XtendiMax + Warrant was followed by XtendiMax + Roundup POST. LEFFI control late season was at least 99% when Treflan was applied PPI regardless of the POST program (XtendiMax or Liberty). AMAAL control was 100% late season when Engenia was applied with either Roundup or Liberty in XtendFlex cotton. Enlist Duo applied alone or in combination POST with Dual Magnum controlled both AMAPA and LEFFI at least 98% season long. Soybean injury was less than 5% season long with all treatments in the Balance GT soybean trial. Soybean injury was never more than 6% early season and was less than 5% in all Xtend soybean trials later in the season. AMAPA control was 93% prior to the POST treatment when Balance Bean was applied PRE at 3 fl oz/A in combination with Tricor DF at 5.3 oz/A. This control was increased to 100% late season when Liberty + Prefix POST followed the PRE combination. Similar control of IPOHE was observed with this same treatment combination. Late season AMAPA control was at least 99% with dicamba combinations in Xtend soybean regardless of PRE herbicide combination at both Bixby and Chickasha. DIGSA control was at least 98% late season when a preemergence herbicide combination was applied and followed by dicamba + glyphosate + metolachlor. Engenia herbicide programs (PRE herbicide followed by Engenia + Roundup PowerMax with and without Outlook or Zidua) controlled AMAPA and DIGSA at least 99%. Yields were improved in most cases with the Xtend herbicide system compared to

traditional glyphosate herbicide programs especially where glyphosate resistant Palmer amaranth was a problem. These studies all indicate that when these new technologies are in a program approach with residual herbicide excellent control of a wide array of weeds may be managed.

APPLICATION STEWARDSHIP OF ENGENIA HERBICIDE IN DICAMBA TOLERANT CROPS. D.E. Westberg*[1], A. Adams[2]; [1]BASF, Cary, NC, [2]BASF, RTP, NC (187)

ABSTRACT

Engenia herbicide is the most advanced dicamba for use on dicamba tolerant soybean and cotton with the lowest volatility salt (BAPMA- N,N-bis-(aminopropyl)methylamine) and the lowest product use rate at 12.8 fl oz/A. Federal registration for Engenia herbicide was granted by the US EPA in December 2016.

Label requirements for sprayer setup and operation include: 1) nozzle - TTI 11004, 2) carrier volume - 10 gallons or more, 3) travel speed - 15 mph or less, and 4) boom height - 24 inches or less above the target.

Wind and buffer zone label requirements are based on the downwind presence of non-sensitive and sensitive areas. Non-sensitive areas include agricultural fields that have been prepared for planting, most dicamba labeled crops, roads, and other paved and gravel surfaces, and areas covered by a manmade structure with walls or a roof. Sensitive areas are broken down into three categories: 1) areas potentially harboring threatened or endangered species such as woodlands, native pastures, and bodies of water, 2) non-specialty crops such as non-dicamba tolerant soybean, alfalfa, sunflower, and rice, 3) specialty sensitive crops such as fruiting vegetables, cucurbits, grapes, fruit trees, and residential areas. A 110-foot downwind buffer is required for categories (1) and (2) when wind is blowing toward them at 0 to 15 and 0 to 10 mph, respectively. DO NOT spray if any of the following conditions exist: 1) a field level inversion, 2) wind exceeds 10 mph toward a neighboring non-specialty crop that qualifies as a sensitive area, 3) any wind is blowing toward a neighboring specialty sensitive crop, and 4) wind exceeds 15 mph.

Engenia herbicide may only be tank-mixed with products that have been tested and approved by the US EPA. A list of approved products may be found at www.engeniatankmix.com. Do not tank mix products containing ammonium salts or adjuvants that will further decrease pH or acidify the spray solution.

Always read and follow label directions. Additional state restrictions may apply.

COTTON RESPONSES TO VARIOUS SOIL HERBICIDE TREATMENTS CONTAINING FOMESAFEN AND FLURIDONE. S. Li*[1], M. Freeman[2]; [1]Auburn University, Auburn, AL, [2]UGA extension, Hawkinsville, GA (188)

ABSTRACT

Fomesafen is a widely used soil herbicide in cotton and soybean with excellent Palmer amaranth control efficacy. Despite of the occurrence of PPO resistant Palmer amaranth in several southern states, fomesafen is still recommended by many extension specialists and crop consultants for PRE Palmer amaranth control. However, fomesafen injury on cotton has been a long time concern and being difficult to predict. Fluridone and fluridone-based products (Brake herbicides) are developed by SePro and have obtained registration in several cotton-growing states. They provide an alternative mode-of-action to control herbicide resistant Palmer amaranth and have shown promising results. However, the injury potential of fluridone-based products on cotton requires further evaluation in Alabama due to lack of data. Field trials were conducted at three locations (Shorter AL, Fairhope AL and Hawkinsville GA) in 2016 to evaluate cotton tolerance to 13 treatments containing different rates of fomesafen and fluridone-based products. Experimental design was RCBD with 4 replications. Cotton stand was not significantly affected by herbicide treatments at Shorter and Fairhope at 20-26 DAP, but this was not the case at Hawkinsville where 4X and 8X rates of fomesafen (64 and 128 oz/A Reflex), fomesafen + acetochlor (16 oz/A Reflex + 48 oz/A Warrant) and fomesafen + diuron (16 oz/A Reflex + 20 oz/A Direx) significantly reduced cotton stand as compared to NTC. Also, these four treatments reduced cotton seedling height at 20-26 DAP with most of the height reduction observed at Hawkinsville. Cotton injury varied from less than 10% to over 90%, with 100% being completely dead; fomesafen at 2X, 4X and 8X rates produced more injury than other treatments. Fomesafen + acetochlor and fomesafen + diuron also caused unacceptable injury at Hawkinsville. At the end of the season, 4X and 8X rates of fomesafen reduced over 50% of cotton yield at Hawkinsville as compared to NTC, while 8X rate fomesafen reduced 40% yield at Shorter. These data suggested more cotton injury, stand count, height and yield reduction were found in Hawkinsville where sand fraction was the highest among all locations. Higher rates of fomesafen tend to cause greater negative impact on cotton growth and yield. Meanwhile, fluridone-based products (Brake FX and F16) did not show any negative effect on cotton growth at any location in this study.

EVALUATION OF LOYANT™ FOR THE CONTROL OF COMMON RICE WEEDS AS A SINGLE APPLICATION AND AS A PROGRAM'S APPROACH. Z.T. Hill*[1], L.T. Barber[2], R.C. Doherty[3], A. Ross[4]; [1]University of Arkansas Cooperative Extension Service, Monticello, AR, [2]University of Arkansas, Lonoke, AR, [3]University of Arkansas, Monticello, AR, [4]University of Arkansas Extension, Lonoke, AR (189)

ABSTRACT

As a result of applying herbicides, such as propanil and quinclorac, resistance to these two herbicides has been confirmed in barnyardgrass throughout large portions of Arkansas. In addition to barnyardgrass, Amazon sprangletop has proved to be a difficult rice weed to control. In order to combat these two troublesome grasses, as well as prevent the loss of current herbicides, new herbicide mechanisms of action are needed. Loyant™, a new herbicide containing Rinskor™ active has been shown to provide broad-spectrum POST control of most broadleaf, grass, and sedge species commonly found in Arkansas rice.

Two experiments were conducted on a Sharkey clay soil at Rohwer, Arkansas to evaluate the use of Loyant for the control of common rice weeds. This experiment was conducted as a randomized complete block design with four replications, where herbicide efficacy was evaluated for control of barnyardgrass, Amazon sprangletop and hemp sesbania. The first experiment in 2015, consisted of treatments using Command applied preemergence (PRE) followed by (fb) Loyant tank-mixed with other common rice herbicides at either early postemergence (EPOST), 3-5 day pre-flood, or 7-10 day post-flood timings. The second experiment in 2016, consisted of Command applied PRE fb Loyant™ and other common rice herbicides applied POST at 3-5 days pre-flood.

In 2015, most herbicide programs provided >90% control of barnyardgrass throughout most of the season; however, very little control of Amazon sprangletop was observed from any program. These data suggest that applying Loyant post-flood does not provide additional control of barnyardgrass later in the season. In 2016, ≥85% control of barnyardgrass was observed for most treatments at 13 days after the pre-flood application. Although applying Loyant and Newpath alone failed to provide >90% control of barnyardgrass and Amazon sprangletop, tank-mixing these herbicides increased the control of both species to >90%. Additionally, Loyant provided >95% control of hemp sesbania throughout most of the growing season, regardless of being applied alone or in a tank-mix.

These data suggest that including Loyant into a rice weed management program will be highly beneficial in controlling common rice weeds, such as barnyardgrass and hemp sesbania. However, it does appear that Loyant will not be effective in controlling populations of Amazon sprangletop. Additionally, these data suggest that the ideal application timing to achieve effective control over these troublesome weeds is to apply Loyant within 5 days of permanent flood.

™Rinskor is not registered with the US EPA at the time of this presentation. The information presented is intended to provide technical information only and is not an offer for sale.

EVALUATION OF WARRANT IN MID-SOUTH RICE HERBICIDE PROGRAMS. M.E. Fogleman*, J.K. Norsworthy, R.R. Hale, M.H. Moore; University of Arkansas, Fayetteville, AR (190)

ABSTRACT

Today, there are few effective management strategies remaining for controlling herbicide-resistant barnyardgrass (*Echinochloa crus-galli*) in Mid-South rice production. Repeated use of the same herbicide site of action is ineffective and may be overcome by targeting alternative sites of action. At relatively low risk for evolution of resistance, (WSSA Group 15) very long-chain fatty acid-inhibiting herbicides such as acetochlor are promising candidates for weed control in rice. A field experiment was conducted in summer 2016 to evaluate the impact of acetochlor (Warrant) on weed control as a part of a complete rice herbicide program. This study was designed as a randomized complete block with factors being A) herbicide, B) rate, and C) timing. A nontreated, weedy check was also included for comparison. Warrant (acetochlor at 1,050 and 1,470 g ai ha^{-1}) or Command (clomazone at 336 g ai ha^{-1}) was applied delayed preemergence (DPRE) 1) alone, 2) followed by Newpath (imazethapyr at 67 g ai ha^{-1}) early-postemergence (EPOST), or 3) followed by Newpath EPOST followed by Newpath pre-flood (PREFLD). Newpath was also applied EPOST and PREFLD without residual herbicides. Command provided > 90% control of barnyardgrass at two weeks after treatment (WAT), while Warrant provided 64% and 71% control at the low and high rate, respectively. Six weeks after PREFLD application, programs containing Command exceeded 98% control of barnyardgrass, while programs containing Warrant provided ≥ 96% control. Programs consisting of either Command or Warrant yielded ≥ 10,000 kg ha^{-1} and ≤ 5% crop injury was observed across all treatments. The results of this study suggest that Warrant, when used in a rice herbicide program, provides comparable weed control to that of current programs.

EFFICACY OF ENLIST™ WEED MANAGEMENT SYSTEMS IN U.S. COTTON - 2016.
L.C. Walton*, L.B. Braxton, J.M. Ellis, R.A. Haygood, R.M. Huckaba, M.L. Lovelace, D.H. Perry, J.S. Richburg; Dow AgroSciences, Indianapolis, IN (191)

ABSTRACT

The Enlist™ weed control system by Dow AgroSciences is a new weed control technology incorporating unique herbicide tolerance traits, a new herbicide featuring glyphosate and 2,4-D choline formulation with Colex-D® Technology This new innovative technology with advanced herbicide and trait technology will allow cotton (*Gossypium hirsutum*) growers to manage some of the most difficult to control weed species including glyphosate resistant weeds that have more than doubled from 2009 to today. The new herbicide tolerant traits will impart robust tolerance to 2,4-D, glyphosate and glufosinate to provide three herbicide modes of action (MOAs) that should be seamlessly intergrated into growers cropping systems. The Enlist™ technology includes a new and innovative 2,4-D choline herbicide that features technology to reduce off-target movement. This research in 2016 was conducted in cooperation with 17 University and Extension researchers from 11 universities in 13 states. A total of 21 broadleaf, sedge and annual grass weed species were evaluated.

The primary objective of this Enlist™ weed management systems research was to collect key weed efficacy data on glyphosate-resistant biotypes such as Palmer amaranth (*Amaranthus palmeri*) and other economically-important weed species and to determine the efficacy of Enlist Duo® herbicide and 2,4-D choline tank-mixed with glufosinate against key problematic glyphosate-resistant and –susceptible species throughout cotton-growing regions of the southern and southeastern U.S and Arizona. These system programs in cotton utilized pre-plant incorporated (PPI) or premergence (PRE) and postemergence (POST) herbicide applications. These programs consisted of a PPI/PRE herbicide followed by sequential POST applications of Enlist Duo, 2,4-D choline + glufosinate and glufosinate applied alone and in tank mixture with other residual herbicide.

All programs containing Enlist Duo® or 2,4-D choline + glufosinate provided more than 90% control of glyphosate-resistant Palmer amaranth. Programs containing Enlist Duo® or 2,4-D choline + glufosinate provided greater levels of glyphosate-resistant Palmer amaranth control than glufosinate-only programs. Sequential applications of glufosinate provided greater than 85% Palmer amaranth control, however single MOA programs are not considered to be sustainable.

A full cropping season, Enlist™ enabled approach utilizing multiple herbicide MOAs applied PPI/PRE and POST will allow cotton growers to achieve greater control of economically-important and herbicide-resistant weed biotypes,

UNDERSTANDING THE SENSITIVITY OF SOYBEAN TO OFF-TARGET MOVEMENT OF LOYANT™ HERBICIDE. M.R. Miller*, J.K. Norsworthy, M.L. Young, M.H. Moore; University of Arkansas, Fayetteville, AR (192)

ABSTRACT

Dow AgroSciences has recently announced Loyant™ with Rinskor™ Active (florpyrauxifen-benzyl), a new synthetic auxin herbicide for use in rice (*Oryza sativa*). While this new herbicide provides an alternative mode of action for rice, it is not uncommon for soybean (*Glycine max*) to be planted adjacent to rice. Given these circumstances, there is potential for herbicides applied in rice to drift onto soybean. Historically, dicamba drift has concerned soybean growers due to the high level of sensitivity to this herbicide. Drift concerns from existing synthetic auxin herbicides, multiple field studies were developed to understand the susceptibility of common row crops, such as soybean, to Rinskor relative to dicamba. In one experiment, a field study was conducted during the summers of 2014 and 2015 to: (1) evaluate the sensitivity of soybean to low concentrations of Rinskor and (2) compare soybean injury and yield following applications of Rinskor and dicamba at two soybean growth stages and concentrations. Soybean were treated with 1/10, 1/20, 1/40, 1/80, 1/160, 1/320, or 1/640 of the 1X rate of Rinskor (30 g ai/ha) or dicamba (560 g ae/ha) at the V3 or R1 growth stage. Rinskor applied at 1/10 to 1/40x rates caused significant visual foliar injury and subsequent height reduction. In comparison, dicamba applied at the same rates caused similar injury and growth reductions. As the drift rate of Rinskor was decreased from 1/10 to 1/640X the level of soybean injury declined quickly. Dicamba caused substantial injury at rates as low as 1/640X. Soybean yield reduction was greatest when highest concentrations of the two herbicides were applied. In additional field experiments, soybean were treated with 1/20 or 1/160 of the 1X rate of Rinskor or dicamba at the R1, R2, R3, R4, or R5 growth stage. Sensitivity of soybean during reproductive development indicated 1/160x drift rates of dicamba and Rinskor are less damaging to soybean compared to 1/20x. In addition, more concentrated rates such as the 1/20x drift rates of Rinskor and dicamba will result in significant soybean injury. However, as reproductive growth stage increases from R1 to R5 visible soybean injury from a drift event of Rinskor decreased but seed collected from the progeny exhibited greater reduction in percent germination, vigor, and plant height when planted in the field the following season. Soybean are sensitive to Rinskor at low rates, but we believe the weed control provided by this new herbicide will outweigh the slight risk for off-target movement to soybean.

™Trademark of the Dow Chemical Company ("Dow") or an affiliated company of Dow. Loyant™ is not registered with the US EPA at the time of this presentation. The information presented is intended to provide technical information only.

BRAKE® HERBICIDE: OPTIMIZING THE PERFORMANCE OF A COTTON WEED CONTROL SYSTEM. K.R. Briscoe*; SePRO Corporation, Whitakers, NC (193)

ABSTRACT

In 2016, Brake F16 and Brake FX were federally registered for preplant and preemergence applications in U.S. cotton. Each herbicide is a premix of the PDS-inhibitor fluridone with either the PPO-inhibitor fomesafen (Brake F16) or the PSII inhibitor fluometuron (Brake FX). PDS inhibiting herbicides are not currently used for weed control in cotton. Thus, the use of Brake herbicides may reduce selection pressure caused by repeated use of the same herbicide families. Brake F16 and Brake FX showed excellent cotton selectivity and control of annual grass and small seeded broadleaf weeds including Palmer amaranth (*Amaranthus palmeri*) across the cotton belt in 2016. Because of its longevity of control, herbicide programs that incorporate Brake as a foundational residual with a postemergence program, such as glufosinate plus s-metolachlor, could reduce the number of herbicide applications during the growing season. Brake has also been very effective as a foundational residual in dicamba and 2,4-d systems.

TALINOR™ HERBICIDE: A NEW POSTEMERGENCE BROADLEAF HERBICIDE FOR WEED CONTROL IN CEREALS. B.D. Black*[1], A.S. Franssen[2], P. Forster[3], D.J. Porter[4], M. Saini[4]; [1]Syngenta, Searcy, AR, [2]Syngenta, Pleasant Dale, NE, [3]Syngenta, Eaton, CO, [4]Syngenta Crop Protection, LLC, Greensboro, NC (194)

ABSTRACT

Syngenta is introducing Talinor™ herbicide a new selective postemergence herbicide for the US market that provides broad spectrum broadleaf weed control in wheat and barley. Talinor contains two active ingredients with multiple modes of action, Bicyclopyrone, a HPPD inhibitor (Site of Action Group 27), and Bromoxynil, a PS II inhibitor (Site of Action Group 6). In field trial experiments conducted over multiple years, Talinor at 13.7 to 18.2 fl oz/A combined with CoAct+™ additive at 2.75 to 3.6 fl oz/A provided excellent control of some of the more troublesome broadleaf weeds in cereals, such as Russian thistle, kochia, wild buckwheat, prickly lettuce and mayweed chamomile, including those populations that are resistant to ALS-inhibitor and synthetic auxin herbicides. Talinor has shown excellent crop safety to all tested varieties of spring wheat, durum, winter wheat and barley and can be applied from the 2-leaf stage to the pre-boot stage of the crop. Talinor can be tank mixed with graminicides such as Axial® brands for one-pass grass and broadleaf weed control. Syngenta received EPA registration approval of Talinor in November of 2016. State registration approvals are in process.

DUPONT HERBICIDE PROGRAMS FOR MARESTAIL CONTROL IN DICAMBA-TOLERANT SOYBEAN. K. Backscheider*[1], D. Johnson[2], K.L. Hahn[3], B. Steward[4], J. Krumm[5], V. Klecsewski[6], M. Meyer[7]; [1]DuPont Crop Protection, Franklin, IN, [2]DuPont Crop Protection, Des Moines, IA, [3]DuPont Crop Protection, Bloomington, IL, [4]DuPont Crop Protection, Overland Park, KS, [5]DuPont Crop Protection, Hastings, NE, [6]DuPont Crop Protection, Middletown, DE, [7]DuPont Crop Protection, Norwalk, IA (195)

ABSTRACT

Glyphosate-resistant weeds continue to present control challenges to growers, and dicamba-tolerant soybeans will provide a new tool for in-crop weed control in soybeans. DuPont is working to develop multiple-mode-of-action, residual weed control programs that include dicamba. In this presentation we will show that various combinations of DuPont soybean herbicides provide growers with excellent marestail (Conyza canadensis) control in dicamba-tolerant soybeans.

EVALUATION OF DELAYED PRE AND EARLY POSTEMERGENCE CONTROL OF RYEGRASS IN WINTER WHEAT. W.B. Greer*, J.A. Tredaway, W.C. Greene; Auburn University, Auburn, AL (196)

ABSTRACT

Field studies were conducted at the Tennessee Valley Research and Extension Center (TVREC) in Belle Mina, AL and at the Plant Breeding Unit at E.V. Smith Research and Extension Center (PBU) in Tallassee, AL for the 2015-16 growing season. These studies were conducted to determine if delayed PRE and early postemergence applications could be used to control ryegrass in winter wheat with minimal crop injury or yield loss. Herbicides evaluated at the early postemergence timing were Zidua (pyroxasulfone) at 1.5 oz/A, Valor SX (flumioxazin) at 1.5 and 3 oz/A, Fierce (flumioxazin + pyroxasulfone) at 1.5 and 3 oz/A, and Zidua at 1.5 oz/A + Sencor (metribuzin) at 2 oz/A. The herbicides evaluated at the delayed PRE timing were Zidua at 1.5 oz/A, and Zidau at 1.5 oz/A + Sharpen (saflufenacil) at 2 fl. oz/A. These treatments were applied in late November and early December and evaluations were made throughout the growing season. Ryegrass control and crop injury were evaluated on a scale of 0-100%. At TVREC, treatments were evaluated at 7, 14, 42, 84, and 154 days after the early postemergence treatments were applied. Optimum ryegrass control was achieved with 3 oz. application of Fierce and the combination of Zidua + Sencor at the early postemergence timing. Fierce at 1.5 oz. and Zidua delayed PRE showed good control early but tapered off by the final weed control ratings. The combination of Zidua with Valor in Fierce provided an increase in the control of ryegrass as compared to the Valor alone treatments which only controlled 23.8% and 38.8% by the 154 day rating. There was no injury observed at any time on the early postemergence treatments of Zidua, or the delayed PRE treatments of Zidua + Sharpen or Zidua alone. The remaining treatments of Valor, Fierce, and Zidua + Sencor showed 5% injury or less at 7 and 14 days and no injury by the 42 day rating. Ryegrass control ratings for PBU showed that Fierce and Zidua + Sencor were excellent on ryegrass control, but the Zidua delayed controlled the ryegrass the best. A little more injury was also observed in the sandier soils of PBU, but by 42 days after treatment the injury was less than 5% for all treatments. The yield data for TVREC showed a direct correlation between ryegrass control throughout the season and increased yields. The Fierce at 3 oz/A which showed the greatest percentage of ryegrass control, was also the highest yielding plot with 109.6 bushels per acre. The other Fierce treatment and Zidua + Sencor yielded around 100 bushels per acre. The untreated plot averaged 19.9 bushels per acre and the Valor at 1.5 oz/A only yielded 40.3 bushels per acre. This was likely due to the poor ryegrass control that was observed in this treatment. At PBU, the Zidua delayed PRE and Zidua + Sharpen out yielded the 3 oz. Fierce treatment by 4-5 bushels. These treatments yielded the highest at PBU and were also rated to have the highest percentage of ryegrass control

TOLERANCE OF ENLIST COTTON TO VARIOUS HERBICIDE TANK COMBINATIONS. B.R. Wilson*, D.M. Dodds, C.A. Samples, M.T. Plumblee, A.B. Denton, S.S. Davis, L.X. Franca; Mississippi State University, Starkville, MS (197)

ABSTRACT

Weed resistance to herbicides has become a major problem in cotton production throughout the Mid-South. In 2012, 24.7 Million hectares were infested with glyphosate-resistant weeds. Dow AgroSciences launched Enlist cotton varieties in 2016 that are tolerant to 2, 4-D, glyphosate, and glufosinate. The Enlist™ varieties will provide producers with an additional herbicide mode of action to help control Palmer amaranth, mares-tail, and giant ragweed. The objective of this research was to evaluate tolerance of Enlist™ cotton varieties to multiple herbicide tank mixes.

An experiment was conducted in 2016 in Starkville, MS and Brooksville, MS to determine tolerance of Enlist™ cotton varieties to various herbicide tank mixes. Plots consisted of four rows with four replications. Herbicide treatments included glufosinate (Liberty 280 SL at 0.65 kg ai/ha), glyphosate (Roundup PowerMax at 3.16 kg ai/ha), S-metolachlor + glyphosate (Sequence at 0.83 kg ai/ha + 0.63 kg ai/ha), S-metolachlor (Dual Magnum at 0.43 kg ai/ha), and a combination of S-metolachlor + glufosinate. Additional herbicide treatments included glyphosate + glufosinate, glyphosate + glufosinate + 2, 4-D choline, glyphosate + S-metolachlor + glufosinate, glyphosate + S-metolachlor + glufosinate + 2, 4-D choline. The spray volume for the treatments was 140 L/ha. Herbicide application was made when cotton was at the 3-6 leaf cotton. The experimental design was a randomized complete block. Data collection consisted of stand counts, injury at 7, 14, and 28 days after application, and seed cotton yield. Data were subjected to analysis of variance using PROC GLIMMIX procedure in SAS 9.4 and means were separated using Fishers protected LSD at p = 0.05.

Cotton injury ratings at 7 days after application were significantly greater from treatment of glyphosate + S-metolachlor + glufosinate + 2, 4-D choline compared to glufosinate, glyphosate + glufosinate, S-metolachlor + glyphosate, and glyphosate. There were no significant differences in cotton injury 14 or 21 days after application among treatments. No significant differences in lint yield among treatments were observed.

EVALUATION OF ENGENIA HERBICIDE IN DICAMBA TOLERANT SOYBEAN NO-TILL SYSTEMS. G.S. Stapleton*[1], K.L. Liberator[2], A. Adams[2], J.A. Tredaway[3], L. Steckel[4], M.L. Flessner[5]; [1]BASF, Dyersburg, TN, [2]BASF, RTP, NC, [3]Auburn University, Auburn, AL, [4]The University of Tennessee, Jackson, TN, [5]Virginia Tech, Blacksburg, VA (198)

ABSTRACT

Engenia herbicide was regiatered in December of 2016. It was developed for use with dicamba-tolerant cotton and soybean to control brodleaf weeds including Palmer amaranth. Studies were initiated across the Southern US to evaluate various weed systems for glyphosate resistant Palmer amaranth control and soybean yield. Engenia herbicide was applied in preemergence and postemergence systems to evaluate its utility throughout the growing season.

ZIDUA PRO HERBICIDE: A NEW PREMIUM RESIDUAL OPTION HERBICIDE FOR USE IN SOYBEAN. K.L. Liberator*[1], G.S. Stapleton[2], D.E. Waldstein[1], M.L. Flessner[3]; [1]BASF, RTP, NC, [2]BASF, Dyersburg, TN, [3]Virginia Tech, Blacksburg, VA (199)

ABSTRACT

Increasing incidences of herbicide resistance and weed challenges have intensified the need for new herbicide products and combinations. Zidua® PRO herbicide, a new premium residual option herbicide from BASF, offers the fastest and most complete burndown with long-lasting, broad-spectrum residual weed control. Zidua PRO herbicide combines the three active ingredients found in Sharpen® herbicide (saflufenacil), Pursuit® herbicide (imazethapyr), and Zidua® herbicide (pyroxasulfone). These three sites of action work in concert with each other to provide overlapping weed control.

Field trials were conducted in the summer of 2016 at BASF sites in Princeton, NC and Murray, KY as well as with Virginia Tech University in South Hill, VA. Weed control ratings from Princeton, NC at 63 days after treatment showed 100% burndown of horseweed and 96.3% residual control of Palmer amaranth with Zidua PRO herbicide at 6 fl oz/A applied with Roundup Powermax at 28.4 fl oz/A, 1% v/v MSO, and 8.5 lbs/100 gal AMS. Results from Murray, KY and South Hill, VA also demonstrated excellent control of horseweed (*Conyza canadensis*) and palmer amaranth (*Amaranthus palmeri*) with Zidua PRO herbicide.

Zidua PRO herbicide offers growers a new solution for postemergence and residual weed control in Roundup Ready®, LibertyLink®, Non-GMO and Roundup Ready 2 Xtend® soybean systems. Zidua PRO herbicide also aids in resistance management, combining three sites of action into one liquid formulation.

XTENDFLEX MANAGEMENT IN THE ABSENCE OF DICAMBA TANK-MIX PARTNERS. R.C. Doherty*[1], T. Barber[2], Z. Hill[3], A. Ross[4]; [1]University of Arkansas, Monticello, AR, [2]University of Arkansas, Lonoke, AR, [3]University of Arkansas Extension, Monticello, AR, [4]University of Arkansas Extension, Lonoke, AR (200)

ABSTRACT

A trial was established at Rohwer, AR, on the Southeast Research and Extension Center in 2016 to evaluate herbicide systems in XtendFlex cotton in scenarios where tank-mixtures were not included with dicamba applications. The soil type was a Desha silt loam. Trials were arranged in a factorial arrangement of treatments with four replications. Preemerge (PRE) herbicide comparisons were provided in addition to postemergence options. Herbicides compared preemerge included Brake FX (fluometuron 0.75lb ai/A + fluridone 0.15 lb ai/A), Cotoran (fluometuron), Direx (diuron) and Warrant (acetochlor). Postemergence herbicides evaluated included combinations of Liberty (glufosinate), Clarity (dicamba) and Roundup PowerMax (glyphosate) and were applied to 2-4" weeds. Visual weed control ratings of Palmer amaranth, barnyardgrass, and Southwestern cupgrass were recorded at 14 and 21 DAT (days after final treatment).

Brake FX provided more consistent control across all weed species present throughout the duration of the study. However, at 14 DAT regardless of PRE applied in a system Clarity at 0.5 lb ai/A fb (followed by) Liberty at 0.53 lb ai/A provided greater than 90% control of all weed species present. Barnyardgrass and Southwestern cupgrass control was reduced in programs where Warrant was used PRE, except when followed by Clarity at 0.5 lb ai/A fb Roundup at 0.95 lb ae/A which provided 99%. Brake FX at 0.9 lb ai/A fb Clarity at 0.5 lb ai/A fb Liberty at 0.53 lb ai/A was the system that provided the greatest control across weed species (99%) 14 DAT.

Brake FX systems, 21 DAT, were still providing more consistent weed control across all weed species. Grass control was not adequate with Warrant PRE, except when followed by Clarity 0.5 lb ai/A fb Roundup 0.95 lb ai/A . Brake FX at 0.9 lb ai/A fb Roundup 0.95 lb ae/A fb Clarity at 0.5 lb ai/A provided the greatest control (95, 85, 85%) of Palmer amaranth, barnyardgrass, and Southwestern cupgrass, respectively.

XtendFlex herbicide systems that were established with Brake FX applied PRE provided better overall weed control across all systems while, Warrant provided the least control. All systems that contained two post applications provided greater weed control over systems that contained one. The addition of Liberty or Roundup in the herbicide system improved grass control over two applications of Clarity, but did not improve Palmer amaranth control.

WEED MANAGEMENT WITH DIFLEXX™ AND DIFLEXX® DUO IN TEXAS CORN.
M.E. Matocha[1], P.A. Baumann[1], G. Schwarzlose[2]; [1]Texas A&M AgriLife Extension Service, College Station, TX, [2] Bayer CropScience, Spring Branch, TX (201)

ABSTRACT

Management of glyphosate-resistant broadleaf weeds in corn has been challenging since traditional synthetic auxin herbicides often result in undesirable crop safety issues. To address this Bayer CropScience has developed DiFlexx (dicamba) and DiFlexx DUO (dicamba + tembotrione) herbicides which both contain the new safener cyprosulfamide (CSI). The CSI safener provides several added benefits including minimized crop response and improved plant health, wide application window (burndown to V10), safens the use of MSO or COC in late POST timings, and safens additional HPPD and ALS products as well.

Field studies were conducted in 2015 and 2016 at the Texas A&M Research Farm near College Station, TX to evaluate DiFlexx and DiFlexx DUO for weed control in corn. Species evaluated included, Palmer amaranth (*Amaranthus palmeri* S. Wats), browntop panicum (*panicum fasciculatum*), and junglerice *(echinochloa colonum)*. Treatments employed in 2015 consisted of preemergence (PRE) treatments of Balance Flexx 3 or 4 oz) + atrazine (1 qt) followed by (fb.) late post (LPOST) combinations of Roundup PowerMax with DiFlexx (8 and 10 oz.), Laudis, and Status. Other treatments included a single mid-post (MPOST) timing with different combinations of Capreno, atrazine, Roundup PowerMax, Laudis, and DiFlexx (8 oz.). Comparison treatments included (PRE) fb. Roundup PowerMax (LPOST), and Halex GT + atrazine (MPOST). No crop injury was observed in 2015. Treatments utilized in 2016 were similar with the exception of the inclusion of DiFlexx DUO (24 and 32 oz.) + Roundup PowerMax (LPOST), and DiFlexx Duo (both rates) + atrazine + Roundup PowerMax (MPOST). Early to mid-season crop injury was minimal (data not presented).

Excellent browntop panicum control was observed in 2015 at 16 days after late post (16 DA-LPOST) with most treatments achieving 96-99%. Laudis + atrazine + Roundup PowerMax (LPOST) and Laudis + atrazine + Roundup PowerMax + DiFlexx 8 oz (LPOST) were the only two with statistically less control (90 and 92%, respectively).

All treatments provided excellent control of Palmer amaranth at 16 DA-LPOST (94-100%). At 30 DA-LPOST, 92-99% control of Palmer was observed by all treatments and (PRE) fb. RUPMax + DiFlexx 10 oz (LPOST) statistically outperformed Capreno + ATZ + RUPMax (MPOST) (92%), and Laudis + ATZ + RUPMax + DiFlexx 8 oz (MPOST) (90%). All treatments had significantly higher corn yield than the untreated. Among applied treatments, only one (PRE) fb. Roundup PowerMax + DiFlexx 8 oz (LPOST) (137 bu/ac), statistically yielded more corn than Laudis + ATZ + Roundup PowerMax + DiFlexx 8 oz. (MPOST)(106 bu/ac).

Most treatments in 2016 that consisted of tank mixtures of DiFlexx or DiFlexx DUO applied either as a single MPOST or LPOST (after PRE) provided good control of junglerice 18 DA-LPOST (80-90%). Excellent control of Palmer amaranth was achieved (18 DA-LPOST) and no differences were observed among treatments that included DiFlexx (or DiFlexx DUO) (91-99%)

and the standards either Status or Halex GT (96 & 100%, respectively). Roundup PowerMax (LPOST after PRE) was the only statistically different treatment (80%). At 54 DA-LPOST, control of Palmer amaranth was reduced across treatments (87-93%), and Roundup PowerMax (LPOST) was the only treatment with statistically less control (73%). All but three treatments significantly out yielded the untreated (80 bu/ac); (PRE) fb. Roundup PowerMax (LPOST) (93 bu), (PRE) fb. Roundup PowerMax + Laudis + DiFlexx 8 oz (LPOST) (85 bu/ac), and Capreno + atrazine + Roundup PowerMax + DiFlexx 8 oz (MPOST) (103 bu/ac).

EFFECT OF SIMULATED FLUMIOXAZIN DRIFT ON COTTON AND SOYBEAN. T.B. Buck*[1], D. Stephenson[2], B.C. Woolam[2]; [1]LSU AgCenter, Baton Rouge, LA, [2]LSU AgCenter, Alexandria, LA (231)

ABSTRACT

Due to historical overlapping of cotton and soybean planting dates and subsequent applications of residual herbicides PRE in each crop for resistant weed management, there is a potential for off-target drift to emerged cotton or soybean. Therefore, research was conducted at the LSU AgCenter Dean Lee Research and Extension Center near Alexandria, LA in 2016 to evaluate simulated early-season off-target drift of flumioxazin on cotton and soybean. Experimental design was an augmented factorial arrangement of flumioxazin application timing and rate in a randomized complete block design with four replications. Application timings were cotyledon, 2-, or 4-lf cotton or unifoliate, 2-, or 4-trifoliate soybean. Cotton and soybean response was evaluated in separate experiments. Application rates were 9, 18, or 36 g ai ha^{-1}, which corresponds to 1/8, 1/4, and 1/2x, respectively, of the 1x rate of 72 g ai ha^{-1}. A nontreated check was included for comparison. Visual evaluations of cotton and soybean injury were recorded 3, 7, 14, 28, and 42 d after each application. Cotton and soybean heights were recorded 14, 28, and 42 d after each application. Yields were collected at harvest with seed cotton yield adjusted to lint yield using a 40% turnout and soybean yield was adjusted to 15% prior to analysis. Cotton and soybean heights and yields were converted to percent of the nontreated check prior to analysis. Evaluation date was considered a repeated measure and included as a factor in the analysis.

Regardless of application rate and evaluation date, flumioxazin injured cotyledon cotton 93 to 99%. Averaged across rate, flumioxazin injured 2- and 4-lf cotton 47 and 62%, respectively, 7 d after treatment (DAT); however, injury decreased to 11 and 31%, by 42 DAT. Height following flumioxazin application to cotyledon cotton mirrored injury with height reduced to 11 to 28% of the nontreated check, regardless of rate. Flumioxazin rate did not influence cotton height with height reduced to an average of 65% of the nontreated check 14 DAT and 91% and 83% of the nontreated check following the 2- and 4-lf applications, respectively. Flumioxazin rate did not influence cotton yield; however, yield was reduced to 5, 70, and 69% of the nontreated check following the cotyledon, 2-, and 4-lf applications, respectively. Averaged across flumioxazin rate, unifoliate soybean was injured 16 and 19% 3 and 7 DAT, respectively, but injury decreased to 1% 42 DAT. Flumioxazin injured 2- and 4-trifoliate soybean 23 and 8%, respectively, 3 DAT with injury decreasing to 1 to 2% 42 DAT. Similarly, soybean injury decreased over time for all flumioxazin rates with injury for each rate no greater than 12, 15, and 19% following the 1/8, 1/4, and 1/2x rates, respectively. Neither flumioxazin application timing nor rate reduced soybean height or yield as a percent of the nontreated check. Preliminary results indicate that early-season off-target movement of flumioxazin can have negative implications on cotton and soybean production. While both crops were injured in response to simulated drift of flumioxazin, cotton growth and yield was more severely impacted. Soybean visual injury was observed, but no reduction in height or yield was documented, which may be explained by soybean's ability to compensate to negative early-season issues. Research into this topic will continue in the future.

HUMIDOME: A NEW METHOD TO DETERMINE VOLATILITY OF PESTICIDES.
W.K. Gavlick*; Monsanto, St. Louis, MO (232)

ABSTRACT

In this presentation, a laboratory based method to determine the relative volatility of herbicide formulations will be described. An herbicide formulation is applied to a substrate in a closed dome system, the closed dome is placed into a temperature and humidity controlled chamber, and air is drawn through the closed dome for twenty four hours. The volatile analyte in the formulation is trapped on a piece of polyurethane foam (PUF) during this time period. The analyte is solvent extracted from the PUF and the extract is analyzed by liquid chromatography-mass spectrometry / mass spectrometry (LC-MS/MS). Details of the experimental setup and representative relative volatility data will be presented.

INFLUENCE OF DROPLET SIZE ON LACTOFEN AND ACIFLUORFEN EFFECTIVENESS FOR PALMER AMARANTH CONTROL. L.X. Franca*[1], D. M. Dodds[1], G. R. Kruger[2], T. Butts[2], C. A. Samples[1], M. T. Plumblee[1], D. B. Denton[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska, Lincoln, NE (233)

ABSTRACT

Widespread occurrence of glyphosate and ALS-resistant Palmer amaranth has led to increased use of protoporthyrinogen oxidase (PPO) inhibiting herbicides. Lactofen and acifluorfen are non-systemic, PPO-inhibiting herbicides used to control several annual broadleaf species in soybeans, cotton, and peanuts. Concerns exist with regard to the dissemination Palmer amaranth populations resistant to PPO-inhibiting herbicides across the Midwestern and southern United States. Palmer amaranth populations resistant to fomesafen and lactofen have been reported in Arkansas, Tennessee, and Illinois. Therefore, efficacious and cost effective means of application are needed to maximize lactofen and acifluorfen effectiveness.

Experiments were conducted at Hood Farms in Dundee, MS, and the West Central Research and Extension Center in North Platte, NE to evaluate the influence of droplet size on lactofen and acifluorfen effectiveness for Palmer amaranth control. Lactofen was applied at 0.21 kg ai/ha + Crop Oil Concentrate (COC) at 1% v/v and acifluorfen at 0.42 kg ai/ha + Crop Oil Concentrate (COC) at 1% v/v using the following droplet sizes: 150 µm, 300 µm, 450 µm, 600 µm, 750 µm, and 900 µm. Prior to experiment initiation, droplet size spectra for each herbicide was characterized in a low speed wind tunnel at the Pesticide Application Technology Laboratory at University of Nebraska, North Platte, NE. Treatments were POST applied to 10 cm to 15 cm Palmer amaranth using a tractor mounted sprayer equipped with a CAPSTAN® AG Pulse Modulated Sprayer and Wilger® Precision Spray Technology Tips at 4.8 km per hour. Visual Palmer amaranth control was collected at 7, 14, 21, and 28 days after application. Fifteen plants per plot were tagged and used for dry biomass calculation at the end of the experiment. Data were subjected to analysis of variance and means were separated using Fischer's Protected LSD at α=0.05.

Different droplet sizes of lactofen did not result in different Palmer amaranth control, regardless of rating period. Acifluorfen applied at 300 µm provided the greatest Palmer amaranth control at 14 days after application. In addition, Palmer amaranth control was greater with acifluorfen applied at 300 µm and 600 µm at 7, 21 and 28 days after application. Compared to 450 µm, acifluorfen applied at 300 µm provided a 30% increase in Palmer amaranth control, regardless of rating period. With exception of lactofen applied at 450 µm, all droplet sizes provided significant dry biomass reduction of Palmer amaranth. Acifluorfen applied with 300 µm droplet size resulted in significant reductions in Palmer amaranth biomass. These data suggest that the use of small or large droplet sizes does not affect lactofen effectiveness on 10 to 15 cm Palmer amaranth. Furthermore, in order to optimize Palmer amaranth control from acifluorfen, the use of 300 µm droplets is recommended.

QUANTITATIVE ASSESSMENT OF SPRAY DEPOSITION AND CANOPY PENETRATION WITH FLUORESCENT TRACERS. J.A. Gillilan*[1], M. Ledebuhr[2], G.K. Dahl[3], R.J. Edwards[3], S.L. Wedryk[4], J.J. Skelton[5]; [1]Winfield Solutions, Springfield, TN, [2]Application Insight, LLC, East Lansing, MI, [3]Winfield US, River Falls, WI, [4]Winfield US, Shoreview, MN, [5]Winfield US, Franklin, TN (234)

ABSTRACT

As new dicamba-tolerant crops and technologies are introduced, there is a concern over maintaining herbicide performance and reducing the likelihood of drift. The use of spray nozzles with a droplet spectrum of "Very Coarse" to "Ultra Coarse," (as defined by ASABE S572.1) like TTI nozzles, can reduce drift but may also affect canopy penetration and herbicide efficacy by reducing the number of smaller sized droplets. Another means of mitigating drift is by using drift reduction products such as InterLock and StrikeLock. The combination of drift reduction products and nozzles is effective at decreasing driftable droplets, but the impact on canopy penetration and herbicide performance is less understood. The objective of this study is to determine if the drift reduction products, InterLock and StrikeLock, affect spray deposition and canopy penetration of a tank-mixture of dicamba and glyphosate in soybean. In 2016, field trials were conducted in Tennessee and Minnesota using a fluorescent tracer to quantify the area of spray coverage, number of droplets, and the average droplet size in the upper, middle, and lower levels within the soybean canopy. Mixtures of glyphosate and dicamba with fluorescent tracer and two commercial drift reduction products, InterLock and StrikeLock, were sprayed at 18 gal/A (140 l/ha) using a backpack sprayer in Tennessee and a commercial sprayer in Minnesota, both equipped with TTI nozzles. Sampling cards were positioned within the canopy at three levels, upper (top of the canopy), middle (18-20" from ground), and lower (2-5" from ground) to capture the spray solution. The number of droplet hits, percent area covered by the spray solution, and average droplet size on both sides of the cards were quantified using ImageJ analysis, and the volumetric deposition was determined by rinsing the herbicide from the cards. There were no significant differences between the herbicides alone treatment and the drift reduction products in the area of spray coverage, number of droplets, or average droplet size throughout all three levels of the soybean canopy. The average size of droplets did decrease further in the soybean canopy with all treatments indicating that a range of droplet sizes are required to achieve maximum canopy penetration. The results from this study show that the drift reduction products, InterLock and StrikeLock, can be included in tank-mixtures of dicamba and glyphosate when utilizing dicamba-tolerant crops and technologies to reduce drift while maintaining canopy penetration and spray deposition.

THE EFFECT OF A SHIELDED BOOM ON OFF-TARGET MOVEMENT OF VARIOUS SIZE SPRAY DROPLETS. H.C. Foster*[1], D.B. Reynolds[1], G.R. Kruger[2], S. Claussen[3]; [1]Mississippi State University, Starkville, MS, [2]University of Nebraska, North Platte, NE, [3]Wilmar Fabrication, LLC, Willmar, MN (235)

ABSTRACT

The introduction of auxin resistant crops will allow applicators to make post emergent applications of dicamba over the top of once susceptible soybeans and cotton. This will enable growers to better control weed populations that may have resistance to more popular herbicides. The problem lies with growers who choose not to adopt the new cropping systems and have susceptible crops on their farm or adjoining farms. These auxins have a history of drift problems, partly because very low doses can cause severe injury to sensitive, non-targeted plants. While the Environmental Protection Agency has set forth rigorous drift mitigation measures for the auxin application, further safety precautions should be included to ensure the safest possible application.

The objective of this study is to compare the amount of drift seen using two different boom systems with four different droplet sizes. Field experiments were conducted in 2015 and 2016 in Brooksville, MS and North Platte, NE. An open boom and a Redball hooded boom were used as our two sprayers. Droplet sizes ultra-coarse (UC), very coarse (VC), medium (M), and fine (F) were used with each sprayer.

A formulation of Roundup Powermax® and PTSA dye (rhodamine dye for MS location) were used for each treatment. Each of the four droplet sizes were used with the two spray booms with four replications. There was one 183 m pass down the field for each treatment and small mylar cards were placed downwind of the treated area. There were also petri dishes placed directly under the spray path, as well as an upwind check mylar card. Wind was recorded using a Watchdog Weather Station and a kestrel wind meter for each replication. The data were analyzed using a fluorimeter and the output was in relative fluorescence units to determine the amount of drift seen.

The data were normalized using the most extreme drift position because of the differences in readings between locations. The data show that for all droplet sizes, the incorporation of a hooded spray boom decreased the amount of particle drift found, compared to the open spray boom. The use of fine and medium droplets with the open spray system show greater drift compared to the hooded spray system and the UC/VC droplets with the open spray system. The incorporation of a hooded sprayer does decrease the chances of particle drift but is not a final solution to the problem. Drift reducing agents and proper environmental conditions should be incorporated as well to ensure the safest application is made.

EFFECT OF ALTERNATING WETTING AND DRYING IRRIGATION SYSTEMS ON PHOTOSYNTHESIS AND TEMPERATURE OF RICE AND WEED PLANTS. D.R. Gealy*, J. Rohila; USDA-ARS, DBNRRC, Stuttgart, AR (236)

ABSTRACT

Reduced input systems such as alternating wetting and drying (AWD) and furrow irrigation can potentially reduce water costs and limit the release of greenhouse gases in rice production, but also can introduce unwanted crop stresses that compromise crop yield and quality, as well as introducing complications to weed management. This research investigated the effect of AWD practices on key plant productivity parameters such as leaf net photosynthesis (Pn) and canopy temperature (as measured using CI-340 or Li 6800 portable infrared gas analyzers), and grain yield. Field plot experiments were established in 2014-2016 to compare crop and weed performance in AWD and conventionally irrigated systems. Rice was drill-seeded in both systems and plots were maintained identically until application of a conventional permanent flood. All plots were flushed as necessary to maintain healthy rice growth after emergence. Beginning with the application of the permanent flood, conventional plots were maintained fully flooded by periodic reflooding to a depth of 10 cm until all plots were drained at the end of the crop season. By contrast, water levels under AWD irrigation typically were allowed to drop until the soil (silt loam) surface in plots was exposed and had dried to the point of crusting and moderate cracking, but before leaves began curling. Irrigation water was then applied to the AWD plots to a depth of 10 cm. At the time of the greatest potential for crop stress, just prior to reflooding, the canopy temperatures in AWD plots were 0.5 to 2 C greater, and leaf Pn levels in rice and red rice were 10-20% less compared with these parameters under conventional irrigation. AWD typically reduced rice yields 10% or less. These results indicate that Pn rates and canopy temperatures can provide sensitive indications of early stages of stress in rice plants, and might be useful in optimizing the timing of reflooding and in gauging crop recovery from AWD stresses.

EVALUATION OF POST APPLIED CHLOROACETAMIDES IN COMBINATION WITH GLUFOSINATE IN COTTON. W.C. Greene*[1], J.A. Tredaway[1], A.J. Price[2], G.S. Cutts III[1], W.B. Greer[1]; [1]Auburn University, Auburn, AL, [2]USDA, Auburn, AL (252)

ABSTRACT

Two separate field studies were conducted at the Prattville Agricultural Research Unit in Prattville, AL in 2016 to determine the effect of early-Postemergence(EPOST) applied chloroacetamide herbicides on cotton growth as well as S-metolachlor, a chloroacetamide herbicide, in combination with Liberty involving two different types of spray nozzles, on three varieties of cotton with differing herbicide resistance traits. The first study involved Postemergence (POST) applications of Dual Magnum, Outlook, and Warrant. The second study consisted of treatments of Liberty, with and without Dual Magnum, across three different cotton varieties including LibertyLink, Widestrike, and Dicamba tolerant cotton, as well as two different nozzle types, flat fan, and TTI. Stoneville 4848 was planted for the first trial. Varieties planted in the second trial were Stoneville 4848, a LibertyLink variety, Phytogen 333, a WideStrike variety, and Americot ng3406 b2xf, a dicamba tolerant variety. Dual Magnum was applied at a rate of 21 fl. oz/A, Outlook at 12 fl. oz/A, and Warrant at 48 fl. oz/A. In the second trial, Liberty was applied at a rate of 29 fl. oz/A, and Dual Magnum at 21 fl. oz/A. In the first trial, treatments were applied to cotton at the 4-leaf growth stage. In the second trial, identical treatments were applied at both 4-leaf and 8-leaf growth stages. Herbicide induced injury was evaluated on a scale of 0-100% with 0 = no injury and 100%=total plant death. Herbicide injury evaluations were taken at 7, 14, 21, and 28 days after application. In the first study, cotton injury was the highest with acetochlor at 7 and 14 days after treatment, 19% and 10%, respectively, but injury leveled off for all three herbicides at 28 days after treatment. In the latter study herbicide injury was higher, anywhere from 5-20% depending on the timing, for all treatments on WideStrike cotton varieties. Injury ratings were also higher, on average, for treatments applied with TTI nozzles. Although injury ratings were higher for certain treatments, there were no differences in cotton yield and there was no correlation between herbicide induced injury and cotton yield for either study suggesting that injury caused by treatments was strictly visual and the cotton crop was able to overcome any injury caused by herbicide applications earlier in the season.

NITROGEN FERTILIZER PROGRAMS FOLLOWING RICE EXPOSURE TO PARAQUAT. B.H. Lawrence*[1], J.A. Bond[1], B.R. Golden[2], H.T. Hydrick[1], H.M. Edwards[1]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Stoneville, AR (253)

ABSTRACT

Due to Mississippi's diverse cropping mixture rice (*Oryza sativa* L.) is grown in close proximity to corn (*Zea mays*), cotton (*Gossypium hirsutum* L.), and soybean (*Glycine max* [L.] Merr.). Preplant herbicide applications in these crops often include paraquat for glyphosate-resistant weed control, and in recent years off-target paraquat movement to rice has increased. Therefore, research was conducted evaluating whether starter fertilizer aides in rice recovery before and/or after exposure to a sub-lethal rate of paraquat and rice response to different nitrogen fertilizer regimes following exposure to a sub-lethal rate of paraquat.

Two studies were conducted in 2016 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to assess whether starter N fertilizer as AMS (21-0-0) promoted rice recovery from exposure to a sub-lethal rate of paraquat, and evaluate rice response to different urea (46-0-0) fertilizer application strategies following exposure to a sub-lethal rate of paraquat. Treatments in both studies were arranged as a two-factor factorial within a randomized complete block design and four replications. Factor A in both studies was paraquat rate and consisting of paraquat at 0 and 0.075 lb ai/A applied to the two- to three-leaf (EPOST) rice growth stage. Factor B in the starter fertilizer study included starter N fertilizer application timing and consisted of no starter N fertilizer, and N fertilizer at 21 lb N/A as AMS applied at spike- to one-leaf rice (VEPOST), EPOST, and three- to four-leaf rice (MPOST). Factor B in the nitrogen management study included N fertilizer application timings and consisted of N fertilizer at 150 lb N/A as urea applied in a single application at four-leaf to one-tiller rice (LPOST); in two sequential applications of 100 and 50 lb N/A applied LPOST followed by PD; in three sequential applications of 75, 37.5, and 37.5 lb N/A applied LPOST followed by 14 d postflood (14 DPF) followed by PD; in four sequential applications of 37.5, 37.5, 37.5, and 37.5 lb N/A applied MPOST followed by LPOST followed by 14 DPF followed by PD; and in four sequential applications of 37.5, 37.5, 37.5, and 37.5 lb N/A applied LPOST followed by 14 DPF followed by PD followed by panicle emergence (5% Heading). In both studies, visual estimates of rice injury were recorded 3, 7, 14, 21, and 28 d after treatment (DAT), and rice height was recorded 14 DAT. The number of days to 50% heading was recorded as an indication of rice maturity. Rice above ground biomass and rough rice yields were collected at maturity. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with $\alpha = 0.05$.

Paraquat injured rice ≥48%, reduced rice height 56%, delayed rice maturity 8 d, and reduced rough rice yield 56% regardless of starter N fertilizer application timing. However, dry weight at maturity was increased at least 12% regardless of starter fertilizer application timing. Results from the starter N fertilizer study indicated that AMS did not aide in rice recovery following exposure to sub-lethal rates of paraquat. Regardless of N fertilizer application strategy, paraquat injured rice ≥50%, reduced rice height 16%, and delayed rice maturity 5 d. Dry weight at maturity was reduced 42% following exposure to a sub-lethal rate of paraquat regardless of N

application strategy. A nitrogen application strategy utilizing four applications with 50% of N fertilizer after panicle differentiation increased rice yield compared with a strategy utilizing two applications. Differences in rice yield were observed due to N fertilizer strategy, but yield loss due to paraquat was at least 58% regardless of N management strategy.

Both studies indicate severe rice growth and development issues can occur from rice exposure to a sub-lethal rate of paraquat. In either fertilizer study rice was unable to overcome early season exposure to paraquat. Adding starter N or manipulating N fertilizer strategies did not aid rice recovery from early-season exposure to paraquat.

IMPACT OF COOL SEASON COVER CROPS AND SELECTED HERBICIDE PROGRAMS ON PALMER AMARANTH POPULATIONS IN COTTON. M.W. Marshall*, C.H. Sanders; Clemson University, Blackville, SC (254)

ABSTRACT

A glyphosate based weed management strategy in cotton in the southern U.S. has resulted in the selection and rapid increase of glyphosate-resistant Palmer amaranth. Cultural programs are urgently needed to manage these weeds that are effective, economic, and sustainable. Heavy plant surface residue significantly reduces the germination of small seeded weeds, such as Palmer amaranth. Therefore, the objectives of this experiment were to determine efficacy of fall planted cover crops on glyphosate-resistant Palmer amaranth populations in cotton and determine impact of selected herbicide programs in conjunction with fall cover crops on cotton growth and yield. Cover crop mixture (rye, oats, turnip, vetch, radish, and clover) was seeded at 70 lb/A between October and December 2012, 2013, and 2014 in half of the field. Cover crops/weedy cover sections were terminated using glyphosate, 2,4-D ester and Valor approximately 20 days before planting. Cotton was planted in mid-May of each year. Reflex at 1.0 pt/A plus diuron at 1.0 pt/A plus paraquat at 3 pt/A was applied shortly after planting followed by POST1 (APT1) [treatments were glyphosate at 32 oz/A plus Warrant at 3 pt/A or Liberty at 29 oz/A plus Dual Magnum at 1.0 pt/A or Liberty at 29 oz/A plus Staple at 2.5 oz/A] at 2-3 lf cotton, POST2 (APT2) [treatments were glyphosate at 32 oz/A + Warrant at 3 pt/A, Liberty at 29 oz/A, or Liberty at 29 oz/A plus Dual Magnum at 1.0 pt/A] at 6-8 lf cotton, and LAYBY [MSMA at 2.67 pt/A plus diuron at 1.0 pt/A] at 18-20 inch cotton. Cover crops significantly reduced early season Palmer amaranth populations compared to no cover crop when combined across treatments. Liberty plus Staple and Dual Magnum significantly reduced Palmer amaranth populations in the no cover regime compared to the glyphosate based programs. In conclusion, fall seeded cover crops appeared to significantly reduce early season emergence of Palmer amaranth from the soil seed bank.

THIFENSULFURON RESISTANCE QUANTIFICATION IN MOUSE-EAR CRESS (*ARABIDOPSIS THALIANA* L.) AND CROSS RESISTANCE TO OTHER ALS INHIBITING CHEMISTRIES. R.S. Randhawa*[1], M.L. Flessner[1], J.H. Westwood[1], C.W. Cahoon[2]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech, Painter, VA (255)

ABSTRACT

A commercial failure of thifensulfuron to control mouse-ear cress in winter wheat was reported in Essex County, Virginia in 2015. Preliminary analysis in the greenhouse confirmed this result. To evaluate suspected thifensulfuron resistance, dose response studies were conducted. Since cross resistance is common among acetolactate synthase inhibiting (ALS) herbicide resistance cases, research was also conducted to assess cross resistance.

For the dose response study, two biotypes, resistant (R) and susceptible (S), of mouse-ear cress were treated with thifensulfuron (Harmony) plus 0.25% v v^{-1} of non-ionic surfactant (NIS) (Activator 90) at the rosette stage. Thifensulfuron rates evaluated were 0.263, 1.31, 2.63, 13.1, 26.3, 131, 263 and 1310 g ai ha^{-1}, which correspond to 0.05, 0.01, 0.5, 0.1, 1, 5, 10 and 50 times of the labeled rate. For the cross resistance study, R mouse-ear cress was subjected to 10 different ALS herbicide treatments. Herbicides included four different ALS chemistries: sulfonylureas {thifensulfuron at 17.5 g ai ha^{-1}, thifensulfuron + tribenuron (Harmony Extra) at 17.5 + 8.7 g ai ha^{-1}, tribenuron (Express) at 8.8 g ai ha^{-1}, mesosulfuron (Osprey) + ammonium sulfate at 15 + 3360 g ai ha^{-1}, prosulfuron (Peak) + ammonium sulfate at 16 + 3360 g ai ha^{-1}}, triazolopyrimidines {pyroxsulam (Poweflex HL) + ammonium sulfate at 18.4 + 3360 g ai ha^{-1}}, triazolinones {flucarbazone (Everest) at 23 g ai ha^{-1}, flucarbazone (Everest;) + ammonium sulfate at 23 + 1680 g ai ha^{-1}} and imidazolinone {imazethapyr (Pursuit) at 52.5 g ai ha^{-1}, imazamox (Raptor) at 35 g ai ha^{-1}}. All the treatments included 0.25% v v^{-1} NIS except imidazolinone herbicides, which included methylated seed oil (MSO) at 1% v v^{-1}. Both studies had a treated (glyphosate at 1260 g ae ha^{-1}) and nontreated check and experiments were setup in randomized complete block design with 10 and 6 replicates per treatment, respectively. Herbicide treatments were made using a spray chamber equipped with 8001 EVS nozzle calibrated to deliver total spray volume of 140 L ha^{-1} at 172 kPa. Above ground dry weight biomass was measured 6 weeks after treatment. For resistance quantification, non-linear regression with log-logistic curve fitting was performed using software RStudio 3.3.0 (RStudio) and Ed_{50} were established for R and S biotypes to calculate the resistance factor. However, for cross resistance study data analysis were performed using JMP 1.1.0 (SAS Institute Inc.). ANOVA was performed and effects were considered significant when $P < 0.05$. Subsequently, data were subjected to means separation using Fisher's protected LSD ($P < 0.05$).

The R biotype of mouse-ear cress was not controlled by 50x rate of thifensulfuron and had a resistance factor of >442 relative to susceptible biotype. Thus, resistance was confirmed. In the cross resistance study, only imidazolinone (IMIs) based herbicides resulted in significantly lower biomass 6 weeks after treatment relative to the nontreated check. Mouse-ear cress was cross resistant to triazolinones and trizolopyrimidines chemistries. Although, resistance to imidazolinone herbicides was not observed these herbicides are not labeled for use in winter wheat. Future research should evaluate the mechanism of resistance as well as alternative herbicidal control options.

GLYPHOSATE-RESISTANT BARNYARDGRASS IN TENNESSEE AND MISSISSIPPI.
L.E. Steckel*[1], J.A. Bond[2], G.B. Montgomery[3], T.L. Phillips[2], V. Nandula[4]; [1]University of Tennessee, Jackson, TN, [2]Mississippi State University, Stoneville, MS, [3]University of TN, Jackson, TN, [4]USDA, Stoneville, MS (256)

ABSTRACT

After initial farmer complaints in Tennessee, seed from a suspected resistant (R) population of barnyardgrass were collected and grown simultaneously with seed from a known susceptible (S) population in a greenhouse simulating conditions similar to those found in west Tennessee in June - July. Glyphosate was applied to each population at rates of 0.193, 0.385, 0.77, 1.54, and 3.08 lb ae/A. The initial assessment indicated that the S population was controlled 91 and 99% with the 0.77 and 1.54 lb ae/A rates, respectively, while the R population was only controlled 55 and 84% with the 1.72 and 3.44 lb ae/A rates, respectively. Although total control was not achieved with the 3.08 lb ae/A rate on the R population, plants from this treatment did not produce viable seed. Only plants from the R population treated with 1.54 lb ae/A or less produced viable seed.

Experiments were then conducted using rates of 0, 0.25, 0.5, 0.75, 1, and 1.25X of the 0.77 lb ae/A rate of glyphosate on the S population and rates of 0, 0.5, 1, 2, 4, and 8X of the 0.77 lb ae/A rate of glyphosate on the R population. Each population was treated with the respective rates of glyphosate when plants reached 15 cm in height and biomass was collected 28 DAT. A mixed analysis using only the 0, 0.5, and 1X rates of glyphosate from each population indicated a main effect of population. Biomass from the R population was significantly higher than that of the S population. However, a dummy regression looking at the percent biomass reduction from each population indicated that the slope for the R population was approximately 4X greater ($P<.0001$) than that of the S population with increasing glyphosate rate.

Progeny from barnyardgrass that was treated with either 0.77 or 1.54 ai ae/A were grown out to 15 cm tall, treated with 1.54 lb ae/A, and survived to produce seed. This provides evidence of heritability of the glyphosate-resistance trait and suggests that glyphosate-resistance evolution in barnyardgrass in Tennessee has occurred.

Research was conducted to evaluate barnyardgrass control with glyphosate mixed with selected herbicides. The experiment was conducted in 2016 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS. Treatments were arranged as a two-factor factorial within a randomized complete block design with four replications. Factor A was glyphosate rate and included no glyphosate and glyphosate at 0, 0.77, and 1.16 lb ae/A. Factor B was tank-mix herbicide and included no tank-mix herbicide, dicamba at 0.5 lb ae/A, 2,4-D at 1 lb ae/A, fomesafen at 0.35 lb ai/A, saflufenacil at 0.045 lb ai/A, and clomazone at 0.5 lb ai/A. Treatments were applied when barnyardgrass was 17 to 28 inches in height with six to eight leaves. Barnyardgrass control was visually estimated 7, 14, 21, and 28 days after application (DAT).

Barnyardgrass control was reduced 7 and 14 DAT when fomesafen or saflufenacil were added to the lower rate of glyphosate but not the higher rate. Dicamba reduced barnyardgrass control 7

and 14 DAT when added to either rate of glyphosate. The only tank mixture that influenced barnyardgrass control with glyphosate at 21 and 28 DAT was fomesafen. Barnyardgrass control was lower with fomesafen plus either rate of glyphosate 21 DAT; however, control was reduced only when fomesafen was mixed with the lower rate of glyphosate 28 DAT.

When the weed spectrum present requires a tank mixture with glyphosate, the rate should be increased to at least 1.16 lb/A and clethodim at 0.09 lb ai/A should be added to avoid reductions in control of barnyardgrass. In summary, data from Tennessee and Mississippi would suggest that the evolution of glyphosate-resistance in barnyardgrass is ongoing to various degrees in these states.

RICE CULTIVAR RESPONSE TO LATE-SEASON EXPOSURE TO GLYPHOSATE OR PARAQUAT. J.M. McCoy*[1], J.A. Bond[1], B.R. Golden[2], B.H. Lawrence[1]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Stoneville, AR (257)

ABSTRACT

In 2016 4.2 million acres of principal crops were planted in the state of Mississippi. Of this acreage, 194,000 acres were devoted to rice production in 2016. The close proximity to other crops such as cotton (*Gossypium hirsutum* L.), corn (*Zea mays*), and soybean [*Glycine max* (L.) Merr.], creates a great potential for off-target herbicide movement onto rice fields. The growing adoption of harvest-aid use in soybeans throughout Mississippi only furthers the risk of late season exposure to off-target herbicide movement. Therefore, research was conducted evaluating rice response across multiple cultivars to late-season exposure to glyphosate or paraquat.

Research was established in 2016 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate rice grain yield and yield component response to late season off-target herbicide movement. Secondary objectives of this research were to identify differences in visual injury response across multiple rice cultivars and identify differences in visual injury response across multiple herbicide chemistries. Treatments were arranged in a randomized complete block with a five (rice cultivars) × three (herbicide chemistry) factorial. The rice cultivars evaluated were CLXL745, XL753, CL163, Rex and Jupiter. Herbicide chemistries evaluated were none (0 lb ai/A), glyphosate (0.1125 lb ae/A) and paraquat (0.025 lb ai/A). Rates were based on 0.10 of the labeled harvest-aid rate in Mississippi. Herbicides were applied at a constant carrier volume of 140 L/ha with a CO_2 pressurized backpack sprayer. Herbicide applications were initiated at the 50% heading growth stage of each respective cultivar. Visual estimates of rice injury were recorded 3, 7, 14, 21, and 28 day after treatment. At maturity a small plot combine was utilized to harvest each plot and collect rough rice yields. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with $\alpha = 0.05$.

Visual estimates of injury from glyphosate were not observed across all cultivars. Paraquat application produced visual injury estimates ranging from 5 to 25%. Hybrid cultivars (CLXL 745 and XL 753) were observed to incur less injury than inbred cultivars. Rex and Jupiter sustained the greatest visual injury estimates in response to paraquat application. Rice grain yield was influenced by late-season exposure to glyphosate and paraquat. Yield reduction from the untreated control ranged from 3 to 32% across cultivar and herbicide chemistries. Hybrid cultivar yield reduction averaged 4 and 8% for glyphosate and parquat and was not different than the untreated control. Grain yield reduction for inbred cultivars ranged from 14-32% to 18-28% for glyphosate and paraquat respectively. Cultivar Rex was unaffected by application of glyphosate or paraquat. However, glyphosate significantly reduced yield of CL 163 and Jupiter. Jupiter was also observed to sustain significant yield reductions from paraquat application.

Preliminary research suggests that rice cultivars may differ in response to exposure to glyphosate and paraquat. Further research will be required to validate and quantify the differential response of cultivars to late-season off target herbicide movement.

WHAT HAVE WE LEARNED AFTER A YEAR OF ON-FARM RESEARCH ON PPO-RESISTANT PALMER AMARANTH? J.K. Norsworthy*[1], T. Barber[2], R.C. Scott[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (258)

ABSTRACT

In Arkansas today, Palmer amaranth has evolved resistance to four herbicides sites of action: G2 (ALS inhibitors), G3 (microtubule assembly inhibitors), G9 (EPSPS inhibitors), and G14 (PPO inhibitors). Actually, populations of Palmer amaranth exist with multiple resistance to all four of the aforementioned herbicide sites of action. With PPO-resistant Palmer amaranth first documented in the summer of 2015, on-farm trials were conducted in 2016 at Crawfordsville, Marion, and Gregory with the intent of developing sound recommendations for managing this weed using preemergence and postemergence herbicides across the various soybean technologies that are registered or will soon be registered. Nineteen soil-applied herbicides were evaluated in two trials in Crawfordsville, and seventeen postemergence herbicides were evaluated in trials at Crawfordsville and Marion. Additionally, 26 residual herbicide programs targeting PPO-resistant Palmer amaranth were tested in ten trials across the three locations. Palmer amaranth control was evaluated 26 to 28 days after applying the preemergence herbicides. Subsequently, either Engenia, Liberty + Prefix, Roundup PowerMax + Prefix, or Enlist Duo + Dual Magnum was applied depending on the technology present in each preemergence program trial. Overall conclusions drawn from this research were that PPO-inhibiting herbicides provide marginal residual control of the resistant biotype and even less control when applied postemergence. The PPO-resistant biotype appears to have increased tolerance to most herbicides evaluated based on the lower than expected efficacy in light of the residual herbicides being adequately activated and the postemergence herbicides applied to nonstressed plants. Generally, multiple herbicides were needed at planting to achieve a high level of control, and even complete control was unobtainable with all programs including three-way mixtures. When directly comparing technologies across all preemergence herbicide programs, the LibertyLink system offered superior Palmer amaranth control over both the Xtend and Roundup Ready systems. Averaged across all preemergence herbicides, the Enlist system was numerically less than the LibertyLink system; however, both systems were statistically similar. In regards to the Roundup Ready system, Palmer amaranth control averaged 55% across all preemergence herbicide programs when followed by Roundup PowerMax + Prefix, indicating this technology is no longer feasible in fields heavily infested with resistant similar to those evaluated in these trials.

TOLERANCE OF LIBERTYLINK VARIETIES TO PREEMERGENCE AND POSTEMERGENCE APPLICATIONS OF THIENCARBAZONE-METHYL. Z.D. Lancaster*, J.K. Norsworthy, J.A. Godwin, N.R. Steppig; University of Arkansas, Fayetteville, AR (259)

ABSTRACT

Herbicide-resistant weeds are a growing problem in the U.S. and around the world. To combat herbicide-resistant weeds, new options are needed to effectively rotate herbicide modes of action, and slow the development of additional herbicide resistance. Bayer CropScience is currently evaluating thiencarbazone-methyl (TCM), an ALS (acetolactate synthase inhibiting) herbicide, for preemergence and postemergence activity on many troublesome Midsouth weeds in soybean. ALS-resistant soybeans are common across the Midsouth, however it is unknown the level of tolerance these varieties have to TCM. Thus, multiple field experiments were conducted across Arkansas in the summer of 2016 to determine the tolerance of ALS-resistant soybean varieties to preemegence and postemergence applications of TCM. The experiment was set up as a strip-plot, randomized complete block design with the whole plot being a two-factor factorial of TCM rate and application timing, with the Strip-plot factor being soybean variety. TCM treatments evaluated were either TCM at 33.5 g ai ha^{-1} or TCM at 67 g ha^{-1}. Application timings were either preemergence or postemergence (V4 soybean growth stage). Ten total soybean varieties were evaluated. Herbicide applications were made with a CO_2-backpack sprayer at 143 L ha^{-1}. Data were collected on soybean injury at 14, 28, 42, and 56 days after application (DAA), crop height 14 DAA, and soybean yield. For all locations no significant interactions or main effects were observed for any parameters evaluated. Overall, soybean injury remained consistently low with <3% injury at 42 DAA. Soybean varieties showed no significant yield difference between plots treated with TCM and non-treated controls. This research shows that ALS-resistant soybean varieties exhibit high levels of tolerance to TCM, with no negative effects to be expected from either preemergence or postemergence applications

PREEMERGENCE AND POSTEMERGENCE CONTROL OF PPO-RESISTANT PALMER AMARANTH IN LIBERTYLINK SOYBEAN. M.M. Houston*[1], T. Barber[2], J.K. Norsworthy[1], J.S. Rose[1], H.D. Bowman[1], A. Ross; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (260)

ABSTRACT

As soybean continues to be the dominant crop produced in Arkansas, effective weed control remains important for growers. One focus of weed control in the Midsouth is the rapid spread of protoporphyinogen oxidase (PPO)-resistant Palmer amaranth, which has now been confirmed in seven states. PPO-inhibiting herbicides, which have been a staple in herbicide programs since establishment of glyphosate-resistant Palmer and are primarily used as a preemergence (PRE) application. LibertyLink® soybean, which is resistant to glufosinate, has become one of the only postemergence (POST) herbicide options for control of glyphosate/PPO-resistant Palmer amaranth. In 2016, on-farm field trials in Marion, Gregory, and Crawfordsville, AR were conducted to assess PPO-resistant Palmer amaranth control. These trials consisted of twenty-six treatments with four replications and were complete randomized block designs. In Marion, two separate applications of glufosinate (0.594 kg ha^{-1}) were made, with only the first application including Prefix™ (fomesafen at 0.267 kg ha^{-1} + S-metolachlor 1.2 kg ha^{-1}). Results show that treatments that do not include metribuzin or pyroxasulfone such as sulfentrazone + chloransulam-methyl or flumioxazin have average control ratings less than 80%. Treatments that do include metribuzin in combination with pyroxasulfone or metolachlor have control ratings above 85%. Glufosinate after the first and second application increased control slightly but ratings were not significantly different among preemergence treatments. Recommendations of PRE applications containing multiple effective modes of action followed by two POST applications of glufosinate plus a residual POST is needed to minimize selection for glufosinate resistance in Palmer amaranth. Additionally, applications of glufosinate should be made before Palmer amaranth reaches 10 cm in height to maximize efficacy.

EFFECT OF FORMULATION ON PYROXASULFONE DISSIPATION IN A WHEAT FIELD SOIL ENVIRONMENT. T.C. Mueller*; University of Tennessee, Knoxville, TN (125)

ABSTRACT

Ryegrass control in wheat has been challenged by resistance development to several commonly used herbicides. Pyroxasulfone is a herbicide that inhibits very long chain fatty acid synthesis and may be used to control ryegrass and other weeds in wheat. This molecule is somewhat unique because it is sold by three different companies with three different formulations. The objective of the study was to determine what effect, if any, the different formulations had on pyroxasulfone dissipation in a winter wheat production system. Field plots (3 x 10 m) were established in Knoxville Tennessee in the Fall of 2014 and 2015, with three sets of studies conducted with initial applications on September 30 and October 22, 2014 and on October 26, 2015. The dosage of each herbicide was 100 g AI per hectare of pyroxasulfone. Treatments included an EC formulation (trade name Anthem), a dry formulation of pyroxasulfone alone (Zidua), and a dry formulation that also included flumioxazin (Fierce). Commercial herbicide formulations were applied in 190 L/ha of water carrier using flat fan nozzles and small plot spray equipment. Soil samples were collected from 0 to 10 cm depth immediately after each herbicide application, and at approximately weekly intervals for seven weeks. At the end of the sampling interval soil temperatures were at or near freezing, thus soil sampling was not possible and it was probable that pyroxasulfone dissipation was minimal. A soil sample was taken the following spring for analysis. After collection soil samples were frozen until later analysis which consisted of methanol extraction of 40 g of moist soil followed by analysis using LC MS. Pyroxasulfone concentrations were compared to external standards prepared from analytical pyroxasulfone. The concentrations were regressed to fit a simple first order regression equation using SigmaPlot 12.5 software. This regression analysis produced a first-order rate constant which was then used to calculate a half-life in days for each respective dissipation curve. Half-lives range from 15 to 52 days with an overall average of 31 days. Half-lives averaged over the three data sets indicated no affect of formulation on differential dissipation of pyroxasulfone.

EVALUATION OF SETHOXYDIM FOR TORPEDOGRASS CONTROL IN AQUATIC SYSTEMS IN FLORIDA. S.F. Enloe*; University of Florida, Gainesville, FL (126)

ABSTRACT

Torpedograss (*Panicum repens*) is an invasive grass that is very difficult to manage in aquatic systems. For many years, non-selective treatments of glyphosate and imazapyr have been the only options that provide meaningful control. However, the lack of selectivity with both herbicides has resulted in considerable non-target damage to many desirable plant species. To address this, the selective graminicide sethoxydim received an experimental use permit in Florida in 2015. Under that permit, in 2016, we evaluated sethoxydim efficacy on torpedograss in a constructed wetland near Bonita Springs, FL. Treatments consisted of single or sequential broadcast applications of sethoxydim at 0.5 kg/ha and a glyphosate + imazapyr commercial standard. Sequential treatments were applied at 14 or 14 and 28 days after initial treatment (DAIT). The experiment was initiated on April 27, 2016 and was repeated beginning on May 27, 2016. For both experimental runs, torpedograss visual control data was collected at 30, 60, 90, and 180 DAIT. Additionally, live green torpedograss cover was estimated in three randomly placed one square meter quadrats at 180 DAIT. Live belowground biomass was quantified at 90 and 180 DAIT with a 15 cm diameter aquatic sediment sampler to a depth of 30 cm. Single applications of sethoxydim resulted in poor visual control at all sample dates. However, sequential (two or three sethoxydim treatments) resulted in torpedograss visual control and comparable to the glyphosate + imazapyr commercial standard at 60, 90, and 180 DAIT. However, sequential sethoxydim treatments did not negatively impact torpedograss rhizomes to the extent of the glyphosate + imazapyr treatment. These results indicate that repeated applications of sethoxydim may be useful for torpedograss control and may be most useful when selectivity is needed.

MORPHOLOGICAL IDENTIFICATION AND HERBICIDE EFFICACY OF WATER PRIMROSE COMPLEX (*LUDWIGIA URUGUAYENSIS*) IN FLORIDA. A. Banu*, C.C. Jacono, S.F. Enloe; University of Florida, Gainesville, FL (127)

ABSTRACT

The water primrose complex (*Ludwigia uruguayensis*) has become one of the most serious problems in many Florida lakes over the past few years. Its rapid spread, coupled with the formation of dense mats and subsequent difficulty in control has become a great concern. Furthermore, variable morphology has been observed between populations and there is a lack of clear taxonomic and morphological characters to assist aquatic managers in field identification. Therefore, the objectives of this study were to identify morphological characters to recognize taxonomic types of *L. uruguayensis* populations in Florida and to evaluate their response to commonly used herbicides. For the morphological study, plants were collected from five different lakes in Florida and grown in stock tanks under common garden conditions. Twelve vegetative and floral morphological parameters were quantified from these accessions as well as multiple field sites. Quantitative morphological characters were analyzed using ANOVA and Tukey's HSD and qualitative morphological characters were analyzed using contingency tables and a chi-squared test. Results showed the presence of two clearly distinct species *Ludwigia hexapetala* and *Ludwigia grandiflora* in Florida and also the presence of intermediate types within *L. grandiflora*. A greenhouse bioassay was conducted on five accessions collected from five lakes in Florida to evaluate their response to the herbicides imazamox, triclopyr and glyphosate. Seven rates of each herbicide were compared with an untreated control. Shoot regrowth dry weight data at 70 days after treatment (DAT) was transformed to binomial data (alive vs dead). A two-parameter log-logistic model appropriate for binomial data was used to estimate the herbicide dose causing 50% mortality (LD_{50}) for each accession. Results indicated there was differential herbicide sensitivity among Florida populations. These studies will assist aquatic managers both in taxonomic identification of target Ludwigia species and in proper herbicide selection for management.

TANK CLEANING PRODUCT COMPARISON TO REMOVE AUXIN-TYPE HERBICIDE RESIDUES FROM SPRAY EQUIPMENT. T.C. Mueller*[1], M.L. Bernards[2]; [1]University of Tennessee, Knoxville, TN, [2]Western Illinois University, Macomb, IL (128)

ABSTRACT

A search of the refereed literature found no citations on the topic of tank cleaners. This report details our efforts to provide an objective assessment of commercially available tank cleaning agents to remove residues of dicamba or 2,4-D from simulated spray tank components. An overview of the method consists of applying a known amount of herbicide to simulated tank parts (in this study EPDM sheets which would be comparable to hose material used in some commercial spray equipment), allowing that material to dry, removing them with various tank cleaner treatments, and quantifying the difference using chemical assay. Preliminary studies showed that physically abrading the EPDM surface altered pesticide adherence to the EPDM sheet. For this study we conducted separate studies with dicamba or 2,4-D (both at normal field use rates) plus glyphosate at 1.1 kg ae/ha in the spray mixture of 94 L/ha. The tank parts were placed into a fume hood and 1.0 mL of the spray solution was added in 16 to 24 drops to the top of each tank part. These parts were then allowed to dry in a fume hood for approximately 12 hours at room temperature. Tank cleaners were prepared by adding 0.25% v/v per label instructions (this was 1.0 ml into 400 mL). Each 5*10 cm EPDM sheet was inserted in 400 mL of each respective tank cleaner for 5 seconds. An aliquot of the tank cleaner rinsate water was diluted for later analysis on LCMS for each respective herbicide. Another type of data measured was the pH of the tank cleaner solution. There were statistically different pHs and recoveries from the various tank cleaners. All treatments were also compared to a control treatment where the initial 1.0 mL of herbicide mixture was placed directly into a 1000 mL bottle as a comparison. For dicamba, the order of most effective tank cleaners was FS Rinseout ≥ Ammonia = water alone > Purus = All Clear = Neutralize = Wipeout = Innvictis. For 2,4-D choline salt the order starting with most effective was FS Rinseout = Ammonia = water only ≥ Innvictis > Purus = All Clear = Neutralize = Wipeout. These preliminary data indicated only minor benefits of using the commercial tank cleaners, although further studies on different tank components still need to be conducted.

PRE-EMERGENCE WEED MANAGEMENT PROGRAM WITH PENOXSULAM IN APPLE (*MALUS DOMESTICA*) AND PEACH (*PRUNUS PERSICA*) ORCHARDS. W.E. Mitchem and C. Holmberg. N.C. State University. Mills River, NC (129)

ABSTRACT

Penoxsulam is a triazolopyrimidine sulfonamide herbicide that is market by Dow AgroSciences in premix with oxyfluorfen as Pindar GT. Pindar GT is currently registered for use in tree nuts, as well as pome and stone fruits in several west coast states (CA, WA, OR, ID). Oxyfluorfen is a desirable partner for penoxsulam because it controls certain weed species important in the western United States. In the eastern United States the oxyfluorfen component restricts Pindar GT use, allowing applications only after completion final harvest through fruit tree bud swell.

In 2016 we evaluated penoxsulam with and without the oxyfluorfen component. Trails were conducted in a peach orchard in Edgefield County, SC and in an apple in orchard in Henderson County, NC. Treatments for the peach trial consisted of a December 3, 2015 application of penoxsulam at 0.011 and 0.015 lb ai A^{-1}, flumioxazin at 0.19 lb ai A^{-1}, and indaziflam at 0.045 lb ai A^{-1}. Two treatments consisted of sequential applications with initial being on December 3, 2015 and a second application on March 7, 2016. The herbicides for the sequential treatments consisted of penoxsulam at 0.011 lb ai A^{-1} + oxyfluorfen at 1 lb ai A^{-1} followed by (fb) penoxsulam at 0.011 lb ai A^{-1} + oxyfluorfen at 1 lb ai A^{-1} + oryzalin at 4 lb ai A^{-1} and simazine at 2 lb ai A^{-1} fb flumioxazin at 0.19 lb ai A^{-1}. In the apple trial all treatments were applied as sequential applications with the initial application occurring March 18, 2016 fb a second application on June 14, 2016. The herbicide treatments consisted of penoxsulam at 0.011 or 0.015 lb ai A^{-1} fb a second application of penoxsulam at the same rate, penoxsulam at 0.011 or 0.015 lb ai A^{-1} + oryzalin at 2 lb ai A^{-1} fb by the same, penoxsulam at 0.011 lb ai A^{-1} + oxyfluorfen at 1 lb ai A^{-1} fb diuron at 1.6 lb ai A^{-1}, penoxsulam at 0.015 lb ai A^{-1} + oxyfluorfen at 1 lb ai A^{-1} fb diuron at 1.6 lb ai A^{-1}, indaziflam at 0.045 lb ai A^{-1} fb the same. All treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 20 gal. A^{-1} at 40 psi, fitted with 8002 flat fan TeeJet nozzles. Visual observations were made to evaluate herbicide efficacy. Observations were made in the peach trial on March 22 (correlated to peach tree bloom) and April 13, 2016 and on June 12 and August 28, 2016 in the apple trial.

All treatments in the peach trial provided adequate control of horseweed (*Conyza canadensis*), and cutleaf eveningprimrose (*Oenothara lanciniata*) on March 22. All the penoxsulam treatments provide 100 % cutleaf eveningprimrose control; better than the 93% and 88% provided by simazine and indaziflam, respectively, on March 22. All penoxsulam treatments provided 100% horseweed control on April 13, exceeding control by the remaining treatments (80 to 90%). Cutleaf eveningprimrose control on April 13 was similar among all treatments.

In the apple trial indaziflam applied sequentially provided 88% and 93% white clover (*Trifolium repens*) control and bare ground, respectively, which was less than control by all other treatments on June 12. On Aug. 28 all treatments provided similar goosegrass (*Eluesine indica*) control (88 to 96 %) and excellent (95 to 100%) white clover control. Penoxsulam + oxyfluorfen fb diuron, penoxsulam applied sequentially at 0.015 lb ai A^{-1}, or at 0.01 or 0.015 lb ai A^{-1} with oryzalin provided similar levels of bare ground. Bare ground control provided by penoxsulam at 0.01 lb

ai A^{-1} + oxyfluorfen at 1 lb ai A^{-1} fb diuron and penoxsulam at 0.015 lb ai A^{-1} alone and with oryzalin exceeded that provided by indaziflam.

HANDWEEDING ORGANIC VIDALIA SWEET ONION: COST, BENEFITS, AND PRACTICALITY. W.C. Johnson III*; USDA-ARS, Tifton, GA (130)

ABSTRACT

Organic Vidalia® sweet onion is a highly profitable production system, but weed control is difficult. Research since 2007 has consistently shown that repeated cultivation with a tine weeder provides significant weed control, while herbicides derived from natural sources are too costly and consistently ineffective. Despite the proven benefits of cultivation with a tine weeder, there is a practical limit to weed control efficacy. Densities of cutleaf eveningprimrose (the most common and troublesome weed of organic onion production) were reduced by 59 to 92% by cultivation compared to the non-cultivated control in numerous trials from 2007 to 2015. Similarly, cultivation increased onion yields by 77% over the non-cultivated control during the same time period. However, weeds escaping control by cultivation were very large at the time of harvest and undoubtedly cause losses. Given the substantial profit margin of organic Vidalia® sweet onion, it was hypothesized that a single (i.e. 'once-over') handweeding to control weeds escaping control by cultivation would be beneficial and cost-effective. Trials were conducted in 2014 and 2015 at the Vidalia Onion and Vegetable Research Center near Lyons, GA. The experimental design was a factorial arrangement of three levels of bi-weekly cultivation with a tine weeder (2X, 4X, and non-cultivated control), two levels of herbicide treatment with *d*-limonene (one application and a non-treated control), and two levels of handweeding (one handweeding after cultivation and no handweeding). Data measured included weed counts, graded onion yield, and time to handweed individual plots. Cultivation 2X and 4X reduced densities of cutleaf eveningprimrose, swinecress, and henbit compared to the non-cultivated control, with no difference between cultivation 2X and 4X. Onion yields were similarly improved by cultivation. Treatment with *d*-limonene had no effect on weed densities and graded onion yield. A single handweeding after cultivation reduced final densities of all weeds and increased onion yields. Cutleaf eveningprimrose was the predominant weed both years with densities averaging 31 and 139 plants/m^2 in 2014 and 2015, respectively. In 2014, cultivation followed by handweeding increased onion yields enough to justify the cost of handweeding, and returns from handweeding investment averaged $2,220 and $3,040/A for cultivation 2X and 4X, respectively. With greater weed densities, returns from investing in handweeding were much greater in 2015 compared to 2014. In 2015, handweeding following cultivation increased onion yields enough to justify the cost of handweeding and returns from handweeding investment averaged $6,430 and $9,380/A for cultivation 2X and 4X, respectively. Based on these results, handweeding used to supplement cultivation in organic onion production is an economically viable option due to the high profit margin of the crop and yield response from improved weed control. In locations with history of intense weed pressure, the need for supplemental handweeding should be anticipated due to likelihood of numerous weed escapes. In this scenario, intense cultivation with a tine weeder supplemented by handweeding to control escapes maximizes profits in this lucrative specialty crop.

PREEMERGENCE APPLIED FLURIDONE: POTATO (*SOLANUM TUBEROSUM*) TOLERANCE AND WEED CONTROL. C.W. Cahoon*[1], M.L. Flessner[2], T. Hines[1]; [1]Virginia Tech, Painter, VA, [2]Virginia Tech, Blacksburg, VA (131)

ABSTRACT

Fluridone, a Group 12 herbicide, inhibits phytoene desaturase, an enzyme necessary in the biosynthesis of carotenoids. With norflurazon no longer sold for cotton, no Group 12 herbicides currently are used on agronomic crops in the U.S. Development of glyphosate- and ALS-resistant palmer amaranth renewed interest in using fluridone for residual control of this weed in cotton. Sweetpotato tolerance to fluridone is also reported to be good. Currently, potato producers rely primarily on metribuzin and s-metolachlor for preemergence weed control. However, there is growing concern over weeds developing resistant to triazine herbicides (metribuzin). To be proactive in avoiding herbicide resistant weeds, potato producers need an expanded portfolio of herbicides. The objectives of this research were to determine potato tolerance to fluridone and evaluate weed control by residual combinations including fluridone for use in potato. Two experiments (potato tolerance and weed control) were conducted at the Eastern Shore Agriculture Research and Extension Center near Painter, VA during 2016. Soil at the research site was sandy loam with 1% organic matter and pH 5.8. Common ragweed was the most prominent weed in the weed control study. Potato in both studies were planted on March 18, 2016. At 19 days after planting, hilling followed by drag-off operations were preformed just prior to applying residual herbicides preemergence. All herbicides were applied using a CO_2-pressurized backpack sprayer calibrated to deliver 20 GPA at 24 PSI. For the potato tolerance study, fluridone was applied after drag-off at 0, 0.1, 0.15, 0.2, 0.4, and 0.8 lb ai/acre. Fourteen days after preemergence (DAP), fluridone at 0.1, 0.15, 0.2, 0.4, and 0.8 lb ai/A injured potato 7, 19, 23, 42, and 66%, respectively. Little potato injury was observed by the 0.1, 0.15, and 0.2 lb ai/A rates of fluridone at 56 DAP. However, 0.4 and 0.8 lb ai/A of fluridone injured potato 37 and 62% 56 DAP. Potato yield in plots treated with 0.1, 0.15, 0.2, and 0.4 lb ai/A fluridone yielded similarly to non-treated plots. The 0.8 lb ai/A rate of fluridone reduced potato yield approximately 50 cwt/A.

For the weed control study, fluridone, fomesafen, metribuzin, and *s*-metolachlor were applied alone at 0.15, 0.25, 0.31, and 1.3 lb ai/A, respectively. Combinations of these herbicides also evaluated included fluridone + fomesafen, fluridone + *s*-metolachlor, fluridone + metribuzin, fomesafen + *s*-metolachlor, metribuzin + *s*-metolachlor, fluridone + fomesafen + *s*-metolachlor, fluridone + fomesafen + metribuzin, and fomesafen + metribuzin + *s*-metolachlor. At 42 DAP, fluridone alone, fomesafen alone, metribuzin alone, and *s*-metolachlor alone controlled common ragweed 72, 97, 75, and 23%, respectively. All combinations except fluridone + *s*-metolachlor (85%) controlled common ragweed 90% or better 42 DAP. Potato yielded 298 cwt/A or greater in all treatments except combinations that included both fluridone and metribuzin. Plots treated with fluridone + metribuzin and fluridone + fomesafen + metribuzin yielded 271 and 266 cwt/A, respectively.

Overall, potato tolerance to fluridone is good. However, additional studies conducted under varying environmental conditions are needed to determine if potato tolerance is acceptable. Fluridone provided similar weed control to commonly used potato herbicides. If

potato tolerance to fluridone proves acceptable, potato producers will have another mode of action at their disposal, thus reducing the risk of metribuzin-resistance.

SQUASH AND COLE CROP RESPONSE TO HALOSULFURON APPLIED PREPLANT OVER MULCH. T. Randell*, S.C. Jenna, A.S. Culpepper; University of Georgia, Tifton, GA (132)

ABSTRACT

Nutsedge species are the most problematic weeds for Georgia vegetables grown on plasticulture. This is likely a result of its ability to penetrate the mulch, germinate from deep depths enabling tolerance to deep turning, and reproduce rapidly in mulched systems. Grower's rely heavily on halosulfuron to manage nutsedge where labeled; however, labels do not allow halosulfuron to be applied over mulch prior to planting any crop. Halosulfuron applied prior to planting would be extremely valuable for growers; especially those who produce multiple crops on a single mulch installation. Experimental objectives were to better understand the relationship of halosulfuron and plastic mulch, in regards to injury of broccoli and squash.

The broccoli experiment was conducted twice during 2016 in TyTy, Georgia. Halosulfuron (Sandea) was applied at 0.072 lb ai/A 3 wk, 2 wk, 1 wk, and 1 d prior to transplanting and included a surfactant (0.25% v/v). Additional treatments included halosulfuron at 0.144 lb/A applied 3 wk prior to transplanting and a non-treated control. Rainfall of 19, 13, 12, and 0 cm was recorded for applications made 3 wk, 2 wk, 1 wk, or 1 d prior to transplanting, respectively, for the first location. For the 2nd location, only 2.0 to 3.3 cm of rainfall was received over the treatment window. For both locations, 3.8 to 4.8 cm of rainfall/irrigation occurred during the first 10 d after transplanting. Pooled over locations, halosulfuron at 0.072 lb/A visually injured broccoli 25, 37, 58, and 85% when applied 3 wk, 2 wk, 1 wk, or 1 d prior to transplant, respectively. Halosulfuron at 0.072 lb/A reduced marketable head weights 0, 29, 46, and 95% when applied 3 wk, 2 wk, 1 wk, or 1 d prior to transplant, respectively. With halosulfuron at 0.144 lb/A applied 3 wk before planting, 32% visual injury of broccoli was noted without yield loss occurring.

The squash experiment was conducted three times; once in 2013, 2015, and 2016. Treatments were identical to the broccoli study above. Rainfall patterns in 2013 and 2015 were similar with 8, 6, 6, and 0 cm for applications made 3 wk, 2 wk, 1 wk, or 1 d prior to transplanting, respectively. In 2016, rainfall was nearly double that in previous years. For all locations, rainfall/irrigation during the 1st 10 d after planting was 6 to 9.6 cm. Pooled over locations, halosulfuron at 0.072 lb/A visually injured squash 2, 3, 16, and 40% when applied 3 wk, 2 wk, 1 wk, or 1 d prior to transplanting, respectively. Halosulfuron at 0.072 lb/A reduced the number of marketable fruit 0, 11, 21, and 40% when applied 3 wk, 2 wk, 1 wk, or 1 d prior to transplant, respectively. With halosulfuron at 0.144 lb/A applied 3 wk before planting, 15% visual injury of squash was noted without yield loss occurring.

VEGETABLE RESPONSE TO GLUFOSINATE APPLIED PREPLANT OVER MULCH OR APPLIED IN ROW MIDDLES. J.C. Smith*1, A.S. Culpepper1, K. Stewart1, K. Rucker2; 1University of Georgia, Tifton, GA, 2Bayer CropScience, Tifton, GA (133)

ABSTRACT

Georgia vegetables account for a farm gate value of nearly $1 billion. Fifteen of the 33 vegetable crops included in the farm gate value report are grown in mulched production systems. Fumigants and herbicides are both critical tools for controlling weeds in mulched systems and are usually effective through the first crop. However, growers in Georgia usually produce 3 to 5 or more crops on a single mulch installation. This practice limits weed control options, especially in crops 2 and beyond, which often leads to poor weed control and heavy weed seed bank populations. Additional herbicidal tools allowing growers to control a previous crop and weeds infesting that crop are badly needed. Additionally, growers would benefit from additional herbicides that could be applied in vegetable row middles. Thus, two experiments were conducted to determine the potential use for glufosinate in vegetables as both a preplant over mulch application prior to transplanting and as a row middle spray.

Experiment one evaluated vegetable response to glufosinate applied over mulch prior to transplanting. Two rates of glufosinate (0.6 or 1.2 lb ai/A) were applied over low density polyethylene mulch followed by either washing the mulch (irrigation of 0.33 inch) or no washing. Bell pepper, cucumber, yellow summer squash, watermelon, and tomato were transplanted within 24 hr after mechanically poking holes through the mulch. Visual injury was not detected when glufosinate was washed from the mulch. When not washing from the mulch, glufosinate at 1.2 lb/A caused 5, 75, 31, 10, and 16% injury for bell pepper, cucumber, squash, tomato, and watermelon, respectively. Crop biomass taken 1 month after transplanting also noted glufosinate had no effect on crops when washed from the mulch; however, biomass reductions of 32, 88, 45, 27, and 18% with 1.2 lb/A were noted for the aforementioned crops. Washing herbicides such as glyphosate and paraquat from the mulch prior to planting are standard practices; thus, glufosinate could be implemented easily by growers for improved weed control without injury concerns if registrations are obtained.

Experiment two determined tomato tolerance to glufosinate applied as a row middle spray (0.6 or 1.2 lb/A), directed spray (0.15 or 0.6 lb/A), and a topical spray (0.15 or 0.6 lb/A). Row middle applications caused no visual injury and did not negatively impact yield (fruit numbers, fruit weights, or fruit sizes). Directed applications made 2 inches up a 7-inch plant caused 43 and 58% injury with 0.15 and 0.6 lb/A, respectively. Topical applications were more injurious with 65 and 100% damage noted with glufosinate at 0.15 and 0.6 lb/A, respectively. Directed and topical applications reduced yield 67 to 100%. Row middle applications of glufosinate applied with shielded or hooded sprays, which are standard practices, would improve weed control options without injury concerns.

POSTEMERGENCE WEED CONTROL IN ROW MIDDLES OF PLASTICULTURE VEGETABLE PRODUCTION. P.J. Dittmar*[1], N.S. Boyd[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Wimauma, FL (134)

ABSTRACT

Glufosinate tolerances in food crops are expanding to include many fruit and vegetable crops. Glufosinate could be applied preplant burndown and in the row middles based on current registrations in vegetables. Experiments were conducted in 2016 to compare glufosinate to current row middle practices in tomato and squash. Commercially available tomato and squash cultivars were planted at the Plant Sciences Research and Education Unit, Citra, FL, and the Gulf Coast Research and Education Center, Balm, FL. Herbicide treatments include glufosinate at 663 g ha^{-1}, glufosinate at 995 g ha^{-1}, paraquat at 567 g ha^{-1}, diquat at 567 g ha^{-1}, halosulfuron at 53 g ha^{-1}, glufosinate at 663 g ha^{-1} + halosulfuron at 53 g ha^{-1}, and paraquat at 567 g ha^{-1} + halosulfuron at 53 g ha^{-1}. At both locations, the same trends in weed control and crop injury were similar between crops, but different between locations. At Citra, grass control was similar among glufosinate, paraquat, and glufosinate + halosulfuron. Diquat had less grass control than the other herbicides, but was greater than the nontreated. This may be consequence of the grass being tall at the time of application. Nutsedge and wild mustard control was similar among glufosinate, paraquat, and halosulfuron early in the season, however, halosulfuron had greater control at the end of the season. No crop significant injury was observed and no yield differences. Glufosinate could be used in the row middles for weed control, however, the spectrum of weed species and size will have an impact on the amount of control compared to current practices.

BURN-DOWN HERBICIDES FOR STRAWBERRY CROP TERMINATION WHEN INTERCROPPING WITH VEGETABLES. N.S. Boyd*; University of Florida, Wimauma, FL (135)

ABSTRACT

Strawberry growers in central Florida frequently intercrop vegetables with strawberry. The vegetable crop is transplanted on the bed between the two strawberry rows in January or February. Berries are harvested until early to mid-March at which point strawberry plants are removed by hand. Trials were conducted at the Gulf Coast Research and Education Center in Balm, FL, in 2014 and 2015 to evaluate multiple transplant dates for eggplant and jalapano peppers in strawberry beds as well as compare hand pulling versus the use of shields to facilitate strawberry crop termination with paraquat. Vegetable transplant date and as a result the duration of competition between crops had no effect on strawberry yield over time or total berry yield. Pepper and eggplant damage was greater at the latest transplant date compared to the earliest date. There was no difference in pepper yield between treatments. Total eggplant yield decreased from the earliest to the latest transplant dates and yields were 15% greater where strawberry plants were removed by hand. We conclude that appropriate shielding can facilitate strawberry crop termination when intercropping but the technique is most effective when the vegetable transplants are taller than the strawberry canopy and it may cause small yield reductions with some crops. The use of this technology could substantially reduce input costs and labor for this production system.

OFF-TARGET DRIFT ON LATE-SEASON RICE (*ORYZA SATIVA*). J.S. Calhoun*[1], T. Barber[2], J.K. Norsworthy[3], R.C. Doherty[4], Z.T. Hill[1]; [1]University of Arkansas Cooperative Extension Service, Monticello, AR, [2]University of Arkansas, Lonoke, AR, [3]University of Arkansas, Fayetteville, AR, [4]University of Arkansas, Monticello, AR (136)

ABSTRACT

Field research was conducted in two separate locations in Arkansas in 2016 to evaluate the effects on growth habits and yields of rice to simulated drift rates of glyphosate, glufosinate-ammonium, paraquat dichloride, and sodium chlorate at varying crop growth stages.

Two trials were conducted in Lonoke, Arkansas on a silt loam soil. Variety CL151 rice was planted on May 18 in a complete randomized block design with four replications in 6 ft. by 20 ft. plots. Treatments at the Lonoke location were sprayed with a CO2-pressurized backpack sprayer at 15 GPA. Rates of glyphosate at 0.113 lb. ai/ac and glufosinate at 0.053 lb. ai/ac were applied to rice at early boot, late boot, heading, milk, and soft dough stages. Rates of paraquat at 0.0625 lb. ai/ac and sodium chlorate at 0.6 lb. ai/ac were applied to rice at early boot, late boot, and heading crop stages. Evaluations were made observing reduced heading and injury at 27 days and 38 days after the first application at early boot.

Two other trials were conducted in Rohwer, Arkansas on a sharkey clay soil. Variety CL111 rice was planted on Aril 18 also in a complete randomized block design with four replications in 6.3 ft. by 28 ft. plots. Treatments were applied using a CO2-pressurized Mudmaster™ sprayer at 12 GPA. Rates of glyphosate at 0.113 lb. ai/ac and glufosinate at 0.053 lb. ai/ac were applied to rice at boot, 50% heading, soft dough, hard dough, and draining crop stages. Rates of paraquat at 0.0625 lb. ai/ac and sodium chlorate at 0.6 lb. ai/ac were applied at soft dough, hard dough, and draining crop stages. Evaluations were made observing necrosis, stunting, and reduced heading at 3 days after the hard dough application and 3 days after the draining application.

At the Lonoke location drift simulations of glyphosate delayed heading of the rice at early boot and late boot stages by 60%-70%, but did not cause any noticeable burning injury to the plant. Yield reductions were minimal with the highest reductions being 15% less than that of the control. Drift rates of glufosinate reduced heading by 45% at the early boot stages and provided 20%-25% visible injury at the heading and milk crop stages. Yield reductions were minimal. Drift rates of paraquat provided the most injury with 40%-50% injury at the early boot and late boot stages and greater than 70% injury at the heading stage. Substantial yield reductions were recorded with the early boot and late boot applications only yielding 10% compared to that of the control and yield reductions of approximately 45% when applied at the heading stage. Sodium chlorate applications provided little to no injury or yield reductions at any crop stage.

At the Rohwer location drift rates of glyphosate caused 40% stunting of the rice at the boot stage and approximately 20% at the 50% heading stage, with very little necrosis. Heading was reduced by greater than 90% at the boot stage and greater than 60% at the 50% heading stages. These stages also suffered yield losses of 60%-100%. Approximately 35%-45% necrosis was observed at the boot and 50% heading stages and greater than 70% at sough dough following glufosinate applications. Heading was reduced 40%-60% at those stages and yields were reduced 20%-30%

at boot and the 50% heading stages. Rates of paraquat caused injury of approximately 90% at soft dough and 80% at soft dough stages. Only minor reductions in yield were recorded at the soft dough stage. Sodium chlorate caused minimal injury and had little to no yield reductions at any stage.

THE EFFECT OF HERBICIDES ON COMMON ITALIAN RYEGRASS (*LOLIUM PERENNE SSP. MULTIFLORUM*) SEED. D. Simmons*[1], T. Grey[2], W. Vencill[3], A.S. Culpepper[2]; [1]University of Georgia, TIFTON, GA, [2]University of Georgia, Tifton, GA, [3]University of Georgia, Athens, GA (137)

ABSTRACT

In Georgia, Italian ryegrass (*Lolium perenne ssp. multiflorum*) is listed as the fourth most common and one of the most troublesome weeds in small grain production. Herbicide resistant Italian ryegrass is not only detrimental to yield and quality, it increases herbicide cost and application frequency. It can also affect rye cover crop establishment and forage production systems, especially when escapes occur. A biotype of Italian ryegrass was confirmed for ACCase-resistance in canola and wheat in 1995. Since this first confirmation, there has been limited herbicide screening of Italian ryegrass biotypes in Georgia. Additionally, anecdotal evidence indicated potential ALS-resistance in commercial ryegrass seed. The objective of this research was to screen several commercially available cultivars for susceptibility to herbicides with different mechanisms of action. An experiment was conducted as randomized complete block, split-plot design with four replications, including twenty-six cultivars and six herbicide treatments. The herbicide treatments included a non-treated control (NTC), two PRE herbicides of pyroxasulfone or flufenacet plus metribuzin, and three POST of diclofop, pyroxsulam, or glyphosate. Factors evaluated included injury ratings, fresh shoot biomass, fresh root biomass, regrowth shoot emergence, and regrowth shoot biomass. Among the data collected, the cultivar*herbicide interaction was non-significant at the established statistical level (p=0.05). However, the herbicide treatment variable was significant at p=0.0040. Across cultivars, there was no difference when comparing the 1x labeled rate herbicide treatments to each other. The lack of injury displayed on some cultivars, as shown by outliers, was significant for all of the pre-emergence and post-emergence applications respectively. Preliminary data suggest that complete control was never achieved, but this study is still on-going so no definitive conclusions can be drawn for the Italian ryegrass seed evaluated.

RICE TOLERANCE TO LONG CHAIN FATTY ACID-INHIBITING HERBICIDES. J.A. Godwin Jr.*, J.K. Norsworthy, M.L. Young, R.R. Hale, M.E. Fogleman; University of Arkansas, Fayetteville, AR (138)

ABSTRACT

One of the most important ways to combat herbicide resistance is to alternate herbicide sites of action (SOA) whenever possible. Problematic weeds in rice such as barnyardgrass (*Echinochloa crus-galli*) and red rice (*Oryza sativa* var. *sylvatica*) have become more difficult to control due to the evolution of resistance to many of the most commonly used rice herbicides. Long-chain fatty acid (LCFA)-inhibiting herbicides have been used widespread in U.S. corn (*Zea mays*), cotton (*Gossypium hirsutum*), and soybean (*Glycine max*) production, along with Asian rice (*Oryza sativa*). If appropriate tolerance can be established, LCFA-inhibiting herbicides may be a viable option to combat herbicide-resistant weeds in rice. The hypothesis of this experiment was that at least one LCFA-inhibiting herbicide could be applied to rice with minimal crop injury. In this experiment, LCFA-inhibiting herbicides including pethoxamid, acetochlor, pyroxasulfone, and *S*-metolachlor were evaluated for rice tolerance in 2015 and 2016 following a delayed preemergence, spiking, and 1- to 2-leaf rice application. Herbicides were applied at the following rates: pethoxamid at 840 g ai ha^{-1}, acetochlor at 1,050 g ai ha^{-1}, pyroxasulfone at 150 g ai ha^{-1}, and *S*-metolachlor at 1,070 g ai ha^{-1}. More injury was observed in 2016 than in 2015 across all treatments due to differences in timing and amount of rainfall. However, in both years, less injury occurred with all herbicides from later application timings. Rice treated with pethoxamid or acetochlor at the 1- to 2-leaf rice stage showed the least amount of injury across all ratings, and no significant reduction in yield compared to the nontreated control. In 2016, rice injury of up to 49% from pyroxasulfone and 82% from *S*-metolachlor applications occurred, even at the 1- to 2-leaf rice stages. In 2015, rice treated with *S*-metolachlor and pyroxasulfone had less density and shorter height compared to the nontreated control. Due to little or no injury and reduction in yield to rice from pethoxamid and acetochlor at later application timings, these herbicides should be further pursued for the control of problematic weeds in rice.

RESPONSE OF IRRIGATED PEANUT CULTIVARS TO HERBICIDE TANK MIXES WITH PARAQUAT. K.M. Eason*[1], R. Tubbs[1], T. Grey[2], S. Li[3]; [1]The University of Georgia, Tifton, GA, [2]University of Georgia, Tifton, GA, [3]Auburn University, Auburn, AL (139)

ABSTRACT

In 2016, Georgia farmers produced nearly 1.3 million metric tons of peanuts (*Arachis hypogea* L.) with half of the state producing under irrigated conditions. Post-emergence herbicide tank-mixes are used to effectively and economically improve yield while lowering the potential for resistance. Paraquat is a commonly used active ingredient for peanut weed control in the Southeast. Experiments were conducted in 2016 to evaluate the effects of post-emergence herbicide tank-mixes using paraquat, *S*-metolachlor, acifluorfen, bentazon, and acetochlor on runner-type peanut cultivars under irrigated conditions. Yield, stunting, and leaf burn injury effects were evaluated from the herbicide tank-mixes at TyTy, GA on a Tifton loamy sand and at Plains, GA on a Greenville sandy loam. The effects were tested on Georgia-06G, Georgia-14N, TUFRunner™ '511', and FloRun™ '157' cultivars. The effectiveness of the post-emergence herbicide tank-mixes were investigated on pitted morningglory (*Ipomoea lacunosa* L.), yellow nutsedge (*Cyperus esculentus* L.), and Texas millet (*Urochloa texana* L.). Both locations had high weed populations for the given species. At both locations, the cultivars ($p<0.01$) were significant to the yield. In Plains, the paraquat + acifluorfen + bentazon treatment yielded (4346 kg ha^{-1}) lower than the paraquat + acifluorfen + bentazon + acetochlor treatment (5073 kg ha^{-1}). At the TyTy location, the paraquat + acifluorfen + bentazon + acetochlor treatment and the paraquat + acifluorfen + bentazon + *S*-metolachlor treatment yielded the highest. The treatments were significant ($p<0.01$) to the amount of stunting at both locations. The treatments were significant at 3, 7, and 11 days after application ($p<0.01$) to the amount of necrosis and chlorosis (leaf burn) observed. Choosing a high yielding cultivar coupled with an economical and efficient weed control program will help guide Georgia growers to higher yields.

EVALUATION OF BENZOBICYCLON ON WEEDY RICE POPULATIONS FROM THE MIDSOUTH. **M.L.** Young*, J.K. Norsworthy, J.A. Godwin, M.H. Moore, M.E. Fogleman; University of Arkansas, Fayetteville, AR (140)

ABSTRACT

Weedy rice is one of the most problematic weeds in Midsouth rice production. Much genetic and phenotypic diversity exist in the weedy rice populations from across the Midsouth. Rice growers are running out of viable options to control weeds that have evolved herbicide resistance. With increasing selection pressure on currently registered herbicides, a new mode of action is needed in rice production. A new post-flood herbicide, benzobicyclon, is being developed by Gowan Company. Benzobicyclon, a Group 27 herbicide, will offer a new site of action to growers and will broaden and improve spectrum of control grasses, aquatics, broadleaves, and sedges, including those currently resistant to Group 2 herbicides. This will be the first 4-hydroxyphenylpyruvate dioxygenase (HPPD) herbicide commercially available in U.S. rice production. In 2015, an unexpected observation was made from a field study conducted at the Rice Research and Extension Center near Stuttgart and at the Pine Tree Research Station near Colt, Arkansas. At both locations, bays treated post-flood with benzobicyclon at 247 or 494 g ai/ha had a high level of weedy rice control relative to bays not containing benzobicyclon. This observation prompted a greenhouse evaluation in the spring followed by a field evaluation in the summer of 2016 of the efficacy of benzobicyclon on weedy rice accessions collected across Arkansas, Mississippi, and southeast Missouri. A total of 100 accessions were screened in the greenhouse and field. Percent mortality ratings were collected in the greenhouse and percent control was reported in the field. It appears that benzobicyclon at 371 g ai/ha plus 1% crop oil concentrate will effectively control 29% of the accessions in the greenhouse and 29% of the accessions in the field, based on a minimum acceptable level of 80% mortality or control. This indicates that the sensitivity of weedy rice to benzobicyclon varies tremendously across the Midsouth and more research must be conducted to investigate why.

INTEGRATED APPROACHES FOR TROPICAL SIGNALGRASS (*UROCHLOA SUBQUADRIPARA*) CONTROL IN TURFGRASS. D.G. Pearsaul*[1], R.G. Leon[2], B.A. Sellers[3], D.C. Odero[4], M. Silveira[5]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL, [3]University of Florida, Wachula, FL, [4]University of Florida, Belle Glade, FL, [5]University of Florida, Ona, FL (141)

ABSTRACT

Tropical signalgrass (TSG) is one of the most problematic weeds on golf courses in South Florida. The removal of MSMA from the market has only exacerbated the issue, and the lack of alternative herbicides that can provide effective control with single applications makes necessary developing integrated programs to manage this weed. This research examined the integration of verticutting, a cultural practice, with programs combining preemergence (PRE) and postemergence (POST) herbicides to control tropical signalgrass. Field experiments were conducted in South Florida to: (1) determine whether verticutting before herbicide applications increases tropical signalgrass control and (2) identify herbicide programs that effectively control tropical signalgrass. No interactions between verticutting and herbicide program were found, although verticutting did provide a minor reduction in TSG cover but not enough to warrant a recommendation for its use. The addition of a PRE herbicide did not affect weed control during the 8 weeks after initial treatment (WAIT) but provided a significant reduction in TSG coverage at 52 WAIT. Several POST herbicide programs provided >85% TSG control with only two sequential applications throughout the duration of the experiment. A second study was conducted to determine which two- and three-way POST herbicide combinations provided the highest level of control. Amicarbazone alone provided 30% control at 8 and 12 WAIT. However, a potential synergism between amicarbazone and mesotrione, trifloxysulfuron, and thiencarbazone + foramsulfuron + halosulfuron was observed in two- and three-way combinations providing greater than 80% TSG control at 4, 8, and 12 WAIT. Treatment combinations not containing amicarbazone all provided less than 50% control at each assessment timing.

TANK-MIX INTERACTIONS FOR BARNYARDGRASS CONTROL IN PROVISIA RICE. R.R. Hale*[1], J.K. Norsworthy[1], Z.D. Lancaster[1], M.E. Fogleman[1], R.C. Scott[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (142)

ABSTRACT

One of the most problematic weeds in Midsouth rice production is barnyardgrass [*Echinochloa crus-galli*]. Barnyardgrass can quickly evolve resistance and continues to limit herbicide options for control. BASF is developing Provisia™ rice, a new technology that allows for the use of Provisia™ herbicide (quizalofop), an acetyl CoA carboxylase inhibitor, for control of grass weeds. Saflufenacil (Sharpen®) is a contact herbicide labeled for broadleaf weed control in rice. Tank-mixing contact herbicides with systemic herbicides can lead to antagonism or a reduction in weed efficacy. Hence, field studies were conducted at the Pine Tree Research Station (PTRS) near Colt, AR in 2015 and 2016, and the University of Arkansas Pine Bluff Farm (UAPB) near Lonoke, AR in 2016 to determine whether the addition of saflufenacil with grass herbicides in Provisia™ rice causes an antagonistic interaction or a reduction in barnyardgrass control. The experiment was arranged as a randomized complete block design with two factors. Factor A consisted of graminicides that included cyhalofop (Clincher), fenoxaprop (Ricestar HT), and quizalofop (Provisia). Factor B was the addition of saflufenacil applied at 25 g ai ha^{-1} or no addition of saflufenacil. A nontreated check was included in each study. Treatments were applied when barnyardgrass reached the 3- to 4-leaf growth stage, and all treatments contained crop oil concentrate (COC) at 1% (v/v). Overall, a main effect of graminicide was significant at 2 and 4 to 5 weeks after treatment (WAT). At 2 and 4 to 5 WAT, quizalofop showed >90% control of barnyardgrass. Based on Colby's method for assessing herbicide interactions, antagonism was observed at 2 WAT for tank-mixtures cyhalofop + saflufenacil and quizalofop + saflufenacil. By 4-5 WAT, antagonism was only observed for the tank-mixture containing quizalofop + saflufenacil. From these results, saflufenacil at times may cause antagonism when tank-mixed with a graminicide in a rice.

THE EFFECT OF COTTON GROWTH STAGE ON SUSCEPTIBILITY AND FRUITING PATTERNS FOLLOWING EXPOSURE TO SUB-LETHAL RATES OF 2,4-D OR DICAMBA. J.T. Buol*[1], D.B. Reynolds[1], D.M. Dodds[1], R.L. Nichols[2], J.A. Mills[3]; [1]Mississippi State University, Mississippi State, MS, [2]Cotton Incorporated, Cary, NC, [3]Monsanto Company, Collierville, TN (143)

ABSTRACT

The development and spread of herbicide-resistant (HR) weed species poses a serious challenge to crop producers tasked with feeding and clothing a growing world. In response to the threat of HR weed species, seed companies have developed biotechnologies that will use applications of the auxin hormone-mimic herbicides over the top of many row crops. While these herbicides represent a powerful tool for controlling HR weed species, their efficacious nature renders them capable of severely damaging susceptible off-target species. Two such auxin hormone-mimic herbicides, 2,4-D and dicamba, can each be injurious to susceptible cotton (*Gossypium hirsutum* L.) cultivars even when exposure is only to a sub-lethal concentration of either herbicide. Misapplication events of these herbicides may correspond to varying cotton growth stages. Thus, research was conducted in each of two locations in Mississippi in 2014, 2015, and 2016 to determine the cotton growth stage most susceptible to injury and yield partitioning effects from simulated off-target applications of sub-lethal concentrations of 2,4-D or dicamba. Visual injury data were consistent with previous work inasmuch as the most severe injury occurred from exposure in mid-late vegetative stages (2,4-D) or early-bloom (dicamba). Crop height was increased by exposure at these times to 2,4-D, and decreased with dicamba. Generally, a decrease in yield partitioned on lower nodes and inner positions was accompanied by a compensatory increase in yield partitioned on vegetative branches and aborted terminals. However, the magnitude of these yield effects differed significantly by growth stage at exposure and by which herbicide was used.

QUIZALOFOP MIXTURE INTERACTIONS IN ACCASE-RESISTANT RICE. S.Y. Rustom*, E.P. Webster, B.M. McKnight, E.A. Bergeron, G. Mack Telo; Louisiana State University AgCenter, Baton Rouge, LA (144)

ABSTRACT

Management of imidazolinone-resistant (IR) weedy rice (*Oryza sativa* L.) and propanil- or quinclorac-resistant barnyardgrass (*Echinochloa crus-galli* L.) has become a major issue for rice producers throughout the southern United States. Weedy rice refers to a conspecific complex of rice pests including red rice, red rice outcrosses, and F_2 hybrids. This complex is often resistant to imazethapyr and imazamox used in Clearfield rice production. BASF and the LSU AgCenter are currently developing 'Provisia' rice to control weedy rice, barnyardgrass, and other grass weeds commonly found in rice production fields. Previous research has indicated ACCase herbicide activity is often antagonized when mixed with herbicides that have broadleaf and/or sedge activity.

Research was conducted in 2015 and 2016 at the LSU AgCenter H. Rouse Caffey Rice Research Station (RRS) near Crowley, LA to evaluate quizalofop activity when applied alone or in a mixture with herbicides containing acetolactate synthase (ALS) activity. The experimental design was a randomized complete block with a two-factor factorial arrangement of treatments with four replications. Factor A consisted of no quizalofop or quizalofop applied at 120 g ai/ha. Factor B consisted of penoxsulam at 40 g ai/ha, penoxsulam plus triclopyr at 352 g ai/ha, halosulfuron at 53 g ai/ha, bispyribac at 34 g ai/ha, orthosulfamuron plus halosulfuron at 94 g ai/ha, orthosulfamuron plus quinclorac at 491 g ai/ha, imazosulfuron at 211 g ai/ha, bensulfuron at 43 g ai/ha, or no mixture herbicide.

Plot size was 1.5 by 5.2 m with eight 19.5 cm drill-seeded rows containing 4 rows of Provisia 'PVL 024-B', 2 rows of 'CL-111', 2 rows of 'CLXL-745' at a rate of 78 kg/ha. Awnless red rice seed was also broadcast across the plot area. CL-111, CLXL-745, and red rice were planted to represent weedy rice. The plot area was also naturally infested with barnyardgrass. Applications were made with a CO_2-pressurized backpack sprayer calibrated to deliver 140 L/ha when Provisia rice was at the three- to four-leaf growing stage. Evaluations were recorded as percent control at 14, 28, and 42 days after treatment (DAT), with 0 = no control and 100 = complete plant death. A second application of quizalofop was applied at 120 g/ha immediately following the 28 DAT evaluation. Statistical analysis was subject to Blouin's modified Colby's procedure to determine an antagonistic, synergistic, or neutral response occurring with each herbicide mixture.

At 14 DAT, an antagonistic response occurred for barnyardgrass control when quizalofop was mixed with penoxsulam, penoxsulam plus triclopyr, bispyribac, orthosulfamuron plus halosulfuron, or orthosulfamuron plus quinclorac. All mixture herbicides resulted in antagonism of quizalofop for control of CL-111 and CLXL-745, except quizalofop mixed with bensulfuron on CL-111 and quizalofop mixed with halosulfuron, orthosulfamuron plus halosulfuron, imazosulfuron, or bensulfuron on CLXL-745. Antagonistic responses were observed at 14 DAT on red rice when quizalofop was mixed with penoxsulam, penoxsulam plus triclopyr or

bispyribac, and all other quizalofop mixtures resulted a neutral response. No herbicide mixed with quizalofop resulted in a synergistic response for any weed or rice line evaluated.

At 28 DAT, quizalofop mixed with imazosulfuron resulted in a neutral response for barnyardgrass control. All other herbicides antagonized quizalofop activity on barnyardgrass, CL-111, CLXL-745, and red rice. No herbicide mixed with quizalofop resulted in a synergistic response for any weed or rice line evaluated.

In conclusion, a second application of quizalofop alone at 120 g/ha was applied immediately after the 28 DAT evaluation. The second application was able to overcome antagonism that occurred with the initial application of all the mixtures evaluated, except when penoxsulam or penoxsulam plus triclopyr were mixed with quizalofop in the initial application.

These data indicate that herbicides with group 2 mode of action, or ALS activity, should be avoided when considering a mixture with quizalofop. Research conducted in Louisiana indicates that quizalofop should be applied 1 to 3 days prior to an ALS herbicide application. A second application of quizalofop alone will be necessary to control weeds that escape the initial application.

EFFECTS OF PREEMERGENCE HERBICIDES ON SPRIGGED ESTABLISHMENT OF HYBRID BERMUDAGRASS. E.G. Begitschke*, J. McCurdy, T. Tseng, C. Baldwin, B. Stewart, C. Barickman; Mississippi State University, Starkville, MS (145)

ABSTRACT

Preemergence herbicides often negatively affect establishment of sprigged hybrid bermudagrass (*Cynodon dactylon* (L.) Pers. × *C. transvaalensis* Burtt-Davy). However, limited research has quantified the effects of preemergence herbicides commonly used in warm-season sod production of the southeastern United States. Research was conducted at Mississippi State University during summer 2016 to evaluate the effects of atrazine (1.12 kg ha^{-1}), atrazine (1.12 kg ha^{-1}) + metolachlor (0.86 kg ha^{-1}), dithiopyr (0.56 kg ha^{-1}), flumioxazin (0.286 kg ha^{-1}), indaziflam (0.033 kg ha^{-1}), liquid and granular applied oxadiazon (2.24 kg ha^{-1}), metolachlor (2.78 kg ha^{-1}), pendimethalin (1.66 kg ha^{-1}), prodiamine (0.594 kg ha^{-1}), and simazine (2.24 kg ha^{-1}) on sprigged 'Latitude 36' hybrid bermudagrass establishment. Plots (4.65m^2) were sprigged at a rate of 44 m^3 ha^{-1} (468 US bushels ac^{-1}) on May 10, 2016. Visual assessment of % cover, as well as ratio vegetation index (RVI), normalized difference vegetation index (NDVI), and relative chlorophyll concentration (Cl-RE) were recorded every two weeks throughout the experiment. Regression analysis was used to estimate days (d) to 50% cover. Confidence intervals at $\alpha = 0.05$ level of significance were used to detect differences compared to the nontreated. Data measured 8 and 12 weeks after treatment (WAT) were subject to means separation. Indaziflam (839 d), metolachlor (80 d), dithiopyr (96 d), and flumioxazin (79 d) increased estimated time to 50% cover when compared to the nontreated (55 d). At 8 WAT and 12 WAT, dithiopyr and indaziflam reduced NDVI values compared to the nontreated. Metolachlor, flumioxazin, dithiopyr, and indaziflam reduced visual ratings of cover when evaluated 8 WAT; however, only indaziflam reduced visual ratings of cover 12 WAT. No differences were detected in RVI values 8 WAT; however, dithiopyr and indaziflam reduced RVI values 12 WAT. Indaziflam reduced C1-RE when evaluated 8 and 12 WAT. A second replication of this study will be completed during summer 2017.

DEVELOPING HERBICIDE TOLERANT TOMATOES: GREENHOUSE SCREENING TO FIELD CHARACTERIZATION. G. Sharma*[1], Z. Yue[1], E. Avila dos Santos[2], T. Tseng[1]; [1]Mississippi State University, Starkville, MS, [2]Universidade Federal De Santa Maria, Santa Maria, Brazil (146)

ABSTRACT

The United States is one of the world's leading producers of tomatoes, second only to China. In terms of consumption, tomato is the nation's fourth most popular fresh-market vegetable. In Mississippi it is grown on over 444 acres across 627 farms. Unfortunately, tomato yield is reduced by up to 25% because of herbicide drift mostly from row crops, thus discouraging the grower near Mississippi delta region from growing tomatoes even in the greenhouse. Major drifted herbicides are auxin herbicides and glyphosate. Thus, there is a need of herbicide tolerant tomatoes with better yield. A diverse germplasm of tomato exists that includes wild relatives known to be tolerant to numerous biotic and abiotic stresses. Chemical stress is an abiotic stress, and we hypothesized that wild tomato accessions have natural tolerance to herbicides in addition to other abiotic stresses. One hundred ten tomato lines were used for screening of herbicide tolerance. Plants from these accessions were sprayed with simulated drift rates of 2,4-D, dicamba, glyphosate, quincloarc, aminopyralid, aminocycloparachlor and picloram in greenhouse bioassay., and visual injury rating of each accession for each herbicide treatment was recorded. Numerous accessions were found to be tolerant to each of the herbicide tested; 9 accessions for 2,4-D and aminocycloparachlor, 10 for glyphosate, 11 for dicamba ,5 for quinclorac,3 for picloram and 2 for aminopyralid. Tolerant accessions from the greenhouse screening were further characterized in field at two different locations. Among the accessions screened, TOM18 AND TOM35 was tolerant to dicamba showing significantly lesser injury and similar fruit yield compared to a commonly grown tomato cultivar; while, for quinclorac treatment, TOM129 showed significantly lesser injury as well as higher yield compared to cultivated tomato. Further studies to determine the mechanism of herbicide tolerance will help us better understand chemical stress tolerance at the genetic and biochemical level.

EFFECT OF DICAMBA DRIFT EVENTS ON SOYBEAN PROGENY. G.T. Jones*, J.K. Norsworthy, J.A. Godwin, N.R. Steppig; University of Arkansas, Fayetteville, AR (147)

ABSTRACT

The recent labeling of dicamba postemergence in dicamba-resistant soybean and cotton will likely lead to greater use and increased possibility for off-target movement of the herbicide. In the occurrence of dicamba drift, it is not well understood what measurements from soybean plants would correlate with damage to soybean offspring. Dicamba drift trials were established in 2014 and 2015 at the Northeast Research and Extension Center (NREC) in Keiser, AR. A single pass with a high clearance sprayer was made in each soybean field to simulate a dicamba drift event. At soybean harvest, seeds were collected from plants in each drift trial and planted in the field the following year. Several observations from parent and offspring were recorded. Data were subjected to multivariate analysis using JMP 12 Pro (SAS Institute, Cary, NC) to determine pairwise correlations among parent and offspring observations. Auxin-like symptomology (primarily leaf cupping) appeared in plots at the unifoliate and first trifoliate stages. Auxin-like symptoms increased with delay in drift trial initiation to later growth stages. The highest correlation coefficients occurred when parent plants were exposed to dicamba drift at R5 growth stage. Parent mature pod malformation was significantly correlated with offspring emergence ($r = -0.3698$), vigor ($r = -0.5673$), injury ($r = 0.9282$), and amount of plants injured ($r = 0.9187$). This research documents that soybean damaged from dicamba drift during stages of reproduction can negatively impact offspring and that some measurements taken on the parent plants are better indicators of the offspring response than others. The greatest concern for soybean offspring would be in the occurrence of dicamba drift on seed production fields, causing seed quality to suffer or growers to be alarmed by the occurrence of auxin-like symptoms on plants soon after emergence the subsequent year. Furthermore, dicamba symptomology occurring in newly emerged soybean could be mistaken as soil carryover or recent drift exposure and tempt growers to quickly place blame on neighbors or custom applicators.

DIAMOND ZOYSIAGRASS PUTTING GREENS TOLERANCE TO VARIOUS PLANT GROWTH REGULATORS. M.B. Addy*, L.B. McCarty; Clemson University, SC (149)

ABSTRACT

Diamond Zoysiagrass (*Z. matrella*) has become a popular choice for putting greens in the transition zone due to cold and shade tolerance. Plant growth hormones increase turf health and stress tolerance. The objective of this research was to examine Diamond Zoysiagrass quality and health following applications of prohexadione-Ca and trinexapac-ethyl.

Various plant growth regulators were applied to a Diamond Zoysiagrass nursery green at The Walker Course located in Clemson, SC. Treatments were applied by a CO_2 back pack sprayer with an 8004 flat fan nozzle. The sprayer was adjusted to apply 40 gallons per acre. Treatments consisted of FAL-2006 (prohexadione-Ca) at 44 oz/a + NIS at .25% v/v, FAL-2006 (prohexadione-Ca) at 44 oz/a + AMS at .6 lb N/a + NIS at .25% v/v, FAL-2007 (prohexadione-Ca) at 44 oz/a + NIS at .25% v/v, FAL-2023 (prohexadione-Ca) at 230 oz/a, FAL-2040 (prohexadione-Ca) at 40 oz/a + AMS at .6 lb N/a, FAL-2040 (prohexadione-Ca) at 40 oz/a + AMS at .6 lb N/a + NIS at .25% v/v, Anuew (prohexadione-Ca) at 44 oz/a + AMS at .6 lb N/a + NIS at .25% v/v, Primo (trinexapac-ethyl) at 6 oz/a, and Primo at 4 oz/a. All treatments were applied every three weeks except primo at 4 oz/a. Primo at 4 oz/a was applied weekly. Turf quality ratings (1-9, <6=unacceptable) and phytotoxicity percentage ratings were taken after each application. Randomized complete block design was used as the experimental set up. ANOVA was used to compute the data differentiating means by LSD (α=.05).

Prohexadione-Ca formulations had >30% phytotoxicity three weeks after the second application. Primo treatments had <18% phytotoxicity three weeks after the second application. Primo treatments had >7 turf quality ratings three weeks after the third application, while only FAL-2006 + NIS had >6 turf quality ratings among the prohexadione-Ca formulations. FAL-2006 had less phytotoxicity and higher turf quality ratings compared to FAL-2006 + AMS throughout the experiment. Phytotoxicity for all treatments decreased significantly three weeks after the last two applications on 8/26/2016 and 9/16/2016. Future experiments could examine other PGRs on the health and quality of Diamond Zoysiagrass in the transition zone.

IMPACT OF FOLIAR FERTILIZER ON HERBICIDE PERFORMANCE IN SOYBEAN.
H.T. Hydrick*, J.A. Bond, B.R. Golden, D.C. Blouin, J.D. Peeples, H.M. Edwards, T.L. Phillips. Delta Research and Extension Center, Mississippi State University, Stoneville, MS (150)

ABSTRACT

The use of foliar fertilizers and plant hormone products has increased in Mississippi soybean in recent years. Growers commonly add these products to POST herbicide applications to reduce expenses and/or lessen the severity of herbicide injury. As use increases, research is needed to ensure foliar fertilizers or plant hormone products do not interfere with herbicides efficacy. Therefore, research was conducted to evaluate soybean injury and herbicide efficacy with mixtures of POST herbicides and foliar fertilizer or plant hormone products.

Research was conducted in 2015 and 2016 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS. Two studies were conducted to evaluate the effect of foliar fertilizers and plant hormone products on soybean injury and herbicide efficacy. In both studies, treatments were arranged as a two-factor factorial in a randomized complete block with four replications. In the study evaluating the effects of foliar fertilizer on POST herbicides, Factor A was herbicide treatment and included no herbicide, glyphosate (1.36 kg ae ha^{-1}), glyphosate plus *s*-metolachlor (1.42 kg ai ha^{-1}), glyphosate plus fomesafen (0.395 kg ai ha^{-1}), and glyphosate plus lactofen (0.218 kg ai ha^{-1}). Factor B was foliar fertilizer (4-0-0-3-3-3-0.25%, N-P-K-S-Mn-Zn-B) rates of 0, 0.39, and 0.78 kg ai ha^{-1}. The second study evaluated POST herbicides in combination with plant hormone products. Factor A was herbicide treatment and included no herbicide, glyphosate (1.36 kg ha^{-1}), glyphosate plus *S*-metolachlor (1.42 kg ha^{-1}), and glyphosate plus fomesafen (0.395 kg ha^{-1}). Factor B was cytokinin treatment and included no cytokinin treatment, kinetin 1 (0.09%), and kinetin 2 (0.15%), both applied at 0.000227 kg ai ha^{-1}. Treatments were applied at the V3 soybean [*Glycine max* (L.) Merr.] growth stage. Visual soybean injury was recorded 3, 7, 14, 21, and 28 d after treatment (DAT). Palmer amaranth [*Amaranthus palmeri* (S.) Wats] and barnyardgrass [*Echinchloa crus-galli* (L.) Beauv] control were recorded 7, 14, 21, and 28 DAT. Soybean heights were collected at time of application, 7 and 14 DAT, and at maturity. Yield was also collected and adjusted to 13% moisture content. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with $P = 0.05$.

Foliar fertilizer had no effect on soybean injury 3 to 28 DAT, height 14 DAT, or yield. Pooled over foliar fertilizer rates, Palmer amaranth control 14 DAT was greatest with herbicide treatments containing fomesafen or lactofen. Both rates of foliar fertilizer reduced barnyardgrass control 14 DAT when added to mixtures of glyphosate plus *S*-metolachlor, fomesafen, or lactofen. An antagonistic response in Palmer amaranth control was detected 14 DAT when both rates of foliar fertilizer were added to glyphosate plus *S*-metolachlor and when the higher rate was added to glyphosate alone. An antagonistic response in barnyardgrass control was detected 14 DAT when both rates of foliar fertilizer were added to glyphosate plus fomesafen and when the higher rate was added to glyphosate plus *S*-metolachlor.

Cytokinin treatment had no effect on soybean injury 3 to 28 DAT, height 14 DAT, or yield. Pooled over cytokinin treatments, Palmer amaranth control 14 DAT was greater with glyphosate plus fomesafen compared with glyphosate alone. Barnyardgrass control 14 DAT was lower with glyphosate plus fomesafen compared with glyphosate plus *S*-metolachlor. An antagonistic response was detected 14 DAT when kinetin 1 was added to glyphosate plus *S*-metolachlor.

Foliar fertilizer and cytokinin products did not reduce herbicide injury or improve agronomic performance of soybean when mixed with POST herbicide treatments. The effect of foliar fertilizer on herbicide efficacy varied with weed species and herbicide treatment, and an antagonistic effect was observed with some foliar fertilizer and herbicide combinations. An antagonistic relationship between cytokinin and herbicide treatments was detected only when kinetin 1 (0.09% cytokinin) was mixed with glyphosate plus fomesafen. Because neither the foliar fertilizer nor cytokinin treatments improved soybean agronomic performance and because their effect on herbicide efficacy was inconsistent, these products should not be added to POST soybean herbicide treatments.

POTENTIAL CROP INJURY WITH EARLY POST APPLICATIONS IN XTENDFLEX COTTON. C.A. Samples*[1], D.M. Dodds[1], G.R. Kruger[2], D.B. Reynolds[3], T. Irby[3], A. Catchot[3], J.T. Fowler Jr.[4], L. Franca[1], M.T. Plumblee[1], S.S. Davis[1], B.R. Wilson[1]; [1]Mississippi State University, Starkville, MS, [2]University of Nebraska - Lincoln, Lincoln, NE, [3]Mississippi State University, Mississippi State, MS, [4]Monsanto Company, St. Louis, MO (151)

ABSTRACT

Due to the continued spread of glyphosate resistant Palmer amaranth (*Amaranthus palmeri*), technologies have been developed allowing growers to apply auxin-type herbicides post emergence. The XtendFlex® technology from Monsanto will allow growers to apply glypohsate, glufosinate, and dicamba over the top of cotton (*Gossypium hirsutum L.*). Dicamba applied at 1.1 kg ae ha^{-1} provided up to 90 percent Palmer amaranth control. Dicamba tank mixed with glufosinate increased Palmer amaranth control over dicamba alone. Dicamba has also been observed to control other glyphosate resistant species 79 to 100 percent 14 days after application. As of 09 November 2016, the use of Xtendimax is labeled in XtendFlex® cotton and soybeans. However, currently no tank mix partners are allowed with Xtendimax. Since the development of glyhosate resistance, early POST applications with several modes of actions have become common. However, the crop injury potential from these applications needs to be further examined. Experiments were conducted in Starkville, MS at the R. R. Foil Plant Science Research Center and in Brooksville, MS at the Black Belt Branch Experiment Station. Plots consisted of 4-1 m spaced rows that where 12.2 m in length. Each plot was replicated four times. DP 1522 B2XF was planted in Starkville and Brooksville. Applications were made on 2-4 leaf cotton with a CO_2-powered backpack sprayer calibrated to apply 140 L ha^{-1} @ 317 kpa while walking 4.8 kph. Treatments applied to DP 1522 B2XF included glyphosate @ 1.1 kg ae ha^{-1}, glufosinate @ 0.6 kg ai ha^{-1}, S-metolachlor @ 1.07 kg ai ha^{-1}, dicamba (Engenia) @ 0.6 kg ae ha^{-1}, dicamba (Clarity) @ 0.6 kg ae ha^{-1}, and dicamba (MON 119096) @ 0.6 kg ae ha^{-1} either alone or in combination. Visual injury ratings were made 3, 7, 14, 21, and 28 days after applications. Other data collected included height at 1st bloom, nodes above white flower (NAWF) at 1st bloom, nodes above cracked boll (NACB) at the end of the season and, and lint yield. Data were analyzed using the PROC MIXED procedure in SAS version 9.4 and means were separated using Fisher's protected LSD at p=0.05. All six of the highest injury levels 3 days after application on DP 1522 B2XF were from treatments containing glufosinate and S-metolachlor in which visual injury ranged from 37-47 percent. The highest level of injury came from treatments containing dicamba (Engenia) + glyphosate + glufosinate + S-metolachlor. Similar to 3 days after application, five of the six treatments with the highest level of injury seven days after application contained glufosinate and S-metolachlor with injury levels ranging from 27-32 percent. At 14 days after application injury to DP 1522 B2XF had dissipated and ranged from 3-12 percent. At 21 Days after application, cotton injury had further dissipated and there were no significant differences observed amongst treatments. There were no significant differences in cotton height at first bloom with heights ranging from 61-69 cm. Similarly, there were no significant differences associated with NAWF or NACB with NAWF ranging from 6.8-7.2 NAWF and NACB ranging from 3.6 -4.5, respectively. This indicates that there were no signs of delayed maturity at first bloom or at the end of the year. Furthermore, there were no significant differences in lint yield at the end of the season with yields ranging from 1,904-2,119 kg lint ha^{-1}.

PREPLANT APPLICATIONS OF 2,4-D AND DICAMBA IN SESAME (*SESAMUM INDICUM* L.). B.P. Sperry*[1], J. Ferrell[1], R. Leon[2], D. Rowland[1], M. Mulvaney[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL (152)

ABSTRACT

Two separate experiments were conducted in 2015 and 2016 in Citra, FL to investigate preplant application timing of 2,4-D and dicamba in sesame and to examine yield response to reduced stand. Nonlinear regression analysis was performed to determine the application time interval that caused 10% reduction in stand and yield (GR_{10}) from the non-treated control expressed in days before planting (DBP, longer intervals indicate more injury). Likewise, regression analysis was used to determine the sesame stand that resulted in 10% reduction in yield (YR_{10}) expressed in plants m^{-1}. Stand counts measured 3 weeks after planting (WAP) revealed 2,4-D applied at 0.53 kg ha^{-1} to be the least injurious treatment to sesame stand, which produced a GR_{10} value of 6.4 DBP. Conversely, dicamba at 1.12 kg ha^{-1} produced a GR10 of 15.7 DBP for sesame stand 3 WAP. 2,4-D applied at 0.53 and 1.06 kg ha^{-1} and dicamba applied at 0.56 kg ha^{-1} had the lowest GR_{10}s for sesame yield of 2, 3.7, and 3 DBP, respectively. Dicamba applied at 1.12 kg ha^{-1} proved to be the most injurious treatment to sesame yield, which produced a GR_{10} value of 10.3 DBP. In a separate experiment, sesame was thinned to various plant densities and yield was recorded to determine the relationship between plant stand and seed yield. The regression analysis of these data were then compared to that of the experiment treated with 2,4-D and dicamba to determine any physiological effects of the herbicides on yield. Rate constants were compared and no statistical differences were detected between herbicide and non-herbicide treatments, suggesting that yield reductions that occur from preplant applications of 2,4-D and dicamba were purely due to stand reductions.

IMPLICATION OF ANTAGONISTIC TANK MIXTURES IN ENLIST AND ROUNDUP READY XTEND TECHNOLOGIES. C.J. Meyer*, J.K. Norsworthy, J.K. Green, R.R. Hale; University of Arkansas, Fayetteville, AR (153)

ABSTRACT

The registration of Enlist Duo (glyphosate + 2,4-D) and Xtendimax or Engenia (dicamba) will result in postemergence herbicide combinations of glyphosate, glufosinate, dicamba, and 2,4-D to be more common. Combinations of dicamba or 2,4-D plus glyphosate, and glyphosate plus glufosinate have been identified as antagonistic in past research. Thus, field experiments were conducted in 2015 and 2016 at the Northeast Research and Extension Center in Keiser, AR, to further evaluate potential herbicide interactions that could occur in Enlist and Roundup Ready Xtend cropping systems. Various rates and combinations of glufosinate, glyphosate, dicamba, and 2,4-D were applied and evaluated for percent weed control. Control of Palmer amaranth, prickly sida, and barnyardgrass by these herbicide treatments were evaluated 5 weeks after application (WAA) and analyzed for herbicide interactions based on Colby's method. In the Enlist experiment, glyphosate (dimethylamine salt) at 840 g ae ha^{-1} provided 88% control of barnyardgrass whereas glyphosate and 2,4-D (Enlist Duo, 834 + 785 g ae ha^{-1}, respectively) only provided 80% control 5 WAA. Similarly, in the Roundup Xtend experiment, glyphosate (potassium salt) at 865 g ae ha^{-1} controlled barnyardgrass 86% and glyphosate + dicamba (560 g ae ha^{-1}) only controlled barnyardgrass 79%. In both experiments, control of Palmer amaranth and prickly sida was > 85% for all mixtures. Based upon these results, applying glyphosate with 2,4-D or dicamba on large (30 cm) barnyardgrass produces antagonism compared to glyphosate alone. These results show control of grasses with tank mixtures of glyphosate plus 2,4-D or dicamba may not be as expected, and applying two herbicides that are antagonistic could lead to an increased likelihood of herbicide resistance.

TANK MIXTURES AND IRRIGATION TIMING FOR GOOSEGRASS CONTROL. B. Kerr*, L.B. McCarty; Clemson University, Clemson, SC (156)

ABSTRACT

Goosegrass (*Elusine indica* (L.) Gaertn) is a troublesome weed worldwide; with the ban of MSMA in some parts of SEUSA, control options have become limited. Greenhouse studies at Clemson University have identified potential control options at the 1- to 2-tiller growth stage. One of the limiting factors for goosegrass control options is turfgrass safety. There is potential to improve turfgrass safety by applying irrigation water to a depth of 1 cm immediately after the application of herbicides. Greenhouse studies investigated goosegrass control and Tifway bermudagrass (*Cynodon dactylon* x *C. traansvalensis*) tolerance to several postemergence herbicide followed by immediate irrigation or not at 1cm. Studies were arranged in a randomized complete block design with 4 replications. Ratings included phytotoxicity (%) and goosegrass control (%). Means were subjected to ANOVA and separated using LSD at 0.05.

A single application of Speedzone 2.2L (carfentrazone + 2,4-D + dicamba + MCPP) at 4 pints/acre in combination with Pylex 2.8 SC (topramezone) at 0.125, 0.25, or 0.5 fl oz/acre; provided good to excellent (~85%) goosegrass control 2 weeks after treatment (WAT).

At 3 day after treatment (DAT), 1 WAT, 2WAT, 4WAT and 8WAT, Tifway bermudagrass phytotoxicity for the irrigated treatments was acceptable (<30%). At 3DAT, 1WAT, 2WAT, 4WAT and 8WAT Tifway not receiving irrigation immediately following the herbicide application had unacceptable (>40%) phytotoxicity.

Continued work is required to understand the improved Tifwaybermudagrass safety plus irrigation, while maintaining excellent goosegrass control. Work will continue on identifying other control candidates for POST goosegrass control, as well as identifying potential tank mixtures of existing products.

EVALUATING TANK CLEANER EFFICACY FOR DICAMBA REMOVAL FROM A LARGE SCALE SPRAYER. Z.A. Carpenter*, D.B. Reynolds, A. Johnson; Mississippi State University, Mississippi State, MS (157)

ABSTRACT

The Roundup Ready Plus 2 Xtend System®, introduced by Monsanto, will allow growers to make in season applications of dicamba over previously susceptible cotton and soybean. While this new technology will aid growers in weed control it will also present several problems. Glyphosate is very water soluble, allowing it to be easily removed from spray tanks through three rinses with water alone. Synthetic auxin herbicides however, are not as water soluble and are highly active on some species at very low concentrations.

The objective of this study is to determine which commercial tank cleaners are most effective in the removal of auxin herbicides from spray tanks using a standard washout procedure. Field experiments were conducted in 2016 in Brooksville and Starkville, MS. Eight different cleaners were evaluated, along with a no cleanout treatment and a treatment consisting of only 3 rinses with water. These cleaners include; household ammonia, Erase, Incide-Out, Innvictis Premium Tank Cleanser, Nutra-Sol, Valent Tank Cleaner, Wipeout, and Wetcit.

A John Deere 6700 sprayer was contaminated with dicamba (Clarity, BASF®) and rhodamine dye. The sprayer then underwent a 3 rinse cleanout, adding one of the three cleaners during the second rinse cycle. Rinse volumes were 10% of the tank's volume. During each rinse, the solution was sprayed through the boom and samples were collected for analysis. Once the sprayer was cleaned using the triple rinse procedure it was filled with a labeled rate of glyphosate, and another sample was collected. All samples were sprayed over actively growing soybeans at the R1 growth stage.

Visual rating for phytotoxicity were taken at 7, 14, 21, and 28 DAT (days after treatment) and plant heights were taken 14, 21, and 28 DAT. Samples collected during each rinse were analyzed using HPLC to determine auxin herbicide concentrations as a means to evaluate cleaner efficacy. Samples were also evaluated using a spectrophotometer to determine if a correlation exists between the amount of dye in each solution and the concentration of dicamba. Plants were harvested at end of the growing season for yields (KG/HA).

Data reveal no significant difference in plant heights among the cleaners, following the second rinse, and the untreated check. A significant difference was found in the heights of the no cleanout treatment as well as the no cleanout treatment when compared to all other treatments. No significant difference was found when analyzing yield data following the second rinse for each treatment when compared to the untreated check. HPLC data show that a 10x reduction of dicamba concentration occurs between each rinse. Following the second rinse, concentrations fall below 1 part per million (ppm). No significant difference exists between each cleaner's ability to clean dicamba from a large-scale sprayer when compared to water rinses alone. Spectrophotometer analysis show the same trends as HPLC data and reveal trace amounts of rhodamine dye even when rinses appear clear.

CHANGING THE 'HACK AND SQUIRT' PARADIGM FOR WOODY INVASIVE PLANT CONTROL. C.A. Lastinger*, S.F. Enloe; University of Florida, Gainesville, FL (158)

ABSTRACT

Hack and squirt is a commonly used approach for woody plant control in forestry, rights of ways, and natural areas. The approach is highly selective as a series of hacks are generally made either continuously or semi-continuously around the trunk of a tree with a hatchet or machete and an herbicide solution is injected into each hack. Our goal was to determine if we could reduce the number of hacks on both single stem and multiple stem species to a single hack per stem at a height of 75 cm, reducing the time and energy to treat each and still achieve acceptable control. We compared aminopyralid and aminocyclopyrachlor (0.5 ml of 100 % v/v herbicide) injected into a single hack per stem on nine different invasive woody plant species. We compared these to both basal bark treatment with triclopyr ester (20% v/v) and cut stump treatment with triclopyr amine (50% v/v). Data collected included time to treat each individual plant, the amount of herbicide used, and percent canopy defoliation. Species were treated in individual studies, and trees were blocked by size (diameter at breast height) with three size classes <4, 4 to8, 8 to 12 inches DBH. This presentation will focus on four species: *Casuarina equisetifolia, Triadica sebifera, Bischofia javanica,* and *Schinus terebinthifolius*, which were treated in December 2015 and January 2016. The cut stump and aminocyclopyrachlor hack and squirt treatments resulted in 100% defoliation across all four species and size classes 360 days after treatment. Aminopyralid was not different from either the aminocyclopyrachlor or cut stump treatments across all four species and size classes. Basal bark treatments provided 100% defoliation across all size classes on *Triadica sebifera* and *Schinus terebinthifolius* at 360 days after treatment. However, on *Casuarina equisetifolia* and *Bischofia javanica,* basal bark treatments resulted in less defoliation than either the aminocyclopyrachlor or cut stump treatments. On *Bischofia javanica,* basal bark treatment resulted in less defoliation in the 8 to 12 inch DBH size class than in the two smaller size classes. The studies will be continued through the second growing season following treatment to determine tree mortality. However, our current data suggests that this reduced hack and squirt approach may be a viable alternative to basal bark and cut stump treatments.

APPLICATION TIME OF DAY EFFECTS ON BURNDOWN HERBICIDES APPLIED TO PPO-RESISTANT AND -SUSCEPTIBLE PALMER AMARANTH. G.B. Montgomery*[1], L. Steckel[2], J.L. Reeves[3]; [1]University of TN, Jackson, TN, [2]The University of Tennessee, Jackson, TN, [3]University of Tennessee, Jackson, TN (159)

ABSTRACT

Research was conducted in 2016 in Tennessee in two separate grower fields. One field had a confirmed PPO-resistant Palmer amaranth (approximately 20% of the population) and one field had no confirmed PPO-resistant Palmer amaranth according to a genetic assay performed at Purdue University.

Treatments were applied at noon and sunset to assess the effect of application time of day (TOD) on fomesafen (0.24 lb ai/A) alone, paraquat (1.13 lb ai/A) alone, plus metribuzin (0.25 lb ai/A), or plus fomesafen, and glufosinate (0.53 lb ai/A) alone and plus fomesafen. Fomesafen was affected by application time of day at each location. However, the difference in control from the resistant population was 12, 21, and 14% greater than the effect that was seen on the susceptible population at 3, 7, and 14 DAT, respectively. Control was reduced 8 to 10% on the susceptible population from the noon to the sunset application across all ratings while control was reduced 22 to 31% on the resistant population from the same applications. Control 14 DAT with fomesafen applied at noon was 98% on the susceptible population and 60% on the resistant population. Paraquat, with or without fomesafen or metribuzin, was not affected by application TOD on either susceptible or resistant population with 14 DAT control ranging from 93 to 99%. Glufosinate control 7 DAT was affected by Palmer population and the addition of fomesafen. Control from glufosinate was greater, on each population, when applied at noon vs. sunset. However, the difference in control was significantly greater for glufosinate and glufosinate + fomesafen on the resistant population when compared to the susceptible population. Also, the interaction between population and the addition of fomesafen was not present on the difference in control 14 DAT. Control 14 DAT with glufosinate ranged from 99 to 83% on the susceptible population and from 77 to 28% on the resistant population with control being significantly better when applied at noon from glufosinate and glufosinate plus fomesafen.

In conclusion, the difference in control from fomesafen applied at noon or sunset was different when comparing PPO-resistant and -susceptible populations. Control from glufosinate was affected by TOD, however, the TOD effect was similar on the PPO-resistant and -susceptible populations. Paraquat was not affected by TOD on either population provided the most consistent control of Palmer amaranth in a burndown type scenario. Burndown applications for Palmer amaranth should include paraquat because of its increased consistency over glufosinate.

PHRAGMITES AUSTRALIS RESPONSE TO CHEMICAL CONTROL UNDER CONDITIONS OF ELEVATED CO_2 AND TEMPERATURE. C.M. Prince*, G. MacDonald, J.E. Erickson; University of Florida, Gainesville, FL (160)

ABSTRACT

Native wetland plant communities throughout North America have been replaced by dense monocultures of *Phragmites australis* (common reed; hereafter referred to as *Phragmites*). This species is divided into haplotypes, with native and exotic haplotypes present in the United States. Two haplotypes present management concerns in Florida: Haplotype M (an aggressive Eurasian haplotype) was first identified in the state in 2013, and haplotype I (which has unclear origins) has recently become aggressive in disturbed freshwater wetlands. Increases in atmospheric CO_2 concentrations and temperature can have a significant impact on the growth characteristics and physiological processes of C_3 species such as *Phragmites*, potentially altering their herbicide tolerance. We examined this relationship in a greenhouse experiment. Haplotypes I and M were grown under elevated (700 ppm, 22/34 °C) or ambient (390 ppm CO_2, 18/30 °C) climate conditions for six weeks, before being treated with glyphosate (0.5 lb a.i. per acre). Morphological and photosynthetic characteristics were measured prior to herbicide application. Visual injury symptoms were recorded weekly for 30 days, before height, stem number, and aboveground biomass were measured. Plants regrew for another 30 days before height, stem number, and biomass were measured. Haplotype I was less susceptible to glyphosate under elevated climate conditions, while the response of haplotype M to treatment was largely unaffected by climate.

EVALUATION OF MANAGEMENT OPTIONS FOR GLYPHOSATE, ALS- AND PPO-RESISTANT COMMON RAGWEED IN NORTH CAROLINA. B.W. Schrage*, W.J. Everman; North Carolina State University, Raleigh, NC (161)

ABSTRACT

In 2016, a biotype of common ragweed (*Ambrosia artemisiifoia*) in northeastern North Carolina was confirmed to be resistant to glyphosate, ALS-, and PPO-Inhibiting herbicides. This discovery serves as the first agronomic dicot exhibiting resistance to three modes of action in North Carolina and prompted an evaluation into possible management options for growers in Camden, Chowan, Currituck, Gates, Hertford, Pasquotank and Perquimans counties.

With confirmation imminent, field experiments were conducted in Rocky Mount and Moyock, North Carolina during the summer of 2016 in order to evaluate: PRE programs, Liberty Link systems, POST options, residual herbicides, tank mixtures, and plant sizes during application that may influence efficacy. Rocky Mount experiments were not subjected to overwhelming wildlife populations or high levels of PPO-resistance enabling early canopy and effective control to take place. Analyzed separately, existing PRE, POST and tankmixed products effectively controlled common ragweed in all nearly all circumstances. In Moyock, the effectiveness and longevity of PRE herbicides was inconsistent prompting the recommendation of POST herbicides. Control was improved when POST applications were delayed to 3 or 4 WAP and additionally improved when a residual product was included with glufosinate. The utilization of a PRE herbicide greatly improved control. Fomesafen POST was statistically outperformed by other POST herbicides. Glufosiante, 2,4-D, and dicamba POST were able to effectively control PPO-resistant common ragweed at 15 cm; whereas, mesotrione failed to suppress ragweed applied greater than 10 cm.

FIELD DISSIPATION OF S-METOLACHLOR IN ORGANIC AND MINERAL SOILS IN THE EVERGLADES AGRICULTURAL AREA OF SOUTH FLORIDA. J.V. Fernandez*[1], D.C. Odero[1], G. MacDonald[2], J. Ferrell[2], B.A. Sellers[3], P.C. Wilson[2]; [1]University of Florida, Belle Glade, FL, [2]University of Florida, Gainesville, FL, [3]University of Florida, Wachula, FL (162)

ABSTRACT

S-metolachlor has been proposed for weed management in Florida sugarcane. However, there is no information on its persistence on organic and mineral soils used for sugarcane cultivation in south Florida. Therefore, understanding the dissipation rate and determining the half-life of *S*-metolachlor in these soils is important to formulate weed management programs in sugarcane. Field studies were conducted to determine dissipation of *S*-metolachlor applied preemergence on organic and mineral soils at 2,271 g ai/ha between 2013 and 2016. The organic soil was a Dania muck while the mineral soil was a Holopaw fine sand. *S*-metolachlor dissipated rapidly on mineral compared to organic soil. Dissipation of *S*-metolachlor in the organic soil was linear compared to exponential decay in the mineral soil. The half-life (DT_{50}) of *S*-metolachlor in organic soil was 19 and 62 days in 2013 to 2014 and 2014 to 2015 sugarcane growing seasons, respectively. The DT_{50} was 12 and 24 days in 2014 to 2015 and 2015 to 2016 sugarcane growing seasons, respectively. The DT_{50} of *S*-metolachlor in Florida sugarcane soils was similar to values ranging from 15 to 25 days previously reported in southern United States with the exception of 62 days observed on organic soil in one growing season. Further studies need to be conducted to relate the level of weed control to the DT_{50} of *S*-metolachlor in Florida sugarcane fields.

DIFFERENTIAL RESPONSE OF PPO-RESISTANT PALMER AMARANTH POPULATIONS TO FOLIAR AND SOIL-APPLIED HERBICIDES. R.A. Salas*[1], N.R. Burgos[1], L. Piveta[2], J. Refatti[2], L.E. Estorninos[1], T.M. Penka[1], R.C. Scott[3]; [1]University of Arkansas, Fayetteville, AR, [2]Universidade Federal de Pelotas, Pelotas, Brazil, [3]University of Arkansas, Lonoke, AR (163)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri)* is an economically problematic weed threatening the sustainability of crop production in the United States. Widespread occurrence of Palmer amaranth resistant to ALS-inhibiting and glyphosate herbicides led to the increased use of PPO-inhibiting herbicides. Resistance to PPO-inhibitors in Palmer amaranth is a great concern given the high selection pressure and increasing number of fields with Palmer amaranth escaping or surviving PPO herbicide applications in at least three states in the US. The objectives of this research were to (1) to investigate the response of PPO-resistant Palmer amaranth to various foliar- and soil-applied PPO inhibitors and (2) evaluate the efficacy of foliar-applied herbicides with different modes of action on Palmer amaranth accessions from Arkansas collected in 2014 and 2015. Seventy-three accessions were planted in cellular trays and sprayed with recommended doses of foliar-applied herbicides (dicamba, fomesafen, glufosinate, glyphosate, and trifloxysulfuron). Twelve fomesafen-resistant accessions were sprayed with other foliar-applied PPO herbicides (acifluorfen, carfentrazone, flumioxazin, fluthiacet-methyl, lactofen, pyraflufen-ethyl, and saflufenacil). Mortality and injury of survivors were recorded 3 wk after treatment (WAT). Fomesafen-resistant accessions were also tested for resistance to soil-applied PPO herbicides. Approximately 120 seeds/accession were planted in a tray filled with 5:1 mixture of silt loam field soil: commercial potting soil. Seedling emergence was recorded 3 WAT. Glyphosate and trifloxysulfuron had poor activity on the accessions tested; however, dicamba and glufosinate were effective. Reduced efficacy of foliar-applied fomesafen was evident on samples collected in 2015. The majority of samples from fields with history of PPO herbicides showed reduced sensitivity to foliar-applied PPO herbicides. The efficacy of other foliar PPO herbicides was as follows: saflufenacil > acifluorfen > flumioxazin > lactofen > pyraflufen-ethyl > carfentrazone > fluthiacet-methyl. Saflufenacil, sulfentrazone, and flumioxazin applied to soil were effective in reducing seedling emergence. Some accessions showed decreased sensitivity to soil-applied fomesafen and oxyfluorfen. These studies confirmed the spread of PPO-resistant Palmer amaranth in Arkansas; cross-resistance to foliar-applied PPO herbicides, and the tendency for reduced efficacy of soil-applied fomesafen and oxyfluorfen on populations resistant to foliar-applied fomesafen. Effective control on PPO-resistant accessions is becoming complicated with the pre-existing resistance to glyphosate and ALS herbicides and reduced sensitivity to some soil-applied PPO herbicides. Mitigation of further spread of PPO resistance should be pursued with large-scale implementation of integrated weed management programs.

CRITICAL PERIOD FOR WEED CONTROL IN GRAFTED VS NONGRAFTED WATERMELON. M.B. Bertucci*[1], D.W. Monks[2], K.M. Jennings[1], D.L. Jordan[1], F.J. Louws[2], J.R. Schultheis[2]; [1]North Carolina State University, Raleigh, NC, [2]NC State University, Raleigh, NC (164)

ABSTRACT

Grafting of watermelon is a common practice in East Asia and in Europe, but it has not been implemented on a wide scale in the United States. Grafting allows growers to combine a rootstock having a desirable trait (e.g., disease resistance, increased vigor, drought tolerance) with a high-yielding or high-quality scion that remains genetically unchanged. Primary benefits of grafting include increased resistance to soilborne pathogens and an associated increase in yield. However, no research has investigated the difference in the critical period for weed control (CPWC) in grafted watermelon and nongrafted watermelon. Thus, the objective of this study was to determine the CPWC in grafted and nongrafted watermelon using a mixed weed population of large crabgrass (*Digitaria sanguinalis*), common purslane (*Portulaca oleracea*), and yellow nutsedge (*Cyperus esculentus*).

Two field studies were conducted at the Horticultural Crops Research Station in Clinton, North Carolina in 2015 and 2016 to determine the critical period of weed control. 'Exclamation' a triploid watermelon was used as the scion in all grafting treatments. Grafting treatments included two *Cucurbita maxima* x *Cucurbita moschata* rootstocks 'Carnivor' and 'Kazako', as well as a non-grafted control ('Exclamation'). Weed establishment and removal timings were 0, 2, 3, 4, 6, and 11 wk after watermelon transplanting (WAT). Marketable yield (fruit weighing >4.1 kg) and fruit count were measured over two harvests. A subsample of fruit from each plot were evaluated for hollow heart disorder.

Grafting treatment and timing of weed establishment and removal had a significant effect ($p < 0.05$) on marketable yield and fruit count. Neither grafting nor timing of weed establishment or removal had a significant effect on the incidence of hollow heart in watermelon fruit. Because watermelon is a high value per hectare crop, the CPWC was determined as the period when weeds must be controlled in order to achieve 100% weed-free yield. Results indicate weeds must be controlled from 0 to 32 d after transplant (DAT) to avoid loss in yield for all grafting treatments. Thus, the CPWC did not differ between grafted and nongrafted watermelon.

SURVEYING THE LEVEL OF HERBICIDE-RESISTANT WEED INFESTATION IN TEXAS RICE. R. Liu*[1], X. Zhou[2], M.V. Bagavathiannan[3]; [1]Texas A&M University, College station, TX, [2]Texas A&M AgriLife research, college station, TX, [3]Texas A&M University, College Station, TX (165)

ABSTRACT

Barnyardgrass (*Echinochloa crus-galli*), weedy rice (*Oryza sativa*) and Nealley's sprangletop (*Leptochloa nealleyi*) are dominant weed species in rice production in Texas. In this system, common postemergence herbicides used for weed management include propanil, quinclorac, fenoxaprop and imazethapyr. Repetitive use of these herbicide mechanisms of action (MOA) has led to evolution of herbicide-resistant weeds elsewhere. However, the current status and distribution of weeds resistant to the above herbicides in rice production fields in Texas is not known. To determine this, late-season field surveys were conducted in the 2015 and 2016 growing seasons. Seeds collected from the surveys were germinated in Petri dishes and transplanted to individual pots, with five seedlings per pot and four replications per treatment. The pots were arranged in a completely randomized design. The experiment was repeated in time. A total of 24 barnyardgrass, 11 weedy rice and 13 Nealley's sprangletop populations were evaluated so far. Herbicides were applied at recommended field rates at the 2-3 leaf weed stage, following standard application procedures using an automated spray chamber. Survival (%) and weed injury (%) were assessed at 21 days after treatment on a scale of 0 to 100%. Results showed that 33, 25, 19 and 25% of the barnyardgrass populations tested so far had individuals with high levels of resistance (<25% injury) to propanil, imazethapyr, quinclorac and fenoxaprop, respectively. Among these barnyardgrass populations, six had cross resistance to all four herbicides evaluated in this study. Eleven weedy rice populations evaluated showed moderate to high level of resistance to imazethapyr. All Nealley's sprangletop populations showed low to moderate tolerance to propanil, which may be natural to this species. However, about 36 and 9% of the populations showed moderate (26 to 90% injury) and high levels of resistance, respectively to imazethapyr. The findings of this study will help Texas rice farmers develop effective management practices to combat against herbicide-resistant weeds.

EFFECT OF LONG-TERM TILLAGE PRACTICES ON SOIL PHYSICAL PROPERTIES AND ABOVE AND BELOW GROUND WEED DIVERSITY IN CONTINUOUS SORGHUM PRODUCTION. P. Govindasamy*[1], J. Mowrer[1], T. Provin[1], F.M. Hons[1], M. Bagavathiannan[2]; [1]Texas A&M university, College Station, TX, [2]Texas A&M University, College Station, TX (166)

ABSTRACT

The impact of 34 years of long-term tillage practices on soil physical properties, weed diversity, and weed seedling emergence patterns were studied in two different tillage systems [no-till (NT) and conventional till (CT)] in continuous sorghum production at Texas A&M University Research Farm near College Station, TX. Preliminary results have revealed that the NT system had higher water holding capacity (11% higher), bulk density (1.39 g cm^{-3}), soil resistance (29.61 J cm^{-1}), and soil porosity (52%) compared to CT. Soil moisture and temperature levels were also greater in the NT compared to the CT system. Weed species dynamics were also different between the two systems. The NT system had greater weed diversity (Shannon-Weiner index) and dominance (Simpson index). However, species evenness (Shannon-Weiner index) was greater in the CT system. Moreover, only 59% of the weed species were common between the two production systems (Steinhaus index), indicating a significant weed species shift when adopting continuous NT system. About 60% of the species in NT system were small-seeded annuals, compared to only about 25% in CT. Further, the NT system had greater densities of Johnsongrass (*Sorghum halepense*) (311 seedlings m^{-2} greater than CT), which is the predominant perennial species found in the plots. In the NT system, the germination of Texas millet (*Urochloa texana*) and time to 50% emergence of waterhemp (*Amaranthus tuberculatus*) delayed by 35 days and 11 days, respectively. The weed seeds showed more uniform distribution across the soil profile in the CT system than in the NT system. Further, greater than 50% of the total dormant seeds were present at the soil surface in the NT system. Results emphasize that growers transitioning to conservation tillage practices must consider potential shifts in weed communities and develop a weed management program accordingly.

RESCUE PALMER AMARANTH CONTROL WITH DICAMBA PLUS GLUFOSINATE IN XTENDFLEX® COTTON. R.A. Atwell*[1], C.W. Cahoon[2], R.W. Seagroves[3], M.C. Askew[1], A.C. York[1]; [1]North Carolina State University, Raleigh, NC, [2]Virginia Tech, Painter, VA, [3]NCSU, Raleigh, NC (167)

ABSTRACT

Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats) is a widespread problem for cotton producers in the southeastern United States. Producers commonly use glufosinate to control Palmer amaranth (AMAPA), which simulates concerns for selection of glufosinate-resistant AMAPA biotypes. AMAPA must be 7.5 cm or less for consistent control by glufosinate. Producers often struggle to make timely applications, and this can result in inadequate control by glufosinate. XtendFlex® cotton, tolerant of dicamba, glufosinate, and glyphosate, will provide producers with another tool to manage AMAPA. Concurrent use of dicamba and glufosinate will reduce selection pressure on glufosinate and may widen the window for application. Two experiments were conducted to evaluate AMAPA control in a rescue situation using dicamba and glufosinate.

Both experiments were conducted at five locations in North Carolina during 2015 and 2016. No PRE herbicides were used in order to have dense weed pressure for POST treatments. A layby application of glyphosate potassium salt (1260 g ae ha^{-1}) + *S*-metolachlor (1070 g ai ha^{-1}) + diuron (1120 g ai ha^{-1}) was made in each experiment. A non-treated check was included in each experiment. The experimental design was a RCBD with four replications for each experiment. AMAPA control, late-season weed biomass, cotton height, cotton injury, and cotton yield were evaluated in each experiment.

The objective of the first experiment was to compare glufosinate alone, dicamba alone, and dicamba+glufosinate for AMAPA control in a rescue situation and the subsequent effects on cotton growth and yield. Glufosinate-ammonium, dicamba diglycolamine salt, and dicamba+glufosinate at rates described below were first applied to 20-cm AMAPA followed 10 to 12 d later by a second application. Rates included glufosinate (880 g ai ha^{-1}=GH, 590 g ai ha^{-1}=GL), and dicamba (560 g ae ha^{-1}=D). Treatments included GL followed by GL, GH followed by GL, GL+D followed by GL, GH+D followed by GL, GL+D followed by GL+D, GH+D followed by GL+D, D followed by D, D followed by GL+D, and D followed by GH+D.

Dicamba+glufosinate was more effective at controlling AMAPA 7 d following the first POST application than either active ingredient alone. Greater than 92% AMAPA control was achieved in all treatments except D followed by D, GL followed by GL, and GH followed by GL which had 84, 78, and 82% AMAPA control, respectively, 14 d following the second POST application. Following the layby application, AMAPA was controlled 88 and 91% by GL followed by GL and GH followed by GL, respectively. Other treatments controlled AMAPA >99%. All treatments reduced late-season AMAPA biomass by at least 95%. Cotton lint yield trended towards declining when dicamba was applied alone in the first POST application. This yield decline is attributed to prolonged early season weed competition from slower AMAPA death by dicamba alone compared to glufosinate alone or dicamba+glufosinate.

The objective of the second experiment was to evaluate AMAPA control, cotton growth, and cotton yield in an AMAPA rescue situation created by delaying first POST application timing of dicamba+glufosinate. Timings of the first POST application of dicamba+glufosinate (560 + 880 g ha^{-1}) included timely application and delays of 7, 14, 21, or 28 d. The timely application was made to 1-leaf cotton and AMAPA no larger than 7.5 cm tall. A second POST application of dicamba+glufosinate (560 + 590 g ha^{-1}) was made 14 d after the first application.

AMAPA was controlled 99 and 97% 14 d after the first POST application with 0- and 7-d delays, respectively. Control declined to 92, 81, and 78% with 14-, 21-, and 28-d timing delays, respectively. Control improved following the second POST application of dicamba+glufosinate and 99% or greater AMAPA control was achieved following layby. All treatments reduced late-season AMAPA biomass by at least 98%. Although excellent AMAPA control was ultimately achieved, early season AMAPA competition resulting from application delays reduced cotton growth and yield. Cotton height decreased linearly as first POST application timing was delayed. Cotton lint yield also decreased linearly as first POST application timing was delayed, with yield reductions of 11, 32, 42, and 50 % observed with 7-, 14-, 21-, and 28-d delays in first POST application timing, respectively.

This research demonstrates that XtendFlex® cotton will provide producers an option to control AMAPA in a rescue situation with a co-application of dicamba+glufosinate when timely application is not possible, however delayed applications are not recommended because AMAPA competition will reduce crop yield as applications are delayed. Results indicate that producers should avoid depending solely on glufosinate or dicamba in this system to achieve greater efficacy in AMAPA control and to slow herbicide resistance development.

EVALUATION OF THE IMPACT OF FLOODING ON THE GERMINATION AND GROWTH OF DIFFERENT RICE WEEDS. S.B. Abugho*[1], X. Zhou[2], R. Liu[3], V. Singh[1], M.V. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife research, college station, TX, [3]Texas A&M University, College station, TX (168)

ABSTRACT

Organic rice is increasing in popularity in Texas and weed management is a major challenge in organic rice production. Flooding is considered an important cultural tactic for weed management in organic rice. However, little is known on the impact of flooding on the germination and growth characteristics of some of the dominant weeds present in Texas rice production fields. To address this, two experiments were conducted in a greenhouse at Texas A&M University, College Station. The first experiment was focused on understanding the impact of flooding on the germination and emergence pattern of Amazon sprangletop, Nealley's sprangletop, hemp sesbania, barnyardgrass, Palmer amaranth and weedy rice, whereas the second experiment investigated the impact of flooding on continued growth and development of these weeds when flooding occurred at different seedling growth stages. In the first experiment, 250 seeds each of the study species were planted in plastic containers filled with a 1:1 ratio of field soil and LC1 potting soil mix and flooded at three depths: 0, 2.5 and 7.5 cm. This experiment was conducted in a randomized complete block design with four replications. Emerged seedlings were counted and removed once every four days for a month period. The second experiment has been complete only for barnyardgrass, hemp sesbania and weedy rice. Seedlings (stages: just emerged, 1, 2, 5 and 10 cm tall) were transplanted to Styrofoam cups (17 cm tall x 15 cm dia) filled with the field soil-potting soil mix described above and were flooded at two levels: 0 and 10 cm. Each treatment had 8 replications and were arranged in a completely randomized design. Flooding severely reduced the germination of most species, but more germination was observed under the flooding depth of 2.5 cm compared to 7.5 cm. Further, flooding at 7.5 cm delayed the emergence of hemp sesbania by 12 days and barnyardgrass by 8 days. Weedy rice had the highest germination with ~40 and 6% germination under 2.5 and 7.5 cm flooding, respectively. Hemp sesbania and barnyardgrass did not survive when flooding occurred prior to the 1 cm seedling stage. There was an increasing trend in plant height and above-ground biomass production with hemp sesbania and barnyardgrass, especially when flooded at the 5 and 10 cm tall seedling stages. Further, there was a significant increase in root biomass when hemp sesbania was flooded at later growth stages; this trend was not observed in barnyardgrass or in weedy rice. Preliminary results of this study show that flooding can influence the germination, growth, and development of weeds, but the degree of response varied across the weed species. More research is currently underway to fully understand the effect of flooding as a tool for weed management in organic rice production.

LONG TERM ATRAZINE USE REDUCES SOIL PERSISTENCE: DOES THE SAME OCCUR WITH METRIBUZIN AND SIMAZINE? E.T. Parker*, T.C. Mueller; University of Tennessee, Knoxville, TN (169)

ABSTRACT

The triazine herbicides are one of the most important classes of agricultural chemicals ever developed. This class of persistent herbicides provide season-long weed control and are a vital component in managing herbicide resistant weeds in corn and soybeans. Widespread atrazine use each year has contributed to the phenomenon of adapted soils; those with microbial populations adapted to metabolizing atrazine. Atrazine applications made to these soils are often less persistent, and therefore are less able to control weed populations. If this reduced persistence is occurring with atrazine in soils with a history of atrazine use, it begs the question whether the same reduction in persistence can be expected with metribuzin and simazine.

Pairs of 'matched' soils were collected from three states (IA, IL, and PA). Each pair contained soil from a field with a history of 3+ years of atrazine application and from a field with no atrazine history. These soils were saturated and drained to simulate field capacity, then 5g of each was placed into 20mL vials. Each vial was fortified with either atrazine, metribuzin, or simazine in water and allowed to equilibrate. Samples remained at ~20 ° C for time intervals of -1, 0, 3, 7, 14, 21, 28, and 42 DAT to allow microbial degradation to occur, then samples were placed in a freezer to halt degradation. Next, 12mL of methanol was added then samples were shaken for 2h. This solution was filtered through a 0.45 micron filter into vials for analysis by LC-MS. Triazine concentrations in ppb were analyzed using SAS PROC GLIMMIX. Concentrations were then regressed across time intervals and the formula $0.693/k=DT_{50}$ was used to determine herbicide half-lives.

Soils from all three states had enhanced atrazine and simazine degradation in history soils, from a factor (DT_{50} History Soil/DT_{50} Non-History Soil = factor) of 2.5 to a factor of 34. Only soil from IA showed enhanced metribuzin degradation (by a factor of 1.9). These results offer insight into future use patterns of triazine herbicides. If atrazine in used annually in soils, the rate of atrazine, simazine, and possibly metribuzin degradation will increase, thereby decreasing residual weed control.

UNMANNED AERIAL SYSTEMS FOR WEED MANAGEMENT APPLICATIONS. M.V. Bagavathiannan*, A. Rana, M. Bishop, J. Valasek, S. Popescu, D. Cope; Texas A&M University, College Station, TX (170)

ABSTRACT

Effective weed management is a requirement to achieve high crop yields and growers spend significant amount of money and other resources each year to control weeds. Field scouting is an important component of weed control, which allows for an assessment of weed infestations and help make informed weed management decisions. Manual field scouting, however, has its own challenges and limitations. Further, herbicides are typically applied as blanket sprays throughout the entire field, thus incurring high weed management costs. Recent advancements in precision agriculture can provide solutions to some of the challenges associated with effective and economic weed management, through effective field scouting for weeds and precision-delivery of herbicides where required. Research is ongoing at Texas A&M University to utilize emerging Unmanned Aerial System (UAS) platforms for precision weed management applications. Weed species detection and differentiation, weed control assessments, crop injury estimation, and developing a real-time precision herbicide delivery system are the major objectives of this project. Weed detection using indices developed based on different RGB ratios was consistent for certain species (e.g., cotton and common waterhemp), but not for many others. Hyperspectral data obtained using a spectroradiometer was useful in distinguishing some other species. Preliminary results suggest that robust detection and differentiation of crop and weed species will require a dynamic integration of plant reflectance at different spectral bands, spatial pattern and structural analysis, as well as knowledge integration. More research is underway to explore the opportunities provided by UAS platforms for precision weed management applications.

PROVISIA™ RICE SYSTEM - NEW TECHNOLOGY FOR CONTROL OF RED RICE AND OTHER GRASSES. A.R. Rhodes*[1], A. Adams[2], J.B. Guice[3], J. Schultz[4], D. Westberg[5], C. Youmans[6]; [1]BASF, Madison, MS, [2]BASF, RTP, NC, [3]BASF, Winnsboro, LA, [4]BASF, Sherwood, AR, [5]BASF, Cary, NC, [6]BASF, Dyersburg, TN (171)

ABSTRACT

The Provisia™ Rice System, a new non-GM herbicide tolerant system under development by BASF which complements the Clearfield® Rice System, will provide growers with another effective tool for weed control and resistance management. The Provisia Rice System allows the planting of Provisia rice one season followed by planting Clearfield rice the next season. This helps rice producers who desire to plant two consecutive years of rice to use two different herbicide modes of action to control red rice and volunteer rice. The Provisia Rice System will be a combination of Provisia rice treated with Provisia Herbicide (quizalofop-P-ethyl). Provisia rice has exhibited excellent herbicide tolerance to single and sequential applications of Provisia Herbicide at proposed labeled rates. Provisia Herbicide controls non-Provisia volunteer rice (*Oryza sativa* L.) and other common annual and perennial grasses, including red rice (*Oryza sativa* L.) and barnyardgrass (*Echinochloa crus-galli* L). Volunteer rice includes conventional, hybrid, and Clearfield rice.

Optimum control of red rice and other grass species requires sequential applications of Provisia Herbicide. Provisia Herbicide, when tankmixed with other rice herbicides, provides control of broadleaf and grass weed species. However, studies show that a few herbicides such as propanil or triclopyr might reduce the efficacy of Provisia Herbicide slightly. An example of a Provisia Rice herbicide program for season long weed control typically includes a preemergence herbicide (example: clomazone or quinclorac); followed by an early postemergence application of Provisia Herbicide + a broadleaf tankmix partner herbicide; followed by a mid postemergence application of Provisia Herbicide. Stewardship is very important for the long-term success of the Provisia Rice System and should be integrated with Clearfield rice and other rotational crops such as GM-soybeans.

COMPARISON OF NON-STS, STS, AND BOLT™ SOYBEAN (*GLYCINE MAX*) SUSCEPTIBILITY TO GRASP® (PENOXSULAM) AND REGIMENT® (BISPYRIBAC).

D.C. Walker[*1], D.B. Reynolds[1], J.A. Bond[2]; [1]Mississippi State University, Starkville, MS; [2]Mississippi State University, Stoneville, MS (172)

ABSTRACT

In 2015, DuPont Pioneer released a new herbicide-tolerant trait called BOLT™. This trait is a further development of their STS (sulfonylurea tolerant) soybean and was developed from plants that were found to exhibit tolerance higher than the STS soybean trait. This technology allows producers to spray LeadOff® (rimsulfuron, thifensulfuron) and Basis® Blend (rimsulfuron, thifensulfuron) on soybean crops. Both of these herbicides have active ingredients that are ALS inhibitors and therefore have the same mode of action as Grasp® and Regiment®. Therefore, an overall evaluation of soybean with BOLT™ technology and evaluating the possibility of using soybean with BOLT™ technology as a drift mitigation tool for off-target deposition of Grasp® and Regiment® herbicides on rice is necessary. If successful, BOLT™ soybean use could be widely adopted by local growers to provide a strong safety net for the protection of off-target herbicides.

The main objective of this study is to evaluate available BOLT™ varieties for differential tolerance to Grasp® and Regiment®. This study was conducted in Brooksville and Starkville, MS. The study was a 3x2x3 factorial arrangement of treatments nested in a RCB design. The factors were three different bean types (Non-STS, STS, and BOLT™), two maturity groups (late group 4, early group 5), and three applications (Grasp, Regiment, untreated check) for a total of 18 treatments. Each application also included a surfactant with Grasp**®** including MSO – premium blend at a rate of 2.33 L ha^{-1} and Regiment**®** including Dyne-a-Pack at a rate of 1% v/v. All applications were made at the three-leaf growth stage (V3) at a delivery volume of 140 L ha^{-1} using Teejet AIXR 110015 nozzles.

Treatments were then compared to their respective untreated checks and visual ratings for phytotoxicity were taken 7, 14, 21, and 28 DAT. Plant heights and node counts were also taken 14 and 28 DAT. Soybean yields were recorded at the conclusion of the growing season (KG ha^{-1}). The results indicated that BOLT™ soybean varieties showed significantly less injury at 28 DAT then other varieties. However, the yield of BOLT™ soybean varieties was not statistically better than STS varieties but was greater than Non-STS varieties.

FACTORS INFLUENCING OFF TARGET MOVEMENT OF NEW HERBICIDE FORMULATIONS. D.M. Simpson*, D.G. Ouse, M. Li, J.G. Gifford, J.J. Schleier; Dow AgroSciences, Indianapolis, IN (173)

ABSTRACT

Soybean herbicide resistance traits that provide tolerance to 2,4-D or dicamba have been developed by Dow AgroSciences and Monsanto. Both 2,4-D and dicamba are potentially susceptible to volatility and vapor drift. Volatility of 2,4-D and dicamba is generally directly correlated to the volatility of the associated counter-ion. For example, laboratory and field studies conducted by Dow AgroSciences have demonstrated that the non-volatile choline cation provides a significant reduction in volatility of 2,4-D even compared to the dimethylammonium (DMA) salt. Similarly, BASF has shown reduction in volatility with the N,N-Bis-(3-aminopropyl)methylamine (BAPMA) salt of dicamba compared to the DMA and diglycolamine (DGA) salts. Historically, vapor pressures of the herbicides have been used to compare relative volatility potential. However, these auxinic herbicides will be applied to plant and soil surfaces and rarely applied as simple herbicide salt solutions. Tank-mixes as well as pre-mixes of 2,4-D or dicamba with glyphosate for broad-spectrum weed control are and will continue to be common. Applications will often include the addition of water conditioning agents such as ammonium sulfate (AMS) or AMS replacements. It is important to understand the impact of spray solution properties on the volatility of auxinic herbicides from soil and plant surfaces. The effect of glyphosate, spray solution pH and the presence of other counter-ions on the volatility of 2,4-D and dicamba were determined in controlled laboratory studies. Corn was treated with the herbicide treatments and volatility measured over a 96-hour period after application. Addition of glyphosate did not increase volatility of 2,4-D choline, but did increase volatility of dicamba DGA and dicamba BAPMA. Volatility was increased when AMS was added to glyphosate + dicamba DGA or dicamba BAPMA. Volatility of 2,4-D choline + glyphosate was not affected by the addition of AMS. Volatility of dicamba increased as the pH of the spray solution decreased. It is imperative that spray solution pH and adjuvants, water conditioning agents, and other pesticide products be considered when determining the volatilization potential of dicamba. In contrast, volatility of 2,4-D choline was not affected by these factors.

VAPORGRIP TECHNOLOGY; HOW IT WORKS AND ITS BENEFITS. A. MacInnes*; Monsanto, St. Louis, MO (174)

ABSTRACT

Monsanto Company has developed formulations containing dicamba for use in the Roundup Ready® Xtend™ Crop System. XtendiMax™ with VaporGrip™ technology is a dicamba standalone formulation based on the diglycolamine (DGA) dicamba salt. Roundup Xtend™ with VaporGrip™ technology is a premix formulation containing DGA dicamba and monoethanolamine (EA) glyphosate delivering a 2 to 1 ratio of glyphosate to dicamba. Both formulations contain proprietary VaporGrip™ technology that reduces the potential of dicamba volatility compared to current commercial dicamba formulations. VaporGrip technology works by preventing the formation of the volatile species in the formulation. Although volatility is a small contributor to potential off-target movement, this often remains a concern from growers and applicators as a legacy from use of the dimethylamine (DMA) salt launched in the 1960s. The DGA salt of dicamba consistently shows low volatility potential, and this can be reduced further by using VaporGrip™ technology. Spray drift and tank contamination are the main contributors to potential off-target movement. These can be decreased significantly through appropriate application practices and proper tank clean out. Application requirements for on-target applications will appear on approved herbicide product labels.

SOYBEAN VARIETAL RESPONSE TO DICAMBA APPLIED AT THE VEGETATIVE GROWTH STAGE. A. Growe*, W. Everman; North Carolina State University, Raleigh, NC (175)

ABSTRACT

With the spread of glyphosate resistant weed species throughout North Carolina, there has been a renewed interest of using growth regulator herbicides for weed control options in the state. As dicamba, a common growth regulator herbicide, is being incorporated back into herbicide programs, there is concern of off target movement to sensitive crops in adjacent fields. In 2015, 1.79 million soybean acres were harvested in North Carolina with a monetary value of 486 million dollars. Since the 1970's research has demonstrated that soybeans are highly sensitive to dicamba. As a major row crop, we must understand dicamba's affects on soybean cultivars grown in North Carolina. It is important to make dicamba applications during the best possible conditions so that risk of drift and volatility is minimized. To date, there has been little information reported on soybean varietal responses to dicamba drift.

The objective of these studies was to evaluate the effects of sub-lethal rates of dicamba on various group V and VI soybean cultivars at vegetative growth stages. Effects of dicamba were determined by collecting visual injury ratings, height reductions and yield reductions. Experiments were conducted at the Upper Coastal Research Station (Rocky Mount, NC), Peanut Belt Research Station (Lewiston, NC) and Lower Coastal Research Station (Kinston, NC) during 2015 and 2016. Five maturity group V and five maturity group VI soybean varieties were treated with dicamba at 1.1, 2.2, 4.4, 8.8, 17.5, 35, and 70 g ae ha $^{-1}$ (1/512 to 1/8 of the labeled use rate for weed control in corn) during the V4 growth stage. Experiments were conducted using a factorial arrangement of treatments in a randomized complete block design, with two factors being soybean variety and dicamba rate. All data were subjected to analysis of variance and means were separated using Fisher's Protected LSD at p= 0.05.

A wide range of visual injury was recorded at 1, 2 and 4 WAT for all varieties. Higher levels of injury were associated with increasing dicamba rates. Injury ratings ranged from 25-73% and 19-66% 2 WAT for Maturity Group V and VI varieties respectively. Significant differences in height reductions to the non-treated check were also observed. Plant height reductions ranged from 22-72% and 11-57% 4 WAT for Maturity Group V and VI varieties respectively. In 6 out of the 7 trials conducted, significant yield reduction was observed when 4.4 g ae ha^{-1} of dicamba was applied. Variety effects on height reductions were small while effects on yield were greater. Dicamba generally had a greater impact Maturity Group V varieties compared to Maturity Group VI. Cultivar and environment may influence soybean's response to dicamba drift. These studies demonstrate soybean's sensitivity to dicamba. It is important to make dicamba applications during the best possible conditions so that risk of drift and volatility is minimized.

EFFECT OF TREATMENT TIMING ON NATURAL PINE AND HARDWOOD CONTROL FOLLOWING APPLICATION OF MIXES CONTAINING AMINOPYRALID OR SAFLUFENACIL. A.W. Ezell*, A.B. Self; Mississippi State University, Starkville, MS (202)

ABSTRACT

Natural pine control continues to be a major problem during site preparation for pine plantation establishment. In order to test the efficacy of aminopyralid and saflufenacil for this control, a study involving 8 treatments was established on a cutover forestry site in north Mississippi. One treatment was applied in June with all others applied in September. Natural pines and hardwoods were both recorded prior to application and again at 12MAT. Results clearly indicate that saflufenacil can enhance the effecicay of glyphosate but will not control pines as a stand alone application. Aminopyralid did not provide acceptable levels of pine control. The early application timing did provide results which indicated that adding saflufenacil to early treatments may improve control.

SCREENING CLEANTRAXX FOR HERBACEOUS WEED CONTROL IN NEWLY PLANTED LOBLOLLY PINE. J.L. Yeiser*[1], A.W. Ezell[2], M. Olson[1]; [1]University of Arkansas at Monticello, Monticello, AR, [2]Mississippi State University, Starkville, MS (203)

ABSTRACT

Cleantraxx with NIS or MSO was compared to Oustar, Goaltender, Milestone+Cleantraxx, and check treatments for herbaceous weed control, as well as pine seedling tolerance and growth. The test site was located near Fountain Hill (Ashley County) in the hilly-upper coastal plain of southeastern Arkansas. The soil was a Pheba loam with 0-2% slope. A wildfire swept the area in September 2013 destroying the early mid-rotational pine stand. The site was aerially sprayed with Arsenal 4SL+Accord XRT II (24oz+3qts; 15GPA) in May 2015 and root raked and combination plowed in September 2015. Genetically improved seedlings were planted in January 2016 on a 6-ft X 12-ft spacing.

Research herbicides were applied on April 8, 2016 with a CO_2 backpack sprayer and single flood nozzle in a 5-ft band over the top of newly planted seedlings. The total application volume was 10 GPA. Herbicides (rate in product/treated acre) were: (1) Cleantraxx-3pt+.25% NIS, (2) Cleantraxx-4.5+.25%NIS, (3) Ceantraxx-3pt+1%MSO, (4) Cleantraxx-4.5pt+1%MSO, (5) Goaltender-3pt+1%MSO, (6) Milestone+Cleantraxx+MSO-7oz+3pt+3pt+1%, (7) Arsenal Ac+Oust XP-4+2 (operational), (8) Oustar-10oz, and (9) untreated check. 0.33-in rainfall occurred on April 11, 2016. Spring growing conditions were uncommonly wet. Plots were visually evaluated for percent bare ground in 10% intervals at 30-, 60-, 90-, and 120-DAT. Initial and late season measurements documented seedling performance. Initial seedling total height and ground line diameter were recorded on March 22, 2016. Total height was recorded again on July 11, 2016, when the first flush was fully mature and the 2nd flush was appearing. Total height and ground line diameter were recorded again on August 30, 2016. Treatments were established in a randomized complete block design with three blocks. Each block contained nine treatments each containing 14 row-plot seedlings with an internal 10 measurement seedlings leaving two buffer seedlings on each end. Study parameter were bare ground (%) and total height (in), ground line diameter (in), and volume index (cub in). On application day, panic grass, dogfennel, wild geranium, dandelion, venus lookinglass, cudweed, and common plantain disproportionately occupied test plots and many were developed beyond the 2-3 leaf stage. Cleantraxx controls early post-emergence weeds only. These weeds were too well developed for Cleantraxx and Goaltender control and influenced the bare ground values. Also, cudweed was uncommonly heavy and was not controlled by Cleantraxx, Goal, and Arsenal AC+Oust XP 4+2oz treatments. At 60-DAT, the winter forbs were largely dead. Bare ground was observed to increase on Cleantraxx, Goal and Arsenal AC plots from 30-DAT to 60-DAT, not because of herbicides, but due to the natural mortality of winter forbs. 30-DAT, Milestone+Cleantraxx+MSO-7oz+3pt+3pt+1% and Oustar-10oz provided significantly more bare ground than other treatments. Cleantraxx and Arsenal AC+Oust (4+2oz) were intermediate with Goaltender and check plots exhibiting significantly less bare ground. At 90-DAT (July), only the Oustar 10oz treatment plots exhibited the >80% bare ground commonly associated with adequate herbaceous weed control for best seedling performance. Seedling tolerance of Milestone+Cleantraxx was inadequate with initial seedling heights 1.3-in greater than July seedlings. MSO seedling flushes were shorter than NIS and other herbicide treated

seedlings. Survival was similar for all treatments with a study average of 91%. Largest seedlings were on plots treated with Oustar or Cleantraxx (4.5pt+.25%NIS, 3pt+1%MSO). Only Milestone+Cleantraxx+MSO and Oustar treatments controlled yellow thistle.

MISSISSIPPI HIGHWAY RIGHTS-OF-WAY: WHAT ARE THE 10 MOST COMMON AND 10 MOST TROUBLESOME WEEDS? J.D. Byrd, Jr.*[1], V.L. Maddox[1], D.G. Thompson[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi Department of Transportation, Jackson, MS (204)

ABSTRACT

According to the 2011 American Association of State Highway and Transportation Officials (AASHTO) Guidelines for Vegetation Management, the objectives of roadside vegetation management are safety, economics, erosion control, environmental value, public relations, legal, aesthetic, and transportation sustainability. Plants on the right-of-way that negatively affect these objectives are objectionable. In 2011, 363 species in 225 genera and 72 families were identified and percent visual ground cover occupied by each species estimated in 800 1.5 m^2 plots across the 10 physiographic regions of Mississippi Department of Transportation (MDOT) maintained 10,885 miles of highway rights-of-way. Divided lane road medians were excluded in the survey. Mississippi roadside rights-of-way have high numbers of warm-season, perennial, native vegetation. Based on published taxonomic descriptions of flower or seed production, 69% of the plants identified are warm-season, while 24% are cool-season. The remaining 7% have a less defined reproductive season. Based on USDA Plants Database (www.plants.usda.gov) descriptions, 77% of species identified are native to North America, 21% introduced, and 2% are listed as both. Based on lifecycle, 61.5% of plants on Mississippi highway rights-of-way are perennial, 24.7%, have an annual lifecycle, 0.5% are biennial, and the 13.3% remaining are various combinations of annual, biennial, and perennial. Plants observed in the greatest number of plots were those species intentionally seeded during right-of-way construction: common bermudagrass (*Cynodon dactylon*) [390 plots], bahiagrass (*Paspalum notatum*) [291 plots], Italian ryegrass (*Lolium multiflorum*) [223 plots], and tall fescue (*Schedonorus arundinaceus*) [145 plots]. Since these were intentionally seeded during right-of-way construction, they are not considered weedy. Species not intentionally seeded on the right-of-way may be considered weeds. Plants not intentionally seeded, but observed in most number of plots included southern crabgrass (*Digitaria ciliaris*) [136 plots], little bluestem (*Schizachyrium scoparium*) [99 plots], annual lespedeza (*Kummerowia striata*) [87 plots], rye brome (*Bromus secalinus*) [84 plots], buckhorn plantain (*Plantago lanceolata*) [80 plots], rattail fescue (*Vulpia myuros*) [75 plots], knotroot foxtail (*Setaria parviflora*) [74 plots], large hop clover (*Trifolium campestre*) [71 plots], broomsedge bluestem (*Andropogon virginicus*) [67 plots], and vaseygrass (*Paspalum urvillei*) [64 plots]. Species identified in the survey were also ranked by plant density, calculated as total percent visual cover summed over all 800 plots divided by the area of all plots (1200 m^2). With this analysis, the most prevalent species on Mississippi highway rights-of-way were (in order of density) common bermudagrass, bahiagrass, tall fescue, southern crabgrass, Italian ryegrass, little bluestem, centipedegrass (*Eremochloa ophiuroides*), annual lespedeza, rye brome, rattail fescue, Johnsongrass (*Sorghum halepense*), cogongrass (*Imperata cylindrica*), Virginia buttonweed (*Diodia virginica*), large hop clover, knotroot foxtail, and broomsedge bluestem. Plants identified in the survey were also ranked by site dominance which was calculated as sum of percent visual cover over all 800 plots divided by the number of plots infested. Site dominance is a function of site suitability, fecundity, and interference. Based on this analysis, two intentionally seeded species occupied more than 30% visual plot cover: bahiagrass [36% cover, 291 plots] and common bermudagrass [33% cover, 390 plots]. Other species with more

than 30% plot ground cover were needlepod rush (*Juncus scirpoides*) [100% cover, 1 plot], eastern gamagrass (*Tripsacum dactyloides*) [44% cover, 4 plots], cogongrass [42% cover, 17 plots], mugwort (*Artemisia vulgaris*) [40% cover, 1 plot], centipedegrass [40% cover, 35 plots], slender fimbry (*Fimbristylis autumnalis*) [34% cover, 3 plots], alligatorweed (*Alternanthera philoxeroides*) [30% cover, 1 plot], variableleaf sunflower (*Helianthus heterophyllus*) [30% cover, 1 plot], Samson's snakeroot (*Orbexilum pedunculatum*) [30% cover, 1 plot], and pale dock (*Rumex altissimus*) [30% cover, 1 plot].

HERBICIDE APPLICATIONS ON HONEY LOCUST. J.R. Jackson*[1], J.R. Ansley[2], C.R. Hart[3]; [1]Texas A&M AgriLife Extension Service, Stephenville, TX, [2]Texas A&M AgriLife Research, Vernon, TX, [3]Dow AgroSciences, Stephenville, TX (206)

ABSTRACT

Honey locust (Gleditsia triacanthos L.) is a common woody invasive plant species in Texas that occurs throughout the central to eastern portion of the state as well as in riparian areas and areas where wet fertile soil exists. While honey locust has been invading rangelands for many years little work has been done on developing control recommendations for this plant. Until recently, the Texas A&M AgriLife Extension publication “Chemical Weed and Brush Control: Suggestions for Rangeland” (RM-1466) only listed an IPT application of Grazon P+D (2, 4-D and Picloram) as the recommend control method. In 2013 work began to develop a broadcast recommendation for control of honey locust, two sites were sprayed with a helicopter in the north Texas area around Denton. In 2014, two more sites sprayed with a helicopter in the north Texas area. The treatments that were applied consisted of Sendero at 28 ounces per acre, Grazon Next HL at 33.6 ounces per acre, Surmount 48 ounces per acre, Chaparral 3.3 ounces per acre, and Grazon P+D at 48 ounces per acre. Evaluations were conducted at one and two years after treatment where treatments were analyzed for percent mortality. At two years after treatment the results indicated that Sendero and GrazonNext HL provided an apparent average mortality of 56-75 percent root kill among treatment locations.

THE ULTIMATE CHALLENGE: REMOVING UNDESIRABLE GRASSES FROM PASTURES. D.P. Russell*, J.D. Byrd, Jr., M.L. Zaccaro, N.H. Thorne; Mississippi State University, Mississippi State, MS (207)

ABSTRACT

Managing unwanted grass weeds in pastures has long posed a daunting challenge to forage producers in the mid-South. For general broadleaf weed control in grass pastures, far more herbicide options exist due to herbicide selectivity. However, removing grasses in perennial grass pastures and hayfields is especially difficult in the transition zone where bermudagrass (*Cynodon dactylon* L.), bahiagrass (*Paspalum notatum* Flueggé), and tall fescue (*Schedonorus arundinaceus* (Schreb.) Dumort) occur. More specifically, the necessity of selective control options of perennial grass weeds like knotroot foxtail (*Setaria parviflora* (Poir.) Kerguélen) and broomsedge (*Andropogon virginicus* L.) in these permanent systems is of utmost importance. Our objective was to express our efforts and limited success of perennial grass control in pastures across northeast Mississippi.

It is known that pendimethalin applications up to 4.48 kg/ha provide activity on a large spectrum of unwanted annual grasses such as crabgrass (*Digitaria spp.*), volunteer ryegrass (*Lolium multiflorum* Lam.), and annual foxtails (*Setaria spp.*) when properly incorporated. Forage production systems often lack irrigation capacity to incorporate pendimethalin timely. In addition, many of the ALS-inhibiting herbicides provide varying degrees of grass selectivity and postemergence options in certain forage pastures. Full and split applications of pendimethalin over consecutive months preceding foxtail germination provided inconsistent results at best in 2015 and 2016. June postemergence applications of nicosulfuron + metsulfuron + glyphosate (0.059 + 0.015 kg ai/ha + 0.24 kg ae/ha) reduced foxtail density by 83% compared to untreated check. This same treatment was applied in July and followed 14 DAT with another nicosulfuron + metsulfuron (0.04 + 0.01 kg ai/ha) application, which provided 64% visual control 55 DAT. Neither of these were without considerable stunting to the tall fescue/bermudagrass forage base.

September 2016 herbicide applications targeted mown and unmown broomsedge in hayfields, but unfortunately, efforts were futile due to an extended severe drought. Research goals for 2017 include postemergence applications of synthetic auxin, ALS, and PPO inhibitors that may have selective activity on broomsedge in mixed-grass pastures.

MANAGEMENT OF FOXTAIL SPECIES (*SETARIA* SPP.) IN HAYFIELDS WITH QUINCLORAC AND PENDIMETHALIN. M.L. Flessner*[1], Q.R. Johnson[2], R.S. Randhawa[1]; [1]Virginia Tech, Blacksburg, VA, [2]University of Delaware, Georgetown, DE (208)

ABSTRACT

Annual foxtails (*Setaria* spp. P. Beauv.) are problematic grassy weeds in hayfields due to their bristly seedheads, which are capable of puncturing mucous membranes leading to injuries to mouth and gum areas, particularly in horses. Herbicidal control options for foxtails are limited and little information exists regarding their efficacy. Research was conducted to evaluate pendimethalin (Prowl H20; BASF) and quinclorac (Facet L; BASF) for giant foxtail (*Setaria faberi* Herrm.) control. Two experiments were conducted in Blacksburg, VA in randomized complete block designs with four replications per treatment. Experiment one evaluated pendimethalin applied PRE (application A) at 1.17, 2.24, 4.5 and 2.24 followed by (fb) 2.24 kg ha^{-1} 30 days apart (application B). Experiment two evaluated pendimethalin PRE (application A) at 4.5, pendimethalin PRE 2.24 fb 2.24 kg ha^{-1} 30 days apart (application A fb B), pendimethalin PRE at 4.5 kg ha^{-1} fb quinclorac at 420 g ae ha^{-1} at first hay cutting (application A fb C), quinclorac at 420 g ha^{-1} early POST (application B), and quinclorac at 420 g ha^{-1} at first cutting (application C). Quinclorac was applied with methylated seed oil at 1.67% v v^{-1}. Both experiments included a nontreated check. Application A was 13 April 2016, application B was 5 May 2016, and application C was 8 June 2016 for both experiments. No foxtail emergence was observed at initiation for both experiments. Visible control data (0 to 100% scale with 0 corresponding to no control and 100 corresponding to complete control relative to the nontreated check) were collected monthly after the PRE treatment for 4 total ratings for both trials. Results indicate that pendimethalin at ≥2.24 kg ha^{-1} maximized giant foxtail control, which was 73 to 90% until mid-July across experiments. Subsequently, these treatments declined to 65 to 88% control in experiment one and 55 to 60% control in experiment two. Quinclorac alone resulted in the better control when applied after the first cutting (85 to 90%) compared to early POST (55 to 81%), across June to August ratings. Pendimethalin fb quinclorac resulted in 90 to 100% control across all rating dates. This result was not different than quinclorac applied alone after the first cutting for all applicable rating dates. These studies indicate that giant foxtail can be controlled in hayfields with both quinclorac and pendimethalin. Future research is needed to assess efficacy on other problematic annual foxtail species.

FRIEND OR FOE, DO WE KNOW? RESPONSE OF GREEN MILKWEED (*ASCLEPIAS VIRIDIS*) TO BROADLEAF HERBICIDES. N.H. Thorne*, J.D. Byrd, Jr., D.P. Russell; Mississippi State University, Mississippi State, MS (210)

ABSTRACT

In an attempt to refute claims that herbicide applications indirectly caused monarch butterfly population decline by reducing the primary host of larvae development, green antelopehorn (*Asclepias viridis*) populations were treated with herbicides routinely used for vegetation management in rights-of-way and forages in 3 locations in Mississippi. Treatments were broken into groups to match available area for field evaluations. All treatments were replicated 4 times in a randomized complete block design. A CO_2 pressurized backpack sprayer that delivered 15 GPA. Response variables measured were visual estimates of herbicide injury, plant growth stage, plant height and stand counts. Data were analyzed by analysis of variance and tested for significance of treatments, growth stage and interactions of treatment by growth stage. Means were separated by least square means.

Treatments in group 1 were applied in Oktibbeha county near Oktoc on May 5: Chaparral (aminopyralid+metsulfuron methyl) at 1.5 and 3.0 oz/A; Arsenal AC (imazapyr) at 1.0 and 2 pt/A; Remedy Ultra (triclopyr) at 2.5 and 5.0 pt/A; Graslan (picloram+2,4-D) at 1.3 and 2.7 pt/A; GrazonNext HL (aminopyralid+2,4-D) at 1.0 and 2.0 pt/A; Milestone (aminopyralid) at 3.5 and 7.0 fl oz/A; Vastlan (triclopyr) at 1 and 2 qt/A; Vista (fluroxypyr) at 11 and 22 fl oz/A. At this application site, Remedy applied at 5 pt/A caused the greatest visual injury to green antelopehorn at 49% at 29 DAT. Injury by this treatment was significantly more than all others. Green antelopehorn response to Vista applied at 22 fl oz/A was estimated at 23%, less than half the injury caused by Remedy, but also significantly higher than other treatments applied at this location. All remaining treatments caused less than 20% visual injury to green antelopehorn 29 DAT. There was no significant difference between 1 and 2 pt/A Arsenal AC, which caused 13 and 16% injury, respectively. The high rates of Milestone, GrazonNext HL, Vastlan, both rates of Chaparral and Graslan although significantly more than the untreated, caused less than12% visual injury. Injury ratings on green antelopehorn treated with low rates of GrazonNext HL, Milestone and Vastlan were not different from the untreated control.

A second group of treatments were applied May 6 near Mayhew, MS: Cimarron Plus (metsulfuron+chlorsulfuron) at 0.6 and 1.2 oz/A; Derigo (foramsulfuron+iodosulfuron+thiencarbozone) at 3 and 6 oz/A; Escort (metsulfuron methyl) at 0.25 and 0.5 oz/A; Method (aminocyclopyrachlor) at 2.0 and 4.0 fl oz/A; Oust (sulfometuron methyl) at 0.5 and 1.0 oz/A; Pastora (metsulfuron methyl+nicosulfuron) at 0.75 and 1.5 oz/A; Perspective (aminocyclopyrachlor+chlorsulfuron) at 2.5 and 5 oz/A; Viewpoint (aminocyclopyrachlor+metsulfuron methyl+imazapyr) at 10 and 20 oz/A; and Velpar (hexazinone) at 1.5 and 3 pt/A. Analysis of 28 DAT visual response data indicated significant differences between herbicide treatments. The most significant and injurious treatment to green antelopehorn was 20 oz/A Viewpoint which caused 64% visual damage. Applied at this rate, Viewpoint caused significantly more damage to green antelopehorn than all other treatments. However, the lower rate of Viewpoint and both rates of Velpar caused 22 to 30% injury 28 DAT to green antelopehorn. Injury caused by the high rate of Velpar and low rate of

Viewpoint was not different to that caused by the high rate of Escort (20%). All other treatments caused less than 15% injury to green antelopehorn at 28 DAT. Pastora at the high rate caused 13% injury, but was significantly different than the untreated control. Green antelopehorn injury from both rates CimarronPlus, Perspective, Derigo, Oust and Method plus low rates of Escort and Pastora was not different from the untreated control.

A third and final group of treatments were applied to green antelopehorn June 20, also near Oktoc in Oktibbeha county: Outrider (sulfosulfuron) at 0.65 and 1.3 oz/A; Roundup Powermax (glyphosate) at 1, 2, and 4 qt/A; Weedmaster (dicamba+2,4-D) at 0.67 and 1.3 pt/A; and Method (aminocyclopyrachlor) at 4, 8, and 12 fl oz/A. Visual injury to antelopehorn by these herbicides was taken 35 DAT. Method at 12 oz/A caused 33% injury, the highest measured at this location. Injury caused by the high rate of Method was not different from the middle (8 oz/A) or low (4 oz/A) Method rate nor 1, 2, or 4 qt/A Roundup Powermax. Both rates Weedmaster and Outrider caused less than 20% visual injury to green antelopehorn.

These preliminary evaluations confirm green antelopehorn is highly tolerant to many herbicides used for integrated vegetation management (IVM) on utility and highway rights-of-way. IVM practices that use these herbicides will protect monarch butterfly larvae habitat. These findings also confirm green antelopehorn management in pastures and hay fields will require diligence and persistence as no individual treatment provided acceptable control.

TROPICAL SIGNALGRASS CONTROL UPDATE IN TURF. L.B. McCarty*, R.B. Cross; Clemson University, Clemson, SC (211)

ABSTRACT

Tropical signalgrass (*Urochloa subquadripara*) has become a serious weed problem in tropical and subtropical areas of the SEUSA in association with the ban of organic arsenical herbicide use in turf. Recent field trials have identified candidates for control (~90+%) including Xonerate 4SC (amicarbazone) at 14 oz/acre, or sequential applications of Xonerate at 7.25 oz/acre in combination with Revolver 0.19 L (foramsulfuron) at 26 oz/acre; Dismiss South 4F (sulfentrazone + imazethapyr) at 7.25 oz/acre; Tribute Total 61WDG (thiencarbazone + foramsulfuron + halosulfuron) at 3.2 oz/acre; or Celsius 68WDG (thiencarbazone + iodosulfuron + dicamba) at 3.7 oz/acre. Sequential applications of Tribute Total at 3.2 oz/acre in combination with either Drive XLR8 1.5L (quinclorac) at 64 oz/acre or Sencor 75DF (metribuzin) also provide similar control. All treatments require 2 applications ~3 weeks apart and fall treatments are superior to spring. However, with fall treatments, end-users face unacceptable periods of turf voids and/or the inability to overseed with perennial ryegrass due to herbicidal soil residual. The purpose of this research was to identify summer applied POST herbicides for satisfactory control of tropical signalgrass. Several studies with various products were conducted in Clermont, FL on a bermudagrass (*Cynodon* spp.) golf fairway during summer 2016. Three weeks following a sequential application on 6/20/2016, control was 90+% for Xonerate 70WDG 5 oz/a + Dismiss South 4L 7.2 oz/a; Xonerate 5 oz/a + Celsius 68WDG 3.7 oz/a; and Xonerate 3 oz/a + Tribute Total 61WDG 3.2 oz/a. Control was 70-80% with Xonerate 3 oz/a + Dismiss South 7.2 oz/a; Pylex 2.8SC (topramezone) + Dismiss 4L 8 oz/a + Sprint 138 (chelated iron) 87 oz/a; Tenacity 4SC (mesotrione) 8 oz/a + simazine 4L 25 oz/a; and glyphosate 4L 5 oz/a followed by Xonerate 3 oz/a. Control was <70% for glyphosate 5 oz/a; Finale 1SC (glufosinate) 16 oz/a; and, Reward 2L (diquat) 16 oz/a.

In a separate study, 8 weeks following a sequential application on 7/26/2016, >90% control followed Tenacity 8 oz/a + simazine 25 oz/a and Tenacity 8 oz/a + metribuzin 75DF 0.33 lb/a with and without glyphosate 5 oz/a. Tribute Total 3.2 oz/a + Xonerate 5 oz/a also provided similar control. Significant short-term bermudagrass phytotoxicity followed all Tenacity, simazine, and metribuzin treatments but had recovered by 2 weeks after application. Control of ~80% followed sequential applications of Tribute Total 3.2 oz/a and Revolver 0.19SC 26 oz/a + Celsius 3.7 oz/a.

Overall, best TSG control following sequential summer applications was Xonerate + either Dismiss South, Celsius, or Tribute Total. Comparable control but short-term (~2 week) turf phytotoxicity followed sequential applications of Tenacity + either simazine or metribuzin with and without glyphosate. Work will continue on POST control of TSG as new candidates emerge as well as with expanded tank mixes of existing products.

POSTEMERGENCE CONTROL OF SOUTHERN WATERGRASS (*LUZIOLA FLUITANS*) AND TORPEDOGRASS. R.B. Cross*, L.B. McCarty; Clemson University, Clemson, SC (212)

ABSTRACT

Southern watergrass (*Luziola fluitans*, formerly *Hydrochloa caroliniensis*) is a warm-season perennial aquatic grass that has become problematic in SEUSA turf. Generally floating in shallow water, Southern watergrass can escape to wet turf areas and form dense colonies, spreading via a network of stolons and stem fragmentation. The foliage is bright green, resembling young crabgrass, and seedheads are rare making identification difficult. Initial attempts by turf managers for control of this weed with MSMA were unsuccessful prompting an investigation for additional potential postemergence control options. A study was conducted during summer 2016 in Lexington, SC on a mixed common/hybrid bermudagrass golf course rough. Southern watergrass cover had reached >90% in a low, wet area adjacent a pond. All herbicide treatments were applied twice at either 7- or 21-day intervals. MSMA at 1.5 lb ai/a with and without Sencor 75DF (metribuzin) at 0.33 lb/a and Dismiss 4L (sulfentrazone) at 8 oz/a + Sencor at 0.33 lb/a were applied on 7-day intervals. Drive 1.5L (quinclorac) 85 oz/a, Tribute Total 61WDG (thiencarbazone + foramsulfuron + halosulfuron) at 3.2 oz/a, Celsius 68WDG (thiencarbazone + iodosulfuron + dicamba) at 3.7 oz/a, Monument 75WG (trifloxysulfuron) at 0.56 oz/a, Xonerate 70WDG (amicarbazone) at 5 oz/a, Tenacity 4L (mesotrione) at 8 oz/a + Princep 4L (simazine) at 25 oz/a, and Pylex 2.8SC (topramezone) at 0.5 oz/a + Xonerate at 5 oz/a were applied on 21-day intervals. The initial application was made on June 21, 2016, and all treatments included NIS at 0.25% v/v. At 6 weeks after initial treatment (WAIT), Tribute Total and Monument controlled Southern watergrass >90% while Drive provided 60-70% control. Control was <50% with all other treatments. At 12 WAIT, Southern watergrass control was <30% for all treatments.

Torpedograss (*Panicum repens*) is perhaps the most difficult to control of all weeds in turf as >80% of this plant is underground in thick torpedo-shaped rhizomes. Few herbicide options exist for control, with traditional control in bermudagrass attempted with Drive and Monument. A study was conducted in Savannah, GA in summer 2016 on a hybrid bermudagrass fairway to evaluate potential alternative herbicide options. All treatments were applied twice on 21-day intervals and included NIS at 0.25% v/v. Treatments included: Drive at 2 lb ai/a followed by (fb) 1 lb ai/a; Monument at 0.56 oz/a; Drive at 1 lb ai/a + Monument at 0.56 oz/a; Pylex at 1 oz/a + Xonerate at 5 oz/a; Pylex at 2 oz/a + Xonerate at 5 oz/a; Pylex at 2 oz/a + Xonerate at 10 oz/a; Pylex at 2 oz/a + Sprint 330 (chelate Fe) at 4 oz/1,000 ft.^{2}; Dismiss South 4SC (imazethapyr + sulfentrazone) at 14.4 oz/a; Dismiss South at 14.4 oz/a + Drive at 1 lb ai/a + Monument at 0.56 oz/a; Roundup 4L (glyphosate) at 4 oz/a; Drive at 1 lb ai/a + Monument at 0.56 oz/a fb Roundup at 4 oz/a; and Roundup at 4 oz/a fb Drive at 1 lb ai/a + Monument at 0.56 oz/a. At 6 WAIT, treatments providing >90% torpedograss control included: Drive; Monument; Drive + Monument; Dismiss South + Drive + Monument; and Roundup fb Drive + Monument. Drive + Monument fb Roundup provided ~80% control and Dismiss South provided 60% control at this time. All other treatments provided <50% control. At 10 WAIT, Dismiss South + Drive + Monument provided 50-60% torpedograss control, while 40-50% control was observed with Drive, Monument, and Drive + Monument. All other treatments controlled torpedograss <30%

10 WAIT. Therefore, long-term (>10 WAIT) single-season torpedograss control in bermudagrass remains elusive.

Overall, long-term Southern watergrass and torpedograss control was not achieved in these studies. 90%+ control of both weeds was achieved short-term (6 WAIT), but significant energy reserves in perennial parts of these weeds allowed for regrowth beyond this time point. Future research will continue to investigate potential control options of these troublesome perennial weeds.

IMPACT OF METSULFURON AND NITROGEN FERTILITY ON CENTIPEDEGRASS. S.W. Tillery[1], J.S. McElroy*[1], A.P. Boyd[1], R. Leon[2], L.B. McCarty[3], P. McCullough[4], S. Kelly[5], R. Baker[6]; [1]Auburn University, Auburn, AL, [2]University of Florida, Jay, FL, [3]Clemson University, Clemson, SC, [4]University of Georgia, Griffin, GA, [5]Scotts Company, Apopka, FL, [6]Scotts Company, Marysville, OH (213)

ABSTRACT

In the spring of 2015, The Scotts Miracle Gro Company (SMG) launched Bonus-S granular fertilizer containing metsulfuron instead of atrazine which the product traditionally contained. Much to the surprise of SMG staff and the greater weed science community, reports of turfgrass injury began to be reported on centipedegrass and St. Augustinegrass from Bonus-S-metsulfuron. SMG promptly stopped the use of Bonus-S-metsulfuron and began a multistate research effort to decipher the reason for the observed injury. The central hypothesis that developed was that Bonus-S-metsulfuron injury was due to a fertilizer-metsulfuron interaction. Research was conducted to test this hypothesis at Auburn University, Clemson University, University of Florida, University of Georgia, and the SMG Research Station in Apopka, Florida. Research was conducted in a randomized complete block design with 21 treatments testing six different products. Products included: Turf Builder Southern (32-0-10) containing no herbicides, Manor or MSM (60% WDG) containing only metsulfuron and no fertilizer, metsulfuron granular on biodac containing metsulfuron and no fertilizer, Bonus-S metsulfuron on 32-0-9 carrier with metsulfuron, Bonus-S fertilizer only on 32-0-9 carrier and no herbicide, and Bonus-S atrazine on 29-0-10 applied with atrazine. All granulars were applied using a shaker can and only Manor/MSM foliar treatment was applied as a foliar spray. For convenience rates of granular metsulfuron-fertilizer products will be listed as lbs N per 1000 sq ft/lb metsulfuron per acre. Treatments of these products included: non-treated control, Turf Builder Southern at 3.13 lb N/1000 sq. ft.; Manor applied at 0.01875, 0.03, or 0.06 lb ai/a, metsulfuron granular on biodac at 0/0.03, 0/0.06, 0/0.12, or 0/0.24; Bonus-S metsulfuron at 1.0/0.03, 2.0/0.06, 4.0/0.12, or 8.0/0.24; Bonus-S fertilizer only at 1.0/0, 2.0/0,4.0/0, or 8.0/0; Bonus-S atrazine at 1.0 lb N/1000 sq ft + 1.6 lb atrazine/acre, 2.0 lb N/1000 sq ft + 3.2 lb atrazine/acre, 4.0 lb N/1000 sq ft + 6.4 lb atrazine/acre, or 8.0 lb N/1000 sq ft + 12.8 lb atrazine/acre. Trials were established in a similar fashion with similar spring application dates. All treatments were applied to dry turfgrass and watered which is thought to minimize foliar absorption of atrazine and metsulfuron. Trials were rated for centipedegrass turfgrass cover and injury at 14, 28, 42, and 56 days after treatment (DAT). Percent visual turfgrass cover was rated on a 0 to 100 scale where 0 is no green turfgrass cover and 100 is complete coverage of green turfgrass. Percent visual injury was rated on a 0 to 100 percent scale where 0 is no phytotoxicity and 100 is complete plant necrosis.

Bonus-S metsulfuron injury increased as rate increased and induced more injury than any other treatment across all locations than any other treatment. Bonus-S metsulfuron injured centipedegrass 12, 34, 63, and 80% at 14 DAT as rate increased from lowest to highest. Comparably metsulfuron granular on biodac injured centipedegrass 8, 9, 11, and 29% as rate increased from lowest to highest across an identical metsulfuron rate increase. Metsulfuron at 0.01875, 0.03, and 0.06 lb ai/a applied as a foliar application injured centipedegrass 17, 23, and 35% 14 DAT, respectively. Injury subsided to <20% for all metsulfuron containing

treatments beginning 28 DAT, except for Bonus-S metsulfuron at the two highest rates containing 0.12 and 0.24 lb metsulfuron/a. Bonus-S metsulfuron induced injury resulted in complementary reductions in centipedegrass cover with the two highest rates inducing >50% centipedegrass cover loss 28 and 42 DAT. Turf cover losses at 28 DAT from all other treatments except foliar-applied metsulfuron at 0.06 lb ai/a and Bonus-S atrazine at the maximum rate were ~<10%. From these data, we conclude that metsulfuron applied on a granular fertilizer carrier can induce greater injury than metsulfuron on an inert granular carrier. Further, consumers/homeowners can exacerbate such injury by lack of calibration and applying at excessive application rates.

INFLUENCE OF RESIDUAL HERBICIDE CONCENTRATION AND ACTIVATED CHARCOAL RATE ON BERMUDAGRASS SPRIG ESTABLISHMENT. S. Askew*, J.M. Craft, S. Rana; Virginia Tech, Blacksburg, VA (214)

ABSTRACT

With the advent of high quality, cold tolerant bermudagrass varieties, many athletic fields in the transitional climate zone of the United States are being converted from cool-season turf to bermudagrass. The decision to renovate a game field may occur suddenly due to loss of existing turf or availability of funds. Fields slated for a summer conversion to bermudagrass often have already been treated with preemergence herbicide in early spring. Information on how herbicide residue in soil influences bermudagrass sprig establishment is lacking. Studies were conducted in Blacksburg, VA to evaluate 'Latitude 36' bermudagrass establishment from row-planted sprigs immediately following treatment with six rates each of prodiamine or dithiopyr. In another study, two rates of prodiamine were applied and incorporated via irrigation and then five rates of activated charcoal were applied immediately prior to row-planting bermudagrass sprigs.

Bermudagrass establishment was severely delayed at 0.25 to 1.0 times the highest labeled use rate of prodiamine (1.5 lb ai/A) or dithiopyr (0.5 lb ai/A) but no delay was noted when herbicide rates were 10% of the labeled rate. Both bermudagrass green cover and shear resistance declined in a curvilinear fashion as herbicide rate increased. These data indicate that it is unlikely that bermudagrass could be successfully established from sprigs in a summer season if prodiamine or dithiopyr were applied at normal rates the previous spring. When prodiamine was applied at 0.38 or 0.75 lb ai/A, the rate of activated charcoal needed to avoid delayed bermudagrass establishment was between 100 to 200 lb/A. Current extension recommendations indicate that activated charcoal should be applied at 300 to 600 lb/A. At current prices, reducing the activated charcoal rate to 200 lb/A as indicated by these research results, would save turfgrass producers $300 to $1500 per acre.

DEMONSTRATION OF A PYTHON SCRIPT FOR DIGITAL IMAGE ANALYSIS. J.S. McElroy*; Auburn University, Auburn, AL (215)

ABSTRACT

Analysis of digital images has become a common method to generate objective quantitative data to complement subjective visual ratings. Using jpeg images for analysis, red-green-blue (RGB) pixel data is first converted to hue-saturation-brightness (HSB) measures. HSB color data is a more intuitive measure color and allow for focusing on specific hue angle values associated with green color or other colors of interest. The number of pixels falling within a given HSB range can then be counted and associated with the percent green cover of an image or the average green color of all or a portion of pixels. Average green color of an image can be objectively to the green color of turfgrass. Such data have been extensively utilized in the quantification of turfgrass injury from herbicides and turfgrass fertilizer response.

SigmaScan Pro is most commonly utilized with macros developed by Drs. Karcher and Richardson of the University of Arkansas for digital image analysis in turfgrass research. SigmaScan Pro is approximately $1000 to purchase, has a GUI that has not been updated in over a decade, and is slow to run. ImageJ has been growing in popularity for digital image analysis. ImageJ is free, written in Java, and allows for development of macros for different types of analyses. A macro for the open source software ImageJ (https://imagej.nih.gov/ij/index.html) was recently developed by Dr. Miller of NC State University and a macro for counting common dandelion flowers was developed by Dr. Patton at Purdue University. One negative draw back however is the ImageJ is a large consortium open-source developed software that does require a time investment to become comfortable with the GUI interface.

To further aid digital image analysis in turfgrass, a computer script was developed called pyGreenTurf. pyGreenTurf, as the name suggests, was written in Python, a fast growing, popular programming language, especially in the field of data science. pyGreenTurf batch analyzes images and writes data to a CSV files that can then be opened in Microsoft Excel. pyGreenTurf can compress images to a specified pixel ratio to increase analysis time. In compressing images, pyGreenTurf writes the newly compressed images to a new directory and stores the csv file in the new directory. The following data are written to the CSV file for each individual image: Image Path, Image Name, Number of Green Pixels, Total Pixel Number, Percent Green Cover, Average Green Color, Average Hue, Hue Standard Deviation, Hue Variance, Average Saturation, Average Brightness, Dark Green Color Index, and Pixel Diversity. Unique to pyGreenTurf is a measure of pixel diversity, which compute the average difference between 10,000 randomly selected pixels in the image which can then be correlated to turfgrass surface uniformity. pyGreenTurf can be run in command line, however the easiest path to use is by downloading the Enthought Canopy Integrated Development Environment (https://www.enthought.com/products/canopy/) which is free for academic users. pyGreenTurf can be downloaded from the following github page (https://mcelrjo.github.io/pygreenturf/).

POSTEMERGENCE GOOSEGRASS (*ELEUSINE INDICA*) CONTROL WITH SPEEDZONE. G.K. Breeden*[1], J.T. Brosnan[1], L.B. McCarty[2], N. Gambrell[2], A.G. Estes[3]; [1]University of Tennessee, Knoxville, TN, [2]Clemson University, Clemson, SC, [3]PBI Gordon Corporation, Pendleton, SC (216)

ABSTRACT

Goosegrass (*Eleusine indica*) is a difficult-to-control annual grassy weed of turf typically requiring multiple POST applications for eradication. Speedzone (ai- carfentrazone + 2,4-D + MCPP + dicamba) is an herbicide primarily used to control broadleaf weeds in turf but noted to possibly have activity on goosegrass. We hypothesized multiple POST applications of Speedzone could control goosegrass similar to commercial standards.

Two separate studies were conducted in 2016 on mature stands of common bermudagrass (*Cynodon dactylon*) infested with goosegrass. Plots (1.5 by 1.5 m) in both studies were maintained as golf course rough and arranged in randomized complete block designs with three replications. Study 1 was conducted at the Clemson University turfgrass research plots (Clemson, SC) and was initiated on 15 July 2016. Study 2 was conducted at Three Ridges Golf Course (Knoxville, TN) and was initiated on 6 July 2016. No supplemental irrigation or nutrients were applied at either site during these studies. Herbicide treatments in all trials were applied with CO_2-pressurized boom sprayers calibrated to deliver 374 L ha^{-1} utilizing four, flat-fan, 8002 nozzles at 276 kPa, configured to provide a 1.5-m spray swath. Weed control and turf injury were visually evaluated in all trials using a 0 (i.e., no weed control or turf injury) to 100 % (i.e., complete weed control or turf injury) scale at 1, 3, 5 and 8 weeks after initial treatment (WAIT).

Treatments in Study 1 included single applications of Speedzone (1230 & 1700 g ai ha^{-1}), Speedzone (1230 g ai ha^{-1}) + metribuzin (277 g ai ha^{-1}), and Speedzone (1230 g ai ha^{-1}) + simazine (560 g ai ha^{-1}). Study 1 treatments also included sequential applications of Speedzone (1230 g ai ha^{-1}) on a two-week interval. All treatments in Study 1 included a non-ionic surfactant at 0.25% v/v. Treatments in Study 2 included sequential applications of Speedzone (1230 g ai ha^{-1}) on a two-week interval and Speedzone (1230 & 1700 g ai ha^{-1}), Speedzone (1230 g ai ha^{-1}) + metribuzin (277 g ai ha^{-1}), and Speedzone (1230 g ai ha^{-1}) + simazine (560 g ai ha^{-1}) applied sequentially on a four-week interval. Study 2 also included single applications of topramezone (18.4 g ai ha^{-1}) + methylated seed soil (MSO; 0.5% v/v) and thiencarbazone (TCM) + foramsulfuron + halosulfuron (136 g ai ha^{-1}) + MSO (0.5% v/v) for comparison.

In both studies, Speedzone (1230 & 1700 g ai ha^{-1}), Speedzone (1230 g ai ha^{-1}) + simazine (560 g ai ha^{-1}) and TCM + foramsulfuron + halosulfuron injured bermudagrass ≤ 15% on all rating dates. Speedzone + metribuzin and topramezone injured bermudagrass ≥ 43% 1 WAIT. Bermudagrass recovered from injury by 3 WAIT. In Study 1, single applications of Speedzone (1700 g ai ha^{-1}), Speedzone + metribuzin, Speedzone + simazine, and sequential applications of Speedzone controlled goosegrass ≥ 83% at 5 WAIT. All other treatments controlled goosegrass ≤ 80% at 5 WAIT. By 8 WAIT in Study 1, all treatments controlled goosegrass ≥ 85%. In Study 2, sequential applications of Speedzone (1230 g ai ha^{-1}) on a two-week interval, and Speedzone (1700 g ai ha^{-1}), Speedzone + metribuzin, and Speedzone + simazine applied sequentially on a four-week interval controlled goosegrass ≥ 78% at 5 WAIT. All other treatments controlled

goosegrass ≤ 67% at 5 WAIT. By 8 WAIT in Study 2, sequential applications of Speedzone (1230 g ai ha^{-1}) on a two-week interval and Speedzone (1230 & 1700 g ai ha^{-1}), Speedzone + metribuzin, and Speedzone + simazine on a four-week interval controlled goosegrass ≥ 90%. All other treatments controlled goosegrass ≤ 30% at 8 WAIT, including commercial standards. Our findings indicate that POST applications of Speedzone at 1230 and 1700 g ai ha^{-1} can be used for effective goosegrass management in bermudagrass turf.

EVALUATING EFFECT OF IMMEDIATE IRRIGATION ON POSTEMERGE HERBICIDES FOR GOOSEGRASS [*ELEUSINE INDICA* (L.) GAERTN.] CONTROL. N. J. Gambrell*, L.B. McCarty; Clemson University, Clemson, SC (217)

ABSTRACT

The purpose of this study was to determine the efficacy of immediate irrigation of various herbicides and combinations for postemergence control of goosegrass in bermudagrass turf. Goosegrass is a clumped summer annual, easily characterized with a white or silverish coloration in the plant's crown. Goosegrass reproduces by seed and possesses a short-toothed, membranous ligule at base of leaf blade. Due to its ability to withstand various mowing heights, competitive growth in compacted, wet, or dry soils, goosegrass disrupts the appearance and uniformity of a turf stand. Lack of persistent aerification, and chemical control options, goosegrass is a very troublesome grassy weed, in most turf situations.

A study with fifteen treatments was initiated in Clemson, South Carolina on July 15, 2016, with rating dates on July 25, August 6, and August 12, corresponding to 2,3, and 4 weeks after initial treatment (WAIT), respectively. Treaments included: Revolver @ 26 oz/a; MSMA @ 32oz/a + Sencor @ 0.3 lb/a; Tenacity @ 5 oz/a + Princep @ 25 oz/ac; Tenacity @ 5 oz/a + Sencor @ 0.3 lb/ac; Tenacity @ 5 oz/a + Princep @25 oz/a + Roundup @ 5 oz/a; Tenacity @ 5 oz/a + Sencor @ 0.3 lb/a + Roundup @ 5 oz/a; Roundup @ 5 oz/a; Pylex @ 0.375 oz/a; Pylex @ 0.75 oz/a; Pylex @ 0.375 oz/a + Xonerate @ 0.3125 lb/a; Pylex @ 0.75 oz/a + Xonerate @ 0.3125 lb/a; Pylex @ 0.75 oz/a + Sprint 330 (Chelated Fe) @ 175 oz/ac; Dismiss @ 12 oz/a; Dismiss @ 8 oz/a + Sencor @ 0.3 lb/a; and Sencor @ 0.5 lb/ac irrigated immediately with 0.25 in of water. A second study with four treatments was initiated in Clemson, South Carolina on July 25, 2016 with rating dates on August 10, 2016, August 24, 2016, and September 6, 2016 which corresponded to 2,4, and 6 WAIT. Treaments included: Dismiss @ 8 oz/a; Dismiss @ 12 oz/a; Pylex @ 0.375 ox/a; and Pylex @ 0.75 oz/a. All treatments were irrigated with 0.25 in of water immediately following application. A sequential application was made on August 10, 2016, 2 WAIT, for all treatments.

On the August 6, 2016 rating date, for the first study, only three treatments provided acceptable turf injury (<30%): Revolver @ 26 oz/a; Roundup @ 5 oz/a; and Dismiss @ 12 oz/ac. For the second study, three treatments provided acceptable turf injury during all rating dates: Dismiss @ 8 oz/a; Dismiss @ 12 0z/a; and Pylex @ 0.375 oz/a. On the September 6, 2016 rating date, two treaments provided excellent goosegass control (>90%): Dismiss @ 12 oz/a; and Pylex @ 0.75 oz/a.

Repeat applications and screening of products will be continued in the future for timing, turf safety, and control of goosegrass in burmudagrass turf.

HERBICIDE PROGRAMS FOR CRABGRASS AND GOOSEGRASS CONTROL ON CREEPING BENTGRASS GREENS. S. Askew*, J.R. Brewer; Virginia Tech, Blacksburg, VA (218)

ABSTRACT

Smooth crabgrass (*Digitaria ischaemum*) and goosegrass (*Eleusine indica*) are two of the most troublesome weeds on creeping bentgrass (*Agrostis stolonifera*) golf greens. There are currently no herbicides registered for postemergence crabgrass or goosegrass control on creeping bentgrass greens. Some research studies have indicated that repeated treatments of fenoxaprop at weekly intervals can selectively control crabgrass and goosegrass on creeping bentgrass greens. Since fenoxaprop can injure creeping bentgrass and is not registered for use on greens, there is need for research to evaluate herbicide programs for crabgrass and goosegrass control with minimal injury to creeping bentgrass greens. At Virginia Tech, we conducted three field trials during the summer of 2016 and two greenhouse studies during the fall of 2016. For field trials, putting greens were maintained at 3.2 mm height by daily mowing and consisted of '007' and 'L93' creeping bentgrass varieties at respective sites. Crabgrass and goosegrass control were evaluated on a USGA-specification green that was maintained fallow without creeping bentgrass. The greenhouse studies used 10 cm plugs of '007' creeping bentgrass placed in two separate greenhouses at the Glade Road Research Center.

Fenoxaprop and quinclorac were the most injurious treatment programs maintaining unacceptable injury (greater than 30%) for majority of the trial period. Fenoxaprop at 35 g ai ha^{-1} (biweekly) injured creeping bentgrass between 60 and 70% at both sites and more than other treatments, while quinclorac at 210 g ai ha^{-1} (biweekly) injured creeping bentgrass between 50 and 60% depending on site. Siduron applied at 5.6 kg ai ha^{-1} weekly or 13.5 kg ai ha^{-1} biweekly and topramezone applied at 1.5 g ai ha^{-1} weekly or 3 g ai ha^{-1} biweekly injured creeping bentgrass the least. Siduron injured creeping bentgrass 10% or less at both trial sites, while topramezone never injured creeping bentgrass more than 20%. The injury seen by topramezone only occurred for a short time after each of up to eight weekly treatments, and after some treatments no injury was observed. NDVI trends were similar to the observed injury. The greenhouse studies are also following the same visual injury trends as the field studies but are not yet complete. All treatments except the topramezone programs completely controlled crabgrass by week 7 on the ‘L-93’ creeping bentgrass green. Topramezone programs controlled crabgrass approximately 89% or better by week 7. Fenoxaprop completely controlled goosegrass and crabgrass at the fallow site, while quinclorac only controlled crabgrass. Siduron controlled crabgrass as well as fenoxaprop, and goosegrass slightly less. For example, siduron controlled goosegrass 80 and 94% when applied weekly or biweekly, respectively at 36 DAT and 43 and 67% when applied weekly or biweekly, respectively at 79 DAT. Topramezone controlled goosegrass as well as fenoxaprop, but was not as effective at controlling crabgrass. Results indicate that both topramezone and siduron can control crabgrass and goosegrass at commercially-acceptable levels with less injury than fenoxaprop or quinclorac.

THE USE OF PGR'S TO REDUCE MOWING FREQUENCY ON GOLF COURSE ROUGHS. P.J. Brown*, L.B. McCarty, N.J. Gambrell; Clemson University, Clemson, SC (219)

ABSTRACT

Low maintenance areas of sports turf, such as golf course rough areas, require regular mowing and other relatively expensive maintenance. Plant Grown Regulators (PGR's) help reduce the growth rate of turf, and therefore, reduce the frequency of maintenance in these areas. The goals of this research were to compare sequential PGR applications for reducing mowing frequency and turf safety in low maintenance areas.

Research was conducted on the Walker Golf Course in Clemson, SC in a Tifway bermudagrass (*Cynodon dactylon* x *C. transvaalensis*) rough. Treatments were applied three times during the summer on 6/6/16, 7/13/16, & 8/17/16. Treatments included Primo (Trinexapac-ethyl 1 EC) at 22 fl oz/a, Plateau (Imazapic 2 L) at 4 fl oz/a, Primo + Plateau (Trinexapac-ethyl + Imazapic) at 22 fl oz/a + 4 fl oz/a, Aneuw (Prohexadione calcium 27.5 WP) at 44 fl oz/a, Cutless (Flurprimidol 1.3 L) at 37 fl oz/a, Legacy (Flurprimidol + Trinexapac-ethyl 1.5 SL) at 18 fl oz/a, Legacy (Flurprimidol + Trinexapac-ethyl) at 30 fl oz/a, Musketeer (Flurprimidol + Trinexapac-ethyl + Paclobutrazol 1 SL) at 30 fl oz/a, Roundup (Glyphosate 4 L) at 3 fl oz/a, Finale (Glufosinate 1 SC) at 1 pt/a, & Journey (Imazapic 2.25 S L + Glyphosate) + NIS at 11 fl oz/a. Treatments were applied with a CO_2 backpack sprayer calibrated to deliver 40 GPA, using 8004 flat fan spray nozzles. Turfgrass phytotoxicity (%) ratings were taken weekly, turfgrass height (cm), and seedhead cover (%) were taken at the end of each application (30 day) cycle. Experimental design was a randomized complete block with three replications. Data was analyzed using ANOVA with means separated by LSD (α=0.05).

Finale at 1 pt/a had >80% turf phytotoxicity the first 2 weeks after application. Treatments containing Imazapic had >30% phytotoxicity 3 weeks after application. Minimum phytotoxicity was seen with other treatments. By 4 weeks after application all treatments recovered to within acceptable ranges. Untreated plots and plots treated with Finale showed the highest (~5 in, 12 cm) turfgrass heights 5 weeks after application. Primo and treatments including Imazapic had the lowest (~1.5 in, 4 cm) turfgrass height. Untreated plots and glyphosate treatments had the greatest (~50-80 %) seedhead cover. Primo and treatments containing Imazapic had the lowest (~10 %) seedhead cover. Further research will include the exploration of lower rates of Finale and Imazapic for reduced turfgrass phytotoxicity, to explore combinations including Primo for reduced turf height and phytotoxicity, and to explore higher rates and shorter treatment frequencies of glyphosate to increase activity.

ANNUAL BLUEGRASS CONTROL IN DORMANT ZOYSIAGRASS FAIRWAYS. J.M. Craft*, J.R. Brewer, S. Askew; Virginia Tech, Blacksburg, VA (220)

ABSTRACT

Annual bluegrass (*Poa annua* L.) is a common winter annual weed in warm-season turf. Turf mangers in the transition zone constantly battle annual bluegrass infestations in golf course putting greens, fairways, and roughs. The main strategy implemented in warm-season turf is late winter applications of non-selective or selective herbicides, which has proven to be an economical and effective tool for control of a broad spectrum of weeds including annual bluegrass. However, turf mangers are hesitant to apply late winter herbicide applications to zoyisagrass (*Zoysia* spp.) due to its perceived sensitivity to herbicides. In spring 2016 a study was conducted to evaluate several herbicides and application timings based on growing degree day at base 32Ëš F (GDD_{32}) accumulation. The study was initiated on March 1, 2016 at Westlake Golf Course near Hardy, VA. Eighteen treatments were evaluated for annual bluegrass control and response of 'Zeon' zoysiagrass maintained at a fairway height with herbicide treatments applied at 200 GDD_{32} cumulative starting February 15, 2016. Initial cover of annual bluegrass ranged from 24 to 48%, and no zoysiagrass green cover was present when treatments were applied. At 2 weeks after treatment (WAT), glyphosate at 527 and 700 g ai/ha, glufosinate at 840 and 1680 g ai/ha, flumioxazin at 430 g ai/ha, glufosinate at 840 g ai/ha + flumioxazin at 430 g ai/ha, glyphosate at 527 g ai/ha + oxadiazon at 3400 g ai/ha, and glufosinate at 840 g ai/ha + oxadiazon at 3400 g ai/ha controlled annual bluegrass greater than 80%. Mixtures of flumioxazin + glyphosate and flumioxazin + glufosinate exhibited less control of annual bluegrass than either herbicide applied alone. At 3 WAT, flumioxazin at 430 g ai/ha and glyphosate at 527 g ai/ha + flumioxazin at 430 g ai/ha were the most injurious treatments causing 33% turf injury. Single applications of non-selective herbicides like glyphosate, diquat, and glufosinate had less than 16% turf injury. At 4 WAT, glyphosate at 700 g ai/ha, glufosinate at 1680 g ai/ha, flumioxazin at 430 g ai/ha, foramsulfuron at 29 g ai/ha, and trifloxysulfuron at 18.4 g ai/ha controlled annual bluegrass greater than 85%, and this trend continued 8 WAT. Herbicide treatments that were most effective at controlling annual bluegrass also had the highest percentage of zoysiagrass green cover, at 8 WAT.

CROSS AND MULTIPLE RESISTANCE IN ANNUAL BLUEGRASS (*POA ANNUA* L.) POPULATIONS IN TEXAS GOLF COURSES. V. Singh*[1], F.C. Reis[2], W. Reynolds[3], M. Elmore[4], M. Bagavathiannan[3]; [1]Texas A&M University, College station, TX, [2]University of Sao Paulo, Sao Paulo, Brazil, [3]Texas A&M University, College Station, TX, [4]Texas A&M University, Dallas, TX (221)

ABSTRACT

Thirty annual bluegrass populations collected from Texas golf courses were evaluated for herbicide resistance during spring 2016. The populations were evaluated for resistance to two photosystem-II (PSII)-inhibitor herbicides, simazine (Princep® 4L); PRE and amicarbazone (Xonerate®); POST and two acetolactate synthase (ALS)-inhibitor herbicides, foramsulfuron (Revolver®); POST, and trifloxysulfuron (Monument®); POST. POST applications were made on 3-tiller seedling stage and PRE applications were made immediately after planting. Seventy percent of the evaluated populations were found to be resistant to at least one of these herbicides. Dose-response bioassays were carried out for the two highest surviving populations (ATX14 and ATX27) for each herbicide in the initial screening, along with a susceptible standard (ATX-S). The putative resistant populations were treated with eight rates (0.5, 1, 2, 4, 8, 16, 32 and 64X) of foramsulfuron, trifloxysulfuron, or amicarbazone, and seven rates of simazine (0.5, 1, 2, 4, 8, 16 and 32X). The experiment was conducted in a completely randomized design with three replications and two experimental runs. At 4 WAT, above-ground biomass was harvested and oven dried at 55°C for 7 d before weighing. Resistance ratios (R/S) were computed from their respective GR_{50} values. DNA was extracted from leaf tissues of resistant and susceptible accessions, according to the protocol provided by Takara DNA isolation kit (Takara Bio Inc.). Approximately 2.1 kb section of the *ALS* gene and 0.6 kb section of *psbA* gene was amplified. Sequences were analyzed using Bioedit®to determine potential single nucleotide polymorphisms conferring herbicide resistance. Dose-response assays have revealed that ATX14 was 186-, 10-, >490- and 29- fold, and ATX27 was 16-, 28-, >490- and 93-fold more resistant to amicarbazone, foramsulfuron, simazine and trifloxysulfuron respectively, compared with the susceptible standard. Gene sequences indicated that target-site mutations at Ser264and Pro197 in psbA & ALS respectively, have contributed to herbicide resistance in tested populations.

PRONAMIDE RESISTANT ANNUAL BLUEGRASS IN GEORGIA TURF. P. McCullough*[1], J. Yu[2], M. Czarnota1; [1]University of Georgia, Griffin, GA, [2]Univ. of Georgia, Griffin, GA (222)

ABSTRACT

A biotype of annual bluegrass with suspected resistance to pronamide was collected from a golf course in Georgia. The objectives of this research were to determine the level of resistance to pronamide and the mechanisms associated with resistance. From POST applications, the pronamide rate that reduced shoot biomass 50% from the nontreated measured >10-times higher for the R-biotype as compared to S-biotypes. The R-biotype was not controlled by PRE applications of dithiopyr or prodiamine, but was controlled >92% by PRE applications of pronamide at 0.56 and 1.68 kg ha^{-1}. Mature plants (3 to 5-tiller) of the R-biotype absorbed 32% less ^{14}C-pronamide than the S-biotype after 72 h in hydroponic culture and accumulated 39% less radioactivity per gram basis of dry shoot mass. The R-biotype metabolized ^{14}C-pronamide similar to the S-biotype, averaging 16% of the extracted radioactivity. The resistance to POST pronamide applications in the R-biotype is associated with reduced absorption and translocation compared to the S-biotype.

A RAPID DIAGNOSTIC ASSAY TO SCREEN FOR HERBICIDE RESISTANCE IN ANNUAL BLUEGRASS (*POA ANNUA* L.). J.J. Vargas*, J.T. Brosnan, G.K. Breeden, E.H. Reasor; University of Tennessee, Knoxville, TN (223)

ABSTRACT

Reports of herbicide resistance in annual bluegrass (*Poa annua* L.) are greater than any other weed species commonly found in turf. Traditional means of testing annual bluegrass phenotypes for herbicide resistance are labor intensive, costly, and time consuming. Rapid diagnostic tests have been developed to confirm herbicide resistance in weeds of agronomic cropping systems that correlate well with traditional whole plant bioassays. Research was conducted at the University of Tennessee in 2016 to determine if agar-based rapid diagnostic tests could be used to confirm herbicide resistance in annual bluegrass phenotypes harvested from golf course turf. Separate experiments were conducted using annual bluegrass phenotypes resistant to acetolactate synthase (ALS), photosystem II (PSII), and aromatic amino acid inhibiting herbicides via target site mutation; an herbicide susceptible control was included in each for comparison. Single tiller annual bluegrass plants were washed free of soil and transplanted into autoclavable polycarbonate plant culture boxes filled with 65 mL of plant tissue culture agar plus a murashigee-skoog media (10MS) amended with trifloxysulfuron (6.25, 12.5, 25, 50, 75, 100, or 150 µM), simazine (0, 6, 12, 25, 50, 100, 200, or 400 µM), or glyphosate (0, 6, 12, 25, 50, 100, 200, or 400 µM). Treatments were arranged in a completely randomized design with 50 replications and repeated in time. Mortality in agar was assessed 7 to 12 days after treatment (depending on herbicide) and compared to responses observed after treating 98 individual plants of each phenotype with trifloxysulfuron (27.8 g ha^{-1}), simazine (1120 g ha^{-1}), or glyphosate (1120 g ha^{-1}) in an enclosed spray chamber. Fisher's exact test ($\alpha = 0.05$) determined that mortality in agar with 100 µM glyphosate was not significantly different than treating whole plants via traditional spray application. Similarly, mortality in agar with 12.5 µM trifloxysulfuron was not significantly different than spraying whole plants with herbicide. In all cases, responses with simazine in agar were significantly different from those observed via traditional spray application, suggesting that further assay refinement is needed to detect annual bluegrass resistance to PSII inhibiting herbicides. However, our results do show that this agar-based assay can reliably provide an assessment of annual bluegrass resistance to glyphosate or trifloxysulfuron in 12 days or less.

HALAUXIFEN-METHYL: A NEW, INNOVATIVE HERBICIDE FOR CONTROL OF BROADLEAF WEEDS IN TURFGRASS. J. Breuninger*[1], A.L. Alexander[2], D. Loughner[3], V. Peterson[4]; [1]Dow AgroSciences, LLC, Zionsville, IN, [2]Dow AgroSciences, LLC, Lawrenceville, GA, [3]Dow AgroSciences, LLC, Lawrenceville, NJ, [4]Dow AgroSciences, LLC, Fort Collins, CO (261)

ABSTRACT

Halauxifen-methyl is a new herbicide for postemergent weed control in turfgrass, cereals and other crops and registrations for use on wheat and other cereal crops has been obtained in the U.S. and other countries around the world. Halauxifen-methyl is an innovative low-dose synthetic auxin (HRAC group O) herbicide and the first member of the new arylpicolinate class of chemistry, designed to provide unique attributes compared to other growth regulator herbicides. Halauxifen-methyl unique binding affinity in the cell nucleus differentiates it from previous synthetic auxin herbicides: Halauxifen-methyl demonstrates an affinity for the AFB5 auxin binding protein site of action in the cell nucleus of susceptible weeds.

Halauxifen-methyl provides consistent control of important broadleaf weeds in turf including common dandelion (*Taraxacum officinale*), narrow plantain (*Plantago lanceolata*), broadleaf plantain (*Plantago major*), common chickweed (*Stellaria media*), henbit (*Lamium amplexicaule*), and dollarweed (*Hydrocotyle sibthorpioides*). Trial work on both cool and warm season turf species including Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*) and tall fescue (*Festuca arundinacea*), bermudagrass (*Cynodon dactylon*), St. Augustinegrass (*Stenotaphrum secundatum*) and zoysiagrass (*Zoysia japonica*) has shown good turfgrass safety.

Halauxifen-methyl is effective at very low use rates of 10 g ae/ha and, due to its low vapor pressure, halauxifen-methyl does not cause off-target damage to desirable broadleaf plantings through volatilization. Tree studies on many different species have shown that the halauxifen-methyl can be used under the drip line without concern for off target injury. Halauxifen-methyl rapidly degrades in soils and plant tissues. Field and laboratory studies with Halauxifen-methyl were conducted at Purdue University, West Lafayette, IN and Woods End Research Laboratory, Mt. Vernon, ME to determine its fate in grass clippings and compost. It was determined that Halauxifen-methyl breaks down very quickly in turfgrass (DT_{50}=1.5 days) and has no significant or lasting herbicidal activity in compost. In November 2016, Dow AgroSciences submitted a request for registration to US EPA for Halauxifen-methyl containing formulations for use on turfgrass in both commercial and residential settings.

CONTROL OF TURFGRASS WEEDS WITH TWO NEW HALAUXIFEN-METHYL CONTAINING FORMULATIONS (GF-3566 AND GF-2687) IN COOL AND WARM SEASON TURFGRASS. A.L. Alexander*[1], J. Breuninger[2], D. Loughner[3], V. Peterson[4]; [1]Dow AgroSciences, LLC, Lawrenceville, GA, [2]Dow AgroSciences, LLC, Zionsville, IN, [3]Dow AgroSciences, Lawrenceville, NJ, [4]Dow AgroSciences, LLC, Fort Collins, CO (262)

ABSTRACT

GF-3566 is a postemergent herbicide composed of three proprietary active ingredients from Dow AgroSciences LLC for use on turfgrass. Two of the three active ingredients (halauxifen-methyl and 2,4-D choline) are new to the turf market and the third component is fluroxypyr. The three actives are synthetic auxin herbicides that act through a synthetic auxin mechanism (HRAC group O, WSSA group 4) modes of action.

GF-3566 provides quick activity and complete control of key problem weeds in cool season and bermudagrass turfgrass. Upon US EPA registration GF-3566 is expected to have a hazard signal word of Warning and will be approved for both commercial and residential use. The application rates will vary from 3.5 -4.67 l/ha (3.5 - 4.0 pints/A) with use rates based on weeds present and turfgrass species. Properties of GF-3566 include low odor and low volatility. GF-3566 is compatible with both low volume and traditional turfgrass application equipment and can be applied in tank mixes with fertilizer and other products.

GF-2687 is a systemic postemergent herbicide that controls both annual and perennial broadleaf weeds with one simple to use rate - safe across major warm and cool season turfgrasses. Turfgrass safety even on herbicide sensitive St Augustinegrass has been demonstrated at temperatures above 90° F (32.2 C). GF-2687 is a 1:1 ratio of new halauxifen-methyl (HRAC group O, WSSA group 4) plus florasulam (HRAC group B, WSSA group 2) combining 2 distinct modes of action to help alleviate weed resistance. This product utilizes the GoDriTM Rapid Dispersion Technology from Dow AgroSciences for quick, complete dispersion in any environment, and is rainfast after one hour. Upon US EPA registration GF-2687 is expected to have a Caution signal word, with no buffer zones and no temperature restrictions. Coupling these features with one, effective low use rate (20 gai/ha or 0.72 oz Pr/A), safe across turfgrass species and environments, GF-2687 should deliver maximum application flexibility for turfgrass managers.

Tree studies have shown that GF-3566 and GF-2687 can be used under the drip line of trees without a concern for off target injury. Upon registration the expected use sites will include established turfgrass (commercial and residential) commercial sod farms, ornamental and sports turf, golf course fairways, aprons and roughs, tee boxes campgrounds, parks, recreation areas, cemeteries and unimproved turfgrass areas.

EH1587: NEW TECHNOLOGY IN BROADLEAF WEED CONTROL. J. Marvin*[1], A. Estes[2]; [1]PBI/Gordon, Kansas City, MO, [2]PBI/Gordon, Pendleton, SC (263)

ABSTRACT

EH-1587, a novel new broadleaf herbicide being developed by PBI-Gordon for use on both cool and warm-season turfgrasses. The formulation contains Halauxifen-methyl (HM), fluroxypyr, and dicamba. Halauxifen-methyl is a new active in the arylpicolinates family being developed by Dow AgroSciences. Injury to target plants from HM is similar to other auxin type herbicides such as 2,4-D and MCPA. EH-1587 has demonstrated excellent activity on annual and perennial broadleaf weeds when applied at rates between 1.5 to 4.0 pt/A of product. Field studies have indicated a low potential for non-target injury, as well as injury from volatility. Field and lab studies indicate HM breaks down rapidly in green leaf tissue, typically within 5 days. EH-1587 offers a favorable ecological and toxilogical profile.

EH-1587 has excellent activity on weeds in the Plantaginacea and Fabaceae families. In addition to the previous weeds over 25 of the most problematic weeds in turfgrass have shown excellent control. EH-1587 will be rain fast 1 hour after application. EH-1587 will bring new technology and help with resistance management for weeds currently resistant to three-way type herbicide formulations.

VEXIS: NEW TECHNOLOGY FOR TURF WEED CONTROL. A.G. Estes*[1], J. Marvin[2]; [1]PBI Gordon Corporation, Pendleton, SC, [2]PBI/Gordon, Kansas City, MO (264)

ABSTRACT

PBI/Gordon would like to introduce a new active we are currently working on for US registration. Pyrimisulfan, a proprietary sulfonanilide, exhibits excellent safety on most turfgrass species as well as woody ornamentals. Pyrimisulfan is currently being formulated as a granule and liquid as an end use product.

Pyrimisulfan also demonstrates excellent herbicidal activity on plants in the *cyperaceae* family as well as some broadleaf weeds. Turfgrass safety has been observed at rates ≥360 g ai/ha, with both cool-season and warm-season turfgrass varieties exhibiting good tolerance.

Pyrimisulfan mode of action is acetolactate synthase (ALS) inhibition. Pyrimisulfan will have a maximum annual use rate of 90g ai/ha. Pyrimisulfan 35 – 90g ai/ha + Penoxsulam 35 – 90 g ai/ha has demonstrated excellent post emergence activity on a wide variety of broadleaf weeds. Control of yellow nutsedge (*Cyperus esculentus*), purple nutsedge (*Cyperus rotundus*) and false green kyllinga (*Kyllinga brevefolia*) has been observed at rates between 35 and 90 g ai/ha with single and sequential applications. In addition to post emergence activity, excellent preemergence activity has been observed on crabgrass, goosegrass and various broadleaf weeds. Length of efficacy appears to be rate dependent. Turfgrass safety on cool and warm-season is variable depending on rates, timing, and grass species.

Extensive research has been conducted throughout the United States. Planned uses include; home lawns, golf courses, sports turf, sod farms, industrial turf.

GREEN KYLLINGA AND YELLOW NUTSEDGE CONTROL WITH PYRIMISULFAN.
J.M. Craft*, S. Askew, J.R. Brewer, S. Rana; Virginia Tech, Blacksburg, VA (265)

ABSTRACT

False green kyllinga (*Kyllinga gracillima,* CYPBP) and yellow nutsedge (*Cyperus esculentus,* CYPES) are troublesome weeds that are often found in turfgrass areas. Regardless of herbicide selection, CYPBP and CYPES are difficult-to-control and may require multiple herbicide applications. Pyrimisulfan (Vexis^{TM}) is a new acetolactate synthase (ALS) inhibiting herbicide being released by PBI Gordon and may offer a new solution for CYPBP and CYPES in turfgrass areas. Trials were conducted to evaluate pyrimisulfan applied at different rates and timings on weed control and turf safety. Study one was initiated on June 17, 2015 at the Pete Dye River Course of Virginia Tech in Radford, VA on rough height creeping bentgrass (*Agrostis stolonifera* L.) to evaluate pyrimisulfan as a soluble concentrate SC formulation for control of CYPBP. Study two was initiated on July 18, 2016 at the Virginia Tech Golf Course in Blacksburg, VA on creeping bentgrass to evaluate pyrimisulfan as a granular G formulation for control of CYPES. Treatments for study one included; pyrimisulfan SC applied once at 35, 50, 70, and 90 g ai/ha, pyrimisulfan SC applied at 35 and 50 g ai/ha followed by sequential applications 40 days after initial treatment (DAIT), pyrimisulfan SC applied at 50 g ai/ha followed by 40 g ai/ha applied 40 DAIT, pyrimisulfan SC applied at 60 g ai/ha followed by 30 g ai/ha 40 DAIT, and halosulfuron (Sedgehammer^{TM}) applied once and twice at 70 g ai/ha. Treatments for study two included, pyrimisulfan G applied twice at 45 g ai/ha and twice at 90 g ai/ha with each rate being applied with two types of carriers (G_1 and G_2). A non-treated check was included for comparison. Initial CYPES cover ranged from 11 to 33% and CYPBP cover ranged from 46 to 81% for study one and two, respectively.

At 21 DAIT, all pyrimisulfan SC and halosulfuron treatments controlled CYPBP ≥ 70%. At 40 DAIT, CYPBP started to recover from lower rates (below 60 g ai/ha), as higher rates began to exhibit necrosis and stand reduction of CYPBP. At 63 DAIT, single pyrimisulfan SC applications controlled CYPBP ≥ 82% at the 90 g ai/ha rate and ≤ 68% at lower rates. Repeat treatments at all rates, except 35 g ai/ha, controlled CYPBP at least 80% and equivalent to repeat treatments of halosulfuron. At 14 DAIT, pyrimisulfan G at low and high rates controlled CYPES ≥ 80%. AT 67 DAIT, pyrimisulfan G at 90 g ai/ha with G_1 and G_2 carrier and 45 g ai/ha with G_2 carrier controlled CYPES 80%, while at 50 g ai/ha with G_1 carrier controlled CYPES 55%. Pyrimisulfan did not cause turf injury in either study. Pyrimisulfan SC was similar to halosulfuron both in appearance and speed of symptom development on CYPBP. These data suggest that pyrimisulfan applied once at higher rates or repeat applications at rates above 50 g ai/ha can control CYPES and CYPBP at commercially acceptable levels.

PREEMERGENCE CRABGRASS SPP. CONTROL WITH EH1579 AND EH1580 CONTAINING VEXIS IN BERMUDAGRASS TURF. G.M. Henry*[1], K.A. Tucker[1], J.T. Brosnan[2], G.K. Breeden[2], A.G. Estes[3]; [1]University of Georgia, Athens, GA, [2]University of Tennessee, Knoxville, TN, [3]PBI Gordon Corporation, Pendleton, SC (266)

ABSTRACT

Field experiments were conducted at the Athens Turfgrass Research and Education Center in Athens, GA and the East Tennessee Research and Education Center in Knoxville, TN during the spring and summer of 2016 to evaluate the preemergence control of crabgrass spp. (*Digitaria* spp.) with EH1579 and EH1580 containing Vexis. Both chemistries previously exhibited cool- and warm-season turfgrass tolerance. Research in GA was conducted on bermudagrass (5.1 cm) with a history of large crabgrass infestation [*Digitaria sanguinalis* (L.) Scop.], while research in TN was conducted on bermudagrass (1.6 cm) with a history of smooth crabgrass [*Digitaria ischaemum* (Schreb.) Schreb. Ex Muhl.]. The experimental design was a randomized complete block with four replications at each location. Herbicide treatments were initiated in GA on March 8, 2016 with a sequential application on May 4, 2016. Treatments consisted of EH1579 (penoxsulam + pyrimisulfan - inert carrier) [90 g ai ha^{-1}, 180 g ai ha^{-1}, and 90 g ai ha^{-1} followed by (fb) 90 g ai ha^{-1}], EH1580 (penoxsulam + pyrimisulfan - fertility carrier) (90 g ai ha^{-1}, 180 g ai ha^{-1}, and 90 fb 90 g ai ha^{-1}), and indaziflam at 32.7 g ai ha^{-1} (industry standard). A non-treated check was added for comparison. Herbicide treatments were initiated in TN on March 7, 2016 with a sequential application on May 2, 2016. EH1579 and EH1580 treatments were similar in TN as previously described, but industry standards consisted of prodiamine at 840 g ai ha^{-1} and dithiopyr at 560 g ai ha^{-1}. Herbicides were applied with a CO_2 powered backpack sprayer calibrated to deliver 187 L ha^{-1} (GA) or 375 L ha^{-1} (TN). Visual ratings of % crabgrass cover was recorded 85 and 112 days after initial treatment (DAIT). Percent cover was compared to the non-treated check within each replication in order to determine % crabgrass control. EH1579 resulted in 52 to 56% large crabgrass control 85 DAIT when single applications were made at 90 and 180 g ai ha^{-1}. However, sequential applications of EH1579 at 90 g ai ha^{-1} resulted in 81% large crabgrass control 85 DAIT. EH1579 at 180 g ai ha^{-1} or 90 fb 90 g ai ha^{-1} resulted in 73 to 80% smooth crabgrass control in TN, while a single application of EH1579 at 90 g ai ha^{-1} only resulted in 43% control. Large crabgrass control was moderate in response to EH1580 85 DAIT. EH1580 at 180 g ai ha^{-1} or 90 fb 90 g ai ha^{-1} resulted in 58 to 62% large crabgrass control in GA, while a single application of EH1580 at 90 g ai ha^{-1} only resulted in 40% control. EH1580 at 180 g ai ha^{-1} or 90 fb 90 g ai ha^{-1} resulted in good smooth crabgrass control (89 to 93%), while EH1580 at 90 g ai ha^{-1} only resulted in 63% control 85 DAIT. Prodiamine at 840 g ai ha^{-1}, dithiopyr at 560 g ai ha^{-1}, and indaziflam at 32.7 g ai ha^{-1} resulted in 99%, 100%, and 63% crabgrass spp. control 85DAIT. Control of crabgrass spp. was ≤ 56% 112 DAIT in response to EH1579, regardless of rate, application frequency, or trial location. EH1580 at 180 g ai ha^{-1} or 90 fb 90 g ai ha^{-1} resulted in 68 to 69% large crabgrass control in GA, while a single application of EH1580 at 90 g ai ha^{-1} only resulted in 41% control 112 DAIT. Smooth crabgrass control was 84% 112 DAIT in TN in response to EH1580 at 180 g ai ha^{-1}, while control dropped to 63 and 43% in response to EH1580 at 90 fb 90 g ai ha^{-1} and 90 g ai ha^{-1}, respectively. Crabgrass spp. control was 96%, 91%, and 69% 112 DAIT in response to prodiamine at 840 g ai ha^{-1}, dithiopyr at 560 g ai ha^{-1}, and indaziflam at 32.7 g ai ha^{-1}, respectively.

MIXING METRIBUZIN WITH MESOTRIONE OR TOPRAMEZONE FOR WEED CONTROL IN BERMUDAGRASS TURF. J.R. Brewer*, J.M. Craft, S. Askew; Virginia Tech, Blacksburg, VA (267)

ABSTRACT

Annual grassy weeds like goosegrass (*Eleusine indica*) and crabgrass (*Digitaria* spp.) are some of the most troublesome weeds in bermudagrass turf. While we still have effective post-emergent options for large (*Digitaria sanguinalis*) and smooth crabgrass (*Digitaria ischaemum*) in bermudagrass (*Cynodon dactylon*), we have lost most of our effective post-emergent options for goosegrass. Now 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibitors like mesotrione and topramezone are beginning to be used to control goosegrass. These herbicides are labeled for use in most cool-season turfgrass species, but registrations in warm-season turfgrass systems are limited or pending. At Virginia Tech in the summer and fall of 2016, there were 7 studies conducted including 1 field demo ('419' bermudagrass), 2 replicated field studies ('419' bermudagrass and unknown bermudagrass cultivar), and 4 greenhouse studies. These studies included topramezone and mesotrione combined with other herbicides primarily metribuzin.

At both field sites 1 week after treatment (WAT), topramezone at 1.22 g ai ha^{-1} and 2.44 g ai ha^{-1} plus metribuzin at 21 g ai ha^{-1} injured bermudagrass less than 45% at most, and bermudagrass fully recovered by 2 WAT. Also at both sites, mesotrione at 140 g ai ha^{-1} plus metribuzin injured bermudagrass more than all other treatments ranging from 80 to 85% injury 1 WAT. Mesotrione at 70 g ai ha^{-1} plus metribuzin injured bermudagrass similar to topramezone alone at 2.44 g ai ha^{-1} at both sites, more than both rates of topramezone with metribuzin, and less than mesotrione at 140 g ai ha^{-1}. The field site with an unknown bermudagrass variety was also infested with smooth crabgrass. By 7 WAT, all topramezone-containing treatments controlled smooth crabgrass less than 55%, while all mesotrione-containing treatments had controlled smooth crabgrass greater than 95%. During the first two greenhouse studies, we evaluated different herbicide combinations with mesotrione including simazine at different rates, triclopyr, and metribuzin. While simazine and triclopyr were the focus, mesotrione plus metribuzin stood out above the other combinations. At 3 WAT, mesotrione at 140 g ai ha^{-1} plus metribuzin at 21 g ai ha^{-1} controlled goosegrass greater than 90% while all other mesotrione-containing treatments controlled goosegrass less than 80%. Sulfentrazone plus metribuzin also controlled goosegrass between 70 and 92% at this time. The other two greenhouse studies evaluated topramezone at 1.22, 3.68, and 6.13 g ai ha^{-1} mixed with metribuzin at 21 g ai ha^{-1}. By 5 WAT, these topramezone plus metribuzin mixtures controlled goosegrass greater than 95% regardless of topramezone rate.

REDUCING BERMUDAGRASS INJURY OF TOPRAMEZONE UTILIZING CHELATED IRON. A.P. Boyd*, J.S. McElroy, W.B. Head; Auburn University, Auburn, AL (268)

ABSTRACT

Bermudagrass (*Cynodon dactylon*) is one of the most common turfgrass species planted on golf courses, home lawns, and sports fields. Bermudagrass is able to tolerate a wide variety of environmental conditions; however, weeds can rapidly invade turfgrass areas weakened due to drought, disease, insect infestation, or mechanical damage. Grassy weeds such as goosegrass (*Eleusine indica*) and crabgrass (*Digitaria spp.*) often fill these voids and control can be problematic once established. Monosodium methanearsonate (MSMA) was a common herbicide used for control of these two grassy weeds until 2009, when its use was banned in sports fields and heavily restricted in sod production and golf courses. Turfgrass managers are now seeking alternative herbicides for postemergence control of these and other grassy weeds. Previous research has shown that topramezone offers excellent control of goosegrass, crabgrass, and other weed species, and potentially could be a viable replacement for MSMA. Topramezone is a HPPD inhibitor which affects the carotenoid biosynthesis pathway causing symptoms of bleaching and injury to occur on various warm season turfgrasses. Field trials were conducted in the summer of 2015 (Auburn University) to determine whether various additives may help safen topramezone (Pylex, BASF, Research Triangle Park, NC) use on bermudagrass by reducing bleaching symptoms. Mixtures of topramezone (12.3 g ai/ha) and MSO (0.5% v/v) were applied in combination with 5 different additives including triclopyr (35 g ai/ha), green turf pigment (1.75 kg ai/ha, Sarge 2.0, Numerator Technologies Inc., Sarasota, FL), green turf paint (8.3% v/v, Lesco Green Turf Paint, Site One Landscape Supply, Roswell, GA), ammonium sulfate (353 g ai/ha), and chelated iron (1.22 kg ai/ha, Sprint 330, BASF, Research Triangle Park, NC). Bermudagrass injury and bleaching symptoms were visually rated on a 0 to 100% scale. The treatments were arranged as a randomized complete block design with 4 replications. All data was analyzed using PROC GLM and Fisher's Protected LSD ($P<0.05$) was utilized for means separation.

Previous research using triclopyr has shown safening of topramezone, but our results showed similar bleaching symptoms and injury to the other treatments. Preliminary results showed that chelated iron significantly reduced bleaching symptoms associated with topramezone injury. At 5 days after treatment (DAT), topramezone plus chelated iron injured bermudagrass <20%, as compared to ~60% for topramezone alone. By 11 DAT, chelated iron and topramezone treatments bleached bermudagrass <5% as compared to the other treatments which bleached bermudagrass 70-90%. By 20 DAT, all bermudagrass plots had recovered and no signs of residual bleaching was observed. Although the bermudagrass fully recovered for all treatments by 20 DAT, all of the treatments except for the combination of chelated iron and topramezone showed unacceptable levels of bleaching injury. This data suggests that the addition of chelated iron to the mixture of topramezone and MSO may act as a safener on bermudagrass.

BERMUDAGRASS RESPONSE TO TOPRAMEZONE PLUS CHELATED IRON IN VIRGINIA. J.R. Brewer*, S.D. Askew; Virginia Tech, Blacksburg, VA (269)

ABSTRACT

Topramezone is becoming more utilized in turfgrass systems every year due to its ability to control annual grasses such as goosegrass (*Eleusine indica*). It is labeled for use in most cool-season turfgrasses, but not yet labeled in warm season turfgrass like bermudagrass (*Cynodon dactylon*). Due to goosegrass's increasing presence in bermudagrass turf and the lack of post-emergent control options, many researchers are evaluating topramezone in bermudagrass to determine if any combinations of other herbicides or fertilizers can effectively reduce the bleaching effects of topramezone. These include products such as triclopyr, quinclorac, or chelated Fe. At Virginia Tech, we conducted two field studies in the summer of 2016 and one greenhouse study in the fall of 2016. The two field studies were specifically used to evaluate chelated Fe in its ability to alleviate the bleaching symptoms of topramezone. The first site was on 'Premiere' bermudagrass at lawn height (3.8 cm) and the second site was on a 'Patriot' bermudagrass fairway (1.7 cm), while the greenhouse study evaluated goosegrass control. The field studies were initiated on September 5, 2016, and had 9 treatments, while the greenhouse study was initiated on November 11, 2016 with 5 treatments. All studies were evaluating different rates of topramezone with or without chelated iron and topramezone plus metribuzin with or without chelated iron.

At the Patriot site 1 week after treatment (WAT), all topramezone treatments except the treatments including metribuzin injured bermudagrass greater than 90%, while at the Premiere site only topramezone at 12.3 g ai ha^{-1} injured bermudagrass greater than 90%. Chelated Fe showed no decrease in injury at either site. Topramezone plus metribuzin without and with chelated Fe injured bermudagrass 63 and 49% at the Patriot site, while only injuring bermudagrass 20 and 12% at the Premiere site with chelated Fe statistically lowering the injury at both sites. Even though chelated Fe did not decrease initial injury, it did aid in faster recovery of bermudagrass at both sites with both the high and low rate of topramezone by 2 WAT, but still maintained unacceptable injury (30%) for most of the treatments at this time. Only topramezone plus metribuzin at both sites and the low rate of topramezone plus chelated Fe at the Premiere site recovered to lower than 30% injury by 2 WAT. NDVI trends were similar to the observed injury. By 2 WAT during the greenhouse study, topramezone plus metribuzin controlled goosegrass greater than 80% with or without chelated Fe, while topramezone at 6.13 g ai ha^{-1} with or without chelated Fe controlled goosegrass approximately 30%. By 6 WAT, topramezone plus metribuzin had controlled goosegrass, while topramezone without or with chelated Fe had controlled goosegrass 73 and 80%, respectively. These results indicate that using chelated Fe in combination with topramezone in Virginia does not effectively reduce the initial injury caused by topramezone on bermudagrass, but could help speed recovery time. Topramezone at lower rates plus metribuzin is showing better results than chelated Fe for both lowering bermudagrass injury and effectively controlling goosegrass.

CHARACTERIZATION OF ANTHRAQUINONES: A POTENTIAL ANTI-HERBIVORY COMPOUND IN SICKLEPOD. Z. Yue*, T.P. Tseng; Mississippi State University, Starkville, MS (237)

ABSTRACT

Deer damage to row crops such as soybean is a common problem in the US. The deer pressure in Mississippi can keep the forage soybean at half height. Currently, the only effective and widely used technique to control deer from crop browsing are establishment of fences and application of repellents, which is expensive, labor intensive, and most of the time ineffective. Plants possess varying levels of herbivore defense mechanisms, and weeds, because of their vast genetic and phenotypic diversity, are a good resource for anti-herbivore traits. Studies have shown that sicklepod weed seeds and plants contain anthraquinone derivatives, and in separate studies were shown to repel herbivores mainly birds. This project selected sicklepod to characterize its anti-herbivore property and apply the property to protect soybean crop. We conducted tests at the Captive Deer Facility at MSU to confirm the anti-herbivore property of sicklepod weed. Soybean plants not applied with the sicklepod extracts were consumed completely, while plants applied with sicklepod extracts were entirely avoided. Using chromatography techniques, we found the levels of these anthraquinone derivatives (chrysophanol, emodin, physcion) to be up to 11 times higher in sicklepod compared to soybean. These anti-herbivore properties can be extracted from sicklepod and applied on soybean to test their anti-herbivore efficacy on deer. As sicklepod and soybean both belong to *Leguminosae*, molecular markers can be developed and used in screening soybean germplasm for the anti-herbivore traits. Soybean with significant anti-herbivore property will prevent yield losses incurred due to herbivores such as deer.

PALMER AMARANTH DEMOGRAPHICS IN WIDE-ROW SOYBEAN. N.E. Korres*, J.K. Norsworthy; University of Arkansas, Fayetteville, AR (238)

ABSTRACT

Knowledge of Palmer amaranth demographics and biology is essential for the development and implementation of weed management strategies. The effects of Palmer amaranth density on weed seedling mortality, flowering, biomass production, and fecundity were investigated in a wide-row soybean field experiment for two consecutive years. The experimental design was a randomized complete block design with three levels of Palmer amaranth density i.e. high, medium, low. Palmer amaranth mortality rate increased at high population density, mostly within 30 to 40 days after Palmer amaranth emergence (DAE) (0.55 and 0.80 for 2014 and 2015, respectively). Likewise, as Palmer amaranth density increased weed biomass and seed production per unit area also increased. Biomass production at the high density in 2014 was 664.7 g m^{-2} compared with 542.9 and 422.1 g m^{-2} at medium and low densities, respectively. Similarly, biomass production at high density in 2015 was 100.6 g m^{-2} compared with 37.3 and 34.2 at medium and low densities, respectively. Seeds produced at high density were 1.5 million and 245,400 seeds m^{-2} for 2014 and 2015, respectively; these were reduced by 29 and 54% in 2014 and by 65 and 75% in 2015 at medium and low densities, respectively. Earlier flowering initiation (i.e. between 30 to 40 DAE) occurred at higher Palmer amaranth densities indicating a trade-off between reproduction and survival. Palmer amaranth male-to-female ratio was greater at high densities (i.e. 1.3 and 1.9 compared with lower densities 0.6 to 0.7 and 0.7 to 0.8 in 2014 and 2015, respectively). The plasticity of Palmer amaranth at various levels of intraspecific competition (i.e. high and low population densities) merits further investigation.

TEMPERATURE EFFECT ON BUCKHORN PLANTAIN (*PLANTAGO LANCEOLATA*).

T.L. Grey*, D. Simmons; University of Georgia, Tifton, GA (239)

ABSTRACT

Winter weed species often dominate from late fall to early summer in pecan row middles, specifically in clovers used as a nitrogen source. The perennial species buckhorn plantain has become a winter weed issue is several pecan growing areas of Georgia. There are post-emergence (POST) herbicides that can be used, but perenniall species are often more difficult to control. Buckhorn plantain is a tap-rooted winter perennial that establishes in the autumn, remains as a vegetative rosette during the winter, then puts out a seed head and goes dormant with increased spring and summer temperatures. It is well adapted to pecan cultural practices, infesting pecan groves from road side areas. Mowing will spread it as the seed are very small and carried easily on equipment. Synthetic auxins (2,4-D), triazines (simazine), and sulfonylureas (halosulfuron - Sandea) are registered and can be applied for POST control, but applications in late winter and spring are often inconsistent, and injury to clover can occur. Cold temperatures, rainfall, and erratic weather conditions reduce absorption and translocation of these herbicides if applications are made in December to March to buckhorn plantain. Failure to control buckhorn plantain with pre-emergence (PRE) herbicides often warrants sequential POST applications that increase maintenance costs and injure clovers, reducing nitrogen output. The specific issue that needs to be addressed is how pecan growers can control buckhorn plantain but maintain clover as a ground cover in the understory. Perennial clovers are establishing at the same time as buckhorn plantain in atumn. Research was conducted to establish the timing of buckhorn plantain germination and emergence and control with autumn herbicide applications. Seed testing was conducted on a thermal gradient for temperatures ranging from 12 to 30 C for 288 hours. Lorentizian regression for estimating time and temperature to maximum plantain seed germination was 17 C at 187 hr. Indaziflam in combination with 2,4-D controlled buckhorn plantain greater than 90% when applied POST in field and greenhouse experiments.

USING POPULATION STUDIES TO UNDERSTAND PALMER AMARANTH (*AMARANTHUS PALMERI*) ADAPTATIONS TO CROPPING SYSTEMS. W. Bravo[1], R.G. Leon*[2], J. Ferrell[1], M. Mulvaney[2], W. Wood[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL (240)

ABSTRACT

Multiple studies on herbicide resistance (HR) avoid genetic variability to more accurately identify how the mutation(s) responsible for the HR trait might affect the physiology and fitness of the plant. This approach has limitations to determine the real fitness of a weed or biotype in a given cropping system because the fitness is determined by multiple polygenic traits. Therefore, considering genetic and phenotypic variability within and among populations can provide a more realistic picture of the behavior and adaptability of the weed to control practices. This is particularly important to assess the long-term viability of integrated weed management approaches. We compared the growth and plant architecture of ten Palmer amaranth populations collected in Florida and Georgia from fields with different cropping histories, ranging from monoculture to two- and three-crop rotations, and from glyphosate based weed control to organic production. The results of the study clearly indicated that there is differentiation among Palmer amaranth populations that is related not only to herbicide use history, but also to crop rotation, crop canopy characteristics, and fertilization history. Additionally, glyphosate resistant (GR) and glyphosate susceptible (GS) populations differed in multiple life-history traits, but these differences were not due to pleiotropic effects of the HR trait. GR populations grew taller and produced more biomass than GS populations. This gain in growth was partially attributed to higher nutrient use efficiency. The present study suggests that Palmer amaranth can quickly evolve life-history traits increasing its fitness in cropping systems, explaining its rapid spread throughout the United States. Also, the results highlight the necessity to consider intra-specific variation of adaptive traits to assess whether the use of more competitive crops could eventually promote the selection of more aggressive weed biotypes.

FITNESS COST ASSOCIATED WITH DIFFERENT RESISTANCE PATTERNS IN ECHINOCHLOA SPP. IN ARKANSAS. T.M. Penka*[1], C. Oliveira[2], J.P. Refatti[3], L. Piveta[2], C.E. Rouse[1], N.R. Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]Universidade Federal de Pelotas, Pelotas, Brazil, [3]UFPel, Pelotas, Brazil (242)

ABSTRACT

Echinochloa interference with rice is well-documented. Herbicide resistance traits associated with fitness costs and a multiple-resistance, is even more documented. Resistance impact on fitness can be manifested in the ability of a resistant plant to compete with wild types; or reduction in either germination capacity, tolerance to abiotic stresses, or fecundity. Understanding the impact of resistance on weed biology can provide insight on better weed management strategies. Experiments were conducted at the Arkansas Agriculture Research and Extension Center (AAREC), Fayetteville, AR to evaluate fitness cost associated with different resistance profiles in *Echinochloa* spp. The first experiment evaluated the germination behavior of eight accessions under different temperatures (15°C, 20°C, 30°C, and 40°C). To minimize background variation and attribute fitness cost to the resistance trait, sensitive (S) and tolerant (T) biotypes were selected from within each accession. Fifty to fifty-five seeds of each sample were placed in a Petri plate lined with paper towel, in four replicates, moistened with DI water, and incubated at the designated temperatures for 12 hours day/night with no temperature fluctuation for four weeks. Germinated seeds were counted every other day and water was replenished. The second experiment evaluated the competitive ability of R and S biotypes of ECO45 with 'Roy J' rice, and with each other, in a replacement series experimental design. Three- to four-leaf seedlings were transplanted into a flooded raised bed in the greenhouse for a total population of 12 plants ft^{-2}. The treatments were arranged in a randomized complete block design with four replications. Plant height and number of tillers were recorded 2, 4, and 6 WAP using the center plants of each plot. The center plants, and entire plot, were harvested 6 WAP and dry biomass was recorded. Relative yields and competitive ratios were calculated. Temperature, accession, and biotype had significant interaction effects on germination. All accessions had higher rates of germination at 30°C and 40°C, but ECO45-S germinated the fastest and had the highest cumulative germination (72%) in week 1 and was higher than that of its resistant counterpart, ECO45-R (62%). The R and S biotypes had similar low germination capacity at 20°C, but the R biotypes had more germination sooner than S biotypes. In general, it took two weeks for most accessions to germinate at 15°C. The R and S biotypes of ECO45 were equally competitive with rice, and no significant differences were observed in relative biomasses. In conclusion, The multiple-resistant ECO45 did not show fitness cost in terms of competitive ability, but the R biotype showed reduced germination rate and germination capacity at low temperature (15°C).

PHYSIOLOGICAL MECHANISMS OF RESISTANCE TO QUINCLORAC IN MULTIPLE-RESISTANT JUNGLERICE (*ECHINOCHLOA COLONA*). C.E. Rouse*, N.R. Burgos; University of Arkansas, Fayetteville, AR (243)

ABSTRACT

Herbicide -resistant *Echinochloa* species are a major concern for global up-land and low-land rice production. Historically a variety of pre- and postemergence herbicides have been used to manage this species with tremendous efficacy. Previously, we reported junglerice (*Echinochloa colona*) as the predominant species impacting Arkansas agricultural production fields, with increasing reports and confirmation of herbicide resistance to common rice herbicides. Our state-wide screening efforts have focused on the evolution of multiple resistance and have resulted in the identification of a unique population, ECO-45, with resistance to cyhalofop, glufosinate, propanil, and quinclorac. ECO-45 is highly resistant to quinclorac (>32x) with vigorous growth that is enhanced in the presence of the herbicide. Quinclorac is a relatively old chemistry in rice with a unique mode of action that has been used extensively throughout Arkansas. While quinclorac is a group 4 herbicide, auxin or plant growth regulator, in grass species the cause of plant death is due to a buildup of toxic cyanide concentrations. To characterize potential non-target-site or physiological processes which enables ECO-45 resistance pattern, three experiments were conducted that seek to characterize the pathway involved in cyanide accumulation. Experiment 1, an agar-based cyanide response assay, was conducted to evaluate the sensitivity of ECO-45 to cyanide. Seedlings at 1- to 2-leaf stage were plated in agar containing 0, 4, and 100 ppb KCN at 5 plants per plate. One week after plating, ECO-45 seedlings survived at all concentrations showing normal root and shoot development as the control plants. The susceptible standard had minimal growth at the lower concentration and did not grow at all at 100 ppb KCN. Experiment 2, endogenous HCN concentration evaluation, was conducted to determine the concentration of HCN produced by ECO-45. Cyanide was detected colorimetrically. ECO-45 appeared to produce a low concentration of HCN 24 hours after herbicide application, which increased slightly at 96 hours after application. The final experiment sought to characterize a potential mechanism for tolerance to cyanide by quantifying the activity of β-CAS, an enzyme involved in natural cyanide detoxification. Enzyme activity was assessed colorimetrically at 24 and 96 hours after herbicide application. At 24 HAA, a slightly elevated absorbance (0.20572 L mol^{-1} cm^{-1}) and subsequent activity of the enzyme were observed in ECO-45 relative to the susceptible standard (0.19925 L mol^{-1} cm^{-1}). These assays indicated one possible resistance mechanism in ECO-45, but the differences were not large enough to account for the extremely high level of resistance to quinclorac.

TRANSGENE AND GLYPHOSATE EFFECTS ON CORN LEAF AND SEED MINERAL CONTENT IN GLYPHOSATE-RESISTANT ISOLINES GROWN ON GLYPHOSATE LEGACY AND NO-LEGACY SOILS. K.N. Reddy*[1], S.O. Duke[2], M.M. Williams[3], J.E. Mual[4], D.R. Shaw[5]; [1]USDA-ARS, Stoneville, MS, [2]USDA-ARS, University, MS, [3]USDA-ARS, Urbana, IL, [4]USDA-ARS, Beltsville, MD, [5]Mississippi State University, Mississippi State, MS (244)

ABSTRACT

Public concerns have been raised about potential effects of the glyphosate resistance transgene and glyphosate on seed chemical composition in glyphosate-resistant (GR) crops, however, a comprehensive study to clarify the possible role of glyphosate is lacking. A field study was conducted in 2013 and 2014 at Stoneville, MS to compare seed mineral composition in a GR corn treated with and without glyphosate and a non-GR isoline cultivar without glyphosate treatment grown in a field with a legacy of glyphosate use and in a field where glyphosate had not been used. The treatments were a non-GR cultivar with no glyphosate, a GR cultivar with no glyphosate, and a GR cultivar with glyphosate at 0.87 kg ae/ha applied twice at 5 and 7 weeks after planting. The experiment was conducted in a randomized complete block design with four replications. Each plot consisted of four rows spaced 1 m apart and 15.2 m long. The glyphosate history field had either GR soybean or GR cotton grown on it the last 15 years. The no-glyphosate history field had cogongrass [*Imperata cylindrica* (L.) Beauv.] (maintained for weed biology studies) with no herbicides applied for the past 12 years. In 2012, cogongrass was killed with repeated tillage, and then non-GR soybean and non-GR corn was planted in alternate rows to prepare the land for this study. Corn and soybean was grown until maturity and flail mowed. Fields were prepared by subsoiling, disking, and bedding in the fall of 2012. In April of 2013 and 2014, corn isoline cultivars, DKC65-17 RR2 (GR) and DKC-65-18 (non-GR) were planted and grown using standard production practices under irrigation. *S*-metolachlor and pendimethalin were applied at planting to provide early season weed control. All plots were maintained weed-free by hand hoeing periodically throughout the season. At the R2 stage (about 4 wk. after second glyphosate application) about 40 flag leaves were sampled randomly from the middle two rows. At harvest, 20 ears were sampled randomly from the middle two rows for seed. Leaves and seeds were analyzed for mineral content using inductively coupled plasma mass spectrometry and glyphosate and its degradation product aminomethlyphosphonic acid (AMPA) were determined using GC-MS. Corn yield was not affected by either transgene or glyphosate in both years. There were no effects of transgene (GR gene) or glyphosate application on leaf content of K, Zn, Fe, Cu, Sr, Ba, Al, Cd, Cr, Co, Ni, Ga, Se, Rb, Cs, Pb, U, V with the exception of Mg and Mn. Leaf Mg and Mn content slightly decreased with transgene under glyphosate history soils. Similarly, transgene and glyphosate application had no effect on Ca, Mg, Mn, Zn, Fe, Cu, Sr, Ba, Al, Co, Ni with an exception of Cd. Seed Cd content slightly increased with transgene under both glyphosate legacy and no legacy soils. Merely 3 of 160 (<2%) treatment means of mineral-tissue-site-year combinations were significant and appeared to be random false positives and false negatives. Glyphosate (2.6 to 2.9 µg/g) and AMPA (25 to 38 ng/g) were detected in leaves but not in harvested seed. These results indicate that the transgene and glyphosate use had no effect on leaf and seed mineral content in corn.

SCREENING AND CHARACTERIZATION OF HERBICIDE TOLERANCE AMONG WEEDY RICE GERMPLASM. S. Shrestha*, G. Sharma, T. Tseng; Mississippi State University, Starkville, MS (245)

ABSTRACT

Weedy red rice (*Oryza sativa* L) is conspecific, aggressive weed that has been identified as a threat to global rice production. This weed has inherited high reproductive ability and high dormancy by outcrossing with modern rice cultivars and wild cultivars, respectively. Traits such as rapid growth, high tillering, enhanced ability to uptake fertilizers, asynchronous maturation, seed shattering, and long dormancy periods, makes weedy rice more competitive than cultivated rice. As weedy rice is more tolerant to biotic and abiotic stresses and has an elevated competitive ability than cultivated rice, we hypothesized that this species is more tolerant to herbicides and possesses weed suppressive ability. We evaluated 54 weedy rice accessions for tolerance to glyphosate at 1.12 kg/ha (1X rate). Three of the fifty-four weedy rice accessions showed less than 40% herbicide injury. These accessions were considered more competitive than other accessions and in the future, we will proceed in determining the molecular mechanisms associated with herbicide tolerance, with the expectation of generating tools for rice breeding and crop improvement. Furthermore, blackhull accessions were generally more tolerant (65% average injury) than strawhull accessions (80% average injury), thus suggesting blackhull accessions being potentially more difficult to manage in the farmer's field and requiring an alternative management strategy.

HERBICIDE TOLERANT TOMATO: IDENTIFYING MOLECULAR MARKERS AND DETERMINING THE TOLERANCE MECHANISMS. H. Yates*[1], G. Sharma[2], S. Stallworth[1], T. Tseng[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (246)

ABSTRACT

Tomato (*Lypersicon esculentum*) is grown on over 444 acres across 627 farms in Mississippi. Even though the crop is primarily grown in a plasticulture system, weeds are still a major problem in tomato production. Major weeds in tomato are yellow nutsedge, purple nutsedge, large crabgrass, and Palmer amaranth. Among these weeds, yellow and purple nutsedge are the most problematic, causing significant yield losses and decreased fruit quality. Herbicide options in tomato are limited, and only a few are highly effective on nutsedge. However, significant injury is observed in tomato from the labeled herbicides. Moreover, injury from herbicides drifted to greenhouse tomatoes leads to deformed fruits and yield reduction. The main goal of this project is to screen and identify tomato lines having tolerance to already labeled herbicides, and to herbicides that can potentially be drifted to tomatoes (major ones being 2,4-D and glyphosate), and determine mechanism(s) of tolerance. Wild cultivars are good source of genetic variability, and in this study we selected 50 wild tomato cultivars (obtained from Tomato Genetic Resource Center) which are resistant to abiotic stresses such as drought, cold or salt. These accessions were screened for tolerance to simulated drift rates of 2,4-D and glyphosate, and tolerant accessions identified were used for QTL analysis to identify molecular markers associated with herbicide resistance. Thirty RFLP and SSR markers linked to abiotic stress tolerance was used. Only 17 markers produced successful amplification product and 15 of these were polymorphic. The overall gene diversity was 0.6317, and populations were equally diverse among and within. Fours markers, TMS37, Tom 236-237, U81996 and SLR 21, were able to distinguish susceptible and tolerant tomato accessions. Potential molecular marker identified from this study can be used for breeding experiments to develop tomato lines with improved herbicide tolerance and high yield potential. These markers associated with herbicide tolerance will be summarized and submitted to Tomato Genetic Resource Center public database and made available to researchers.

TIME OF APPLICATION INFLUENCES AUXINIC HERBICIDE TRANSLOCATION.
C.R. Johnston*[1], P. Eure[2], T. Grey[3], A.S. Culpepper[3], W. Vencill[1]; [1]University of Georgia, Athens, GA, [2]Syngenta, Houston, TX, [3]University of Georgia, Tifton, GA (247)

ABSTRACT

Herbicides have been reported to have differential efficacy based on time of application, and this phenomenon has been observed with auxinic herbicides. The objectives of this research were to evaluate the effect of time of application on ^{14}C-dicamba and ^{14}C-2,4-D absorption and translocation in Palmer amaranth. Nonlinear regression using a rectangular hyperbolic equation was used to analyze the maximum absorption (A_{max}) as well as translocation (T_{max}) out of the treated leaf, above the treated leaf, below the treated leaf and to plant roots. The time required for 90% of absorption or translocation to occur (t_{90}) was also analyzed. Final distribution of radioactivity was compared between application times for both herbicides at 48 hours after treatment (HAT). Two studies were conducted for each herbicide. Both absorption and translocation through all plant tissues generally increased with time for both herbicides. The A_{max} of ^{14}C-2,4-D was significantly affected by time of application in both studies, however trends were different between studies. Significantly higher T_{max} was observed with total ^{14}C translocation out of the treated leaf from 7:00am applications compared to 2:00pm and 12:00am applications in one of two studies for both ^{14}C-2,4-D and ^{14}C-dicamba. The T_{max} of ^{14}C below the treated leaf was significantly higher in one of two studies with dicamba. A significantly higher T_{max} and t_{90} was observed with 7:00am applications in terms of ^{14}C translocation to roots in one of two ^{14}C-2,4-D studies. Final absorption of ^{14}C from both ^{14}C-2,4-D and ^{14}C-dicamba applications was statistically similar across application times. With both ^{14}C-2,4-D and ^{14}C-dicamba applications, total translocation out of the treated leaf was higher with 7:00 am applications, however for neither herbicide was this difference statistically significant. Significantly more ^{14}C was translocated above the treated leaf at 48 HAT from ^{14}C-dicamba applications when applied at 7:00am compared to 2:00pm or 12:00am. Similarly, significantly higher ^{14}C was translocation to roots was observed from ^{14}C-2,4-D applications at 7:00am. Specific radioactivity was similar across application times for both ^{14}C-2,4-D and ^{14}C-dicamba, ranging from 454 to 837 Bq g^{-1} in the roots and 1194 to 2840 Bq g^{-1} in shoots. These data indicate that translocation is affected by time of day, perhaps due to effects on transport mechanisms ultimately influencing the response of Palmer amaranth to auxinic herbicides.

***ECHINOCHLOA* GENOME CONTENT AND MORPHOLOGICAL DIFFERENTIATION**. N.R. Burgos*[1], H. Tahir[1], J.L. Gentry[2], C.E. Rouse[1], V. Singh[1], M. Nadeem[1]; [1]University of Arkansas, Fayetteville, AR, [2]Dept. of Biological Sciences, University of Arkansas, Fayetteville, AR (248)

ABSTRACT

Echinochloa species infesting rice, row crops, and vegetables are collectively called barnyardgrass in the southern US. It is actually a complex composed of two major species – *E. colona* (junglerice) and *E. crus-galli* (barnyardgrass). Recent studies indicate that the former is more common than the latter. Field experiments were conducted in 2012-2013 to examine the morphological and phenological variations in 96 *Echinochloa* accessions collected from rice and soybean fields in Arkansas. Accessions were grown as single plants in a common garden at the Arkansas Agricultural Research and Extension Center, Fayetteville in Captina silt loam (fine-silty, siliceous, mesic Typic Fragiudults) with a pH of 6.1. The accessions were arranged in a randomized complete block design (RCBD) with four replicates. Twenty (20) vegetative and reproductive traits pertaining to panicle, culm, leaf, and spikelet were measured. Morphological features of florets were examined. Emergence date, flowering time, and days to maturity were also evaluated. Species were identified based on taxonomic descriptions. Multivariate cluster analysis was conducted to determine the species grouping based on a large database of morphological traits. Flow cytometry analysis was also conducted on 12 junglerice, 5 barnyardgrass, and 3 rough barnyardgrass accessions to calculate the 2C values of these species using corn and rice as reference genomes. Based on taxonomic descriptors, the dataset was comprised of three species: junglerice (82%), barnyardgrass (9%), and rough barnyardgrass (*E. muricata*, 7%). Except for one or two 'stray accessions', the accessions formed three clusters according to their species ID, with the largest cluster being junglerice. At this location, junglerice was 65.4-94.3 cm tall; barnyardgrass was 87.3-125.5 cm and rough barnyardgrass was 79.1-117.6 cm tall. Junglerice was the earliest to flower (40-58 d after planting, DAP) and rough barnyardgrass was the latest (46-62 DAP). The growth habit of junglerice could be either prostrate, decumbent, or open whereas barnyardgrass and rough barnyardgrass are decumbent to open. Rough barnyardgrass is the largest species and easiest to identify. Barnyardgrass and junglerice are most alike. Whereas junglerice is awnless, barnyardgrass may (56%) or may not be (44%) awned. Junglerice produced 72,900 seeds/plant while barnyardgrass produced less than 50% of that (31,900 seeds/plant) and rough barnyardgrass produced 27,600 seeds/plant. The genomic content was highest with barnyardgrass (2C = 2.84 – 2.94) and lowest with rough barnyardgrass (2C = 1.91 – 2.12). The genome content of junglerice was intermediate between the other two species (2C = 2.46 – 2.68). Based on 2C values, all junglerice accessions formed one cluster. One accession from the barnyardgrass morphological cluster (ECR3) grouped with junglerice and another barnyardgrass accession (ECR91) grouped with rough barnyardgrass. In conclusion, barnyardgrass can be mistaken for junglerice or rough barnyardgrass occasionally. Since barnyardgrass is a hexaploid and rough barnyardgrass is a tetraploid, junglerice could be a pentaploid. This information has evolutionary implication.

USE OF INSECTICIDE SEED TREATMENTS AS POTENTIAL HERBICIDE SAFENERS IN GRAIN SORGHUM. N.R. Steppig*[1], J.K. Norsworthy[1], R.C. Scott[2], J.K. Green[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (249)

ABSTRACT

Off-target herbicide movement caused widespread crop injury throughout the Midsouth in 2016. As a result, it is of great interest to growers to find new methods of reducing crop injury resulting from herbicide drift. Previous research has shown that crop injury following a herbicide drift event can be greatly reduced in rice through the use of some insecticide seed treatments. Field trials were conducted at three locations across Arkansas, the Lon Mann Cotton Research Center (2015 and 2016), the Northeast Arkansas Research and Extension Center (2016), and the PineTree Research and Extension Center (2016), in order to determine whether a similar safening effect could be seen in grain sorghum. Treatments were arranged in a randomized complete block design as a two-factor factorial (insecticide x herbicide). Three insecticides (thiamethoxam, clothianidin, and imidacloprid) were applied in combination with three herbicides (glyphosate, quizalofop, and imazethapyr). Herbicides were applied at 1/10x labeled rates, 3 weeks after planting. Visual crop injury was collected weekly for 4 weeks following application; plant density and crop height were recorded at 2 weeks after application, and yield data was collected at the end of the season. At 1 week after application, thiamethoxam significantly reduced injury to sorghum from imazethapyr at two site-years and injury from quizalofop at one site-year. Clothianidin significantly reduced injury from both imazethapyr and glyphosate at one site-year, 1 week after application. Additionally, imidacloprid significantly reduced injury from glyphosate at one site-year, 1 week after application. At 3 weeks after application, thiamethoxam significantly reduced injury from glyphosate and imazethapyr at one site-year. Clothianidin significantly reduced injury from glyphosate and quizalofop at one site-year. Imidacloprid significantly reduced injury from glyphosate drift at two site-years. In one site-year, injury reduction from glyphosate drift via thiamethoxam and imidacloprid, as well as quizalafop drift via clothianidin, resulted in a higher yielding crop. Results from these experiments indicate that, in some instances, insecticide seeds treatments may provide grain sorghum with protection from drift events from some herbicides, in addition to protection from early season insect pests.

NATURAL PHYTOTOXINS FROM *DIAPORTHE ERES* AND THEIR SYNTHETIC ANALOGS. S.O. Duke*[1], K.M. Meepagala[1], R.D. Johnson[2], B. Gilbreath[3]; [1]USDA-ARS, Oxford, MS, [2]USDA-ARS, Oxford, MS, [3]USDA-ARS, Oxford, MS (250)

ABSTRACT

The fungus *Diaprothe eres* was isolated from an infected leaf of English ivy (*Hedera helix*). The fungal infection causes foliar necrosis. The fungus was grown in Czapek Dox broth culture medium and potato dextrose broth culture medium. The culture broth was fractionated for biassay-guided isolation of phytotoxins, using lettuce and bentgrass in the bioassay. Two phytotoxic compounds (3,4-dihydro-8-hydroxy-3,5-dimethyl-isocoumarin (**1**) and 2-(4-hydroxyphenyl)-ethanol - common name tyrosol) were isolated from the ethyl acetate fraction. Six 3,4-dihydro-isocoumarin analogs were synthesized and found to be phytotoxic. Using a more quantitative duckweed *(Lemna paucicostata*) biassay, **1** inhibited growth ca. 50% at 100 micromolar. The synthesized 3,4-dihydro-8-hydroxy-3,7-dimethyl and 3,4-dihydro-8-hydroxy-3,3,7-trimethyl analogs were two- and three-fold more phytotoxic than **1**. Isocoumarins might be good leads for new herbicides.

SORGOLEONE (SORGHUM ROOT EXUDATE) EFFECTS ON IN VITRO GROWTH OF DIFFERENT WHEAT AND WEED SPECIES. M.K. Bansal*, W.J. Everman; North Carolina State University, Raleigh, NC (251)

ABSTRACT

Sorghum in known to produce the allelochemical sorgoleone. Production of sorgoleone is a dynamic process where plants produce these chemicals either by roots when they are still alive or by dead decaying matter and are known to have negative impact on weeds and following crops. There are concerns about sorghum affecting the following winter wheat crop when grown in rotation in North Carolina. Impact of sorgoleone on growth of wheat and various weed species was investigated under in-vitro conditions. Seeds of wheat (Shirley and USG3251) and four weed species, large crabgrass, Italian ryegrass, velvetleaf, and sicklepod were pre-germinated and then transferred to 20x100mm petri dishes treated with varying concentrations of sorgoleone. Sorgoleone was applied @ 0 (control), 25, 50, 100, 150, 200, and 300 µg ml^{-1}. 10 days after placing seeds on the petri dishes, growth was measured in terms of shoot length. Significant sorgoleone treatment effects were observed for shoot growth when pooled over species. Shoot length was reduced at higher rates of sorgoleone compared to control treatments for all weed species. Wheat shoot length was not significantly affected by sorgoleone concentration. Velvetleaf shoot length was lower at all concentration compared to the non-treated control. At higher rates of sorgoleone, large crabgrass, Italian ryegrass, and sicklepod growth was reduced when compared to lower rates. Results suggests that sorgoleone has a negative impact on growth of weed species, however the wheat cultivars tested were not impacted.

DRIFT REDUCTION TECHNOLOGY AND TESTING: WIND TUNNEL TO THE FIELD. G.R. Kruger*[1], D.B. Reynolds[2]; [1]University of Nebraska - Lincoln, Lincoln, NE, [2]Mississippi State University, Mississippi State, MS (225)

ABSTRACT

Pesticide applications in today's environment are highly scrutinized. Because of that, it is critical that applicators take any and all precautions possible to mitigate unintended effects from pesticide applications. This means that applicators should do everything in their power to minimize pesticide drift. This means that applicators should consider wind speed and wind direction, boom height, buffer zones and other label restrictions and droplet size when making applications around sensitive areas. Applicators have the ability to control droplet size and other application parameters to minimize drift. Having a database that allows applicators to make optimal decisions is critical however. Today we have multiple different approaches to generate data that will allow the scientific community to make recommendations on techniques that can reduce drift. Wind tunnel testing and field drift experiments are by far the most common two approaches. Wind tunnel testing gives data on how nozzle type, orifice size, pressure and tank solution influence droplet size. This research technique is high throughput and is cost effective compared to field drift testing. It is limited in scope though as it shows how droplet size changes from a variety of different combinations of application techniques but it does not provide information on how much drift will occur under a variety of environmental conditions. Field studies on the other hand are complex, complicated and cumbersome, but can provide a baseline for how much drift could occur under a specific set of environmental conditions. Field studies can be difficult to draw clear conclusions because of how quickly environmental conditions change in the field and because of all of the moving parts in these studies. As we move into an era with greater scrutiny and where we are using chemical compounds that are more active at lower rates, both field and wind tunnel testing are going to be required to both provide baselines for risk assessment models for labelling purposes as well as applied data to provide education and recommendations to applicators.

VAPORGRIP TECHNOLOGY & FIELD VOLATILITY TESTING. A. MacInnes*, J.W. Hemminghaus, T.B. Orr; Monsanto, St. Louis, MO (226)

ABSTRACT

Monsanto Company has developed formulations containing dicamba for use in the Roundup Ready® Xtend™ Crop System. XtendiMax™ with VaporGrip™ technology is a dicamba standalone formulation based on the diglycolamine (DGA) dicamba salt. Roundup Xtend™ with VaporGrip™ technology is a premix formulation containing DGA dicamba and monoethanolamine (EA) glyphosate delivering a 2 to 1 ratio of glyphosate to dicamba. Both formulations contain proprietary VaporGrip™ technology that reduces the potential of dicamba volatility compared to current commercial dicamba formulations. VaporGrip technology works by preventing the formation of the volatile species in the formulation. Although volatility is a small contributor to potential off-target movement, this often remains a concern from growers and applicators as a legacy from use of the dimethylamine (DMA) salt launched in the 1960s. The DGA salt of dicamba consistently shows low volatility potential, and this can be reduced further by using VaporGrip™ technology. Spray drift and tank contamination are the main contributors to potential off-target movement. These can be decreased significantly through appropriate application practices and proper tank clean out. Application requirements for on-target applications will appear on approved herbicide product labels.

REGULATORY AND STEWARDSHIP CONSIDERATIONS FOR WEED RESISTANCE MANAGEMENT WITH NEW TECHNOLOGIES. M.J. Horak*, G.A. Elmore, S.M. Allen, M. Starke; Monsanto, St. Louis, MO (227)

ABSTRACT

Until the early 2000's, herbicide registrations had few, if any, requirements regarding herbicide resistance management. In 2001, the U.S. Environmental Protection Agency (EPA) indicated that herbicide resistance management was to remain voluntary and that registrants may provide information on herbicide labels regarding herbicide mechanism of action, a section on herbicide resistance, and information on best management practices to avoid selection for or manage existing populations of herbicide resistant weeds. In the early 2010's, regulatory agencies indicated that they were paying more attention to herbicide resistance issues, and in 2014 the U.S. EPA for the first time required a herbicide resistance management plan as part of the registration for Enlist Duo herbicide. In 2016, the EPA also required an herbicide resistance management plan as a condition of registration for dicamba herbicide for over the top use in tolerant cotton and soybean. The herbicide resistance management plan consists of 5 elements. The first element concerns detection, remediation and testing for herbicide resistance. Monsanto must investigate performance inquiries to assess for herbicide resistance, and if herbicide resistance is suspected, must make recommendations to the farmer to control the existing weeds, seek to collect samples of the weed for further testing and initiate testing. The second element concerns an education plan. Monsanto must develop an education plan for farmers that emphasized best management practices, there must be a written communication to purchasers of the technology, and the plan must be made available to EPA. The third element concern a survey of herbicide users to assess adherence to the label requirements and assess if there were perceived problems with weed control. The information gathered in the previous three elements must be assessed to determine if medications need to be made to the best management practices recommendations – this is the fourth element of the plan. Finally, the fifth element concerns developing an annual report and providing information from all elements to the EPA.

ANTICIPATED XTENDIMAX WITH VAPORGRIP TECHNOLOGY LABEL REQUIREMENTS. R.J. Rector*, J.W. Cubbage; Monsanto, St. Louis, MO (228)

ABSTRACT

Monsanto has been working on the development of dicamba-tolerant crops for over ten years. Dicamba-tolerant cotton and soybeans, included in the Roundup Ready® Xtend Crop System, are anticipated to be the largest launch of a biotechnology and crop protection system in history. The Roundup Ready® Xtend Crop System includes an innovative new formulation of dicamba that has industry leading low-volatility technology, comprehensive application requirements for on-target applications and effective and sustainable weed management recommendations. This presentation highlighted some of the application requirements that must be followed for proper use of the technology.

USING PESTICIDES WISELY. A.S. Culpepper*[1], T. Gray[2], E.P. Prostko[1]; [1]University of Georgia, Tifton, GA, [2]Georgia Department of Agriculture, Atlanta, GA (229)

ABSTRACT

Science is clear that pesticides are essential to the U.S. farmer's ability to provide feed and fiber for the world. However, it is critical and will become even more critical that pesticides are used judiciously and carefully to protect the user, the consumer, and the environment. In 2015 and 2016, a joint educational effort between The University of Georgia (UGA), The Georgia Department of Agriculture (GDA), and the pesticide industry focused on training growers with the goal of helping them apply pesticides more wisely. This partnership was unique and the first of its kind in an effort to improve the sustainability of large-scale agriculture by focusing on precise pesticide applications thereby mitigating off-target issues.

Individuals responsible for applying 2,4-D or dicamba, in-season, on auxin-resistant cotton and soybean in Georgia are required to attend the classroom training. This training was conducted at 25 locations in Georgia, 4 in Alabama and 1 in South Carolina. In Georgia, 1,499 growers and 1,882 total people have been trained. A total of 2,114 people have been trained when combining locations across the Southeast. At each meeting, attendees were surveyed and asked numerous questions including 1) Was the training worth your time? and 2) Will the training help you reduce off-target pesticide issues? Over 99% of 1137 Georgia growers responded that the training was worth their time and over 98% noted the training would help them reduce drift. In Georgia, the number of drift complaints to UGA Cooperative Extension personnel during 2016 was 65% lower than in 2014 which was the year just prior to training implementation. Additionally, the number of confirmed agricultural drift cases by the GDA was 30% lower in 2016 when compared to 2014.

Survey of Herbicide-Resistant Weeds in the South

State	Year	Weed	WSSA SOA
Alabama	1980	annual bluegrass (*Poa annua*)	5
	1987	goosegrass (*Eleucine indica*)	3
	1988	common cocklebur (*Xanthium strumarium)*	17
	2008	Palmer amaranth (*Amaranthus palmeri)*	9
	2012	annual bluegrass (*Poa annua*)	2
	2012	annual bluegrass (*Poa annua*)	3
	2013	horseweed (*Conyza candensis*)	9
	2013	common ragweed (*Ambrosia artemisiifolia*)	9
	2015	annual sedge (*Cyperus compressus*)	2
Arksansas	1989	goosegrass (*Eleucine Indica)*	3
	1989	common cocklebur (*Xanthium strumarium*)	17
	1990	barnyardgrass (*Echinochloa crus-galli* var. *crus-galli)*	7
	1994	Palmer amaranth (*Amaranthus palmeri*)	2
	1995	common cocklebur (*Xanthium strumarium*)	2
	1995	redoot pigweed (*Amaranthus retroflexus)*	2
	1995	Italian ryegrass (*Lolium perenne* ssp. *multiflorum)*	1&2
	1999	barnyardgrass (*Echinochloa crus-galli* var. *crus-galli*)	4&7
	2002	red rice (*Oryza sativa* var. *sylvatica*)	2
	2003	horseweed (*Conyza candensis*)	9
	2003	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	2
	2004	common ragweed (*Ambrosia artemisiifolia)*	9
	2005	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	1
	2005	giant ragweed (*Ambrosia trifida)*	*9*
	2006	Palmer amaranth (*Amaranthus palmeri*)	9
	2007	johnsongrass (*Sorghum halepense)*	*9*
	2008	barnyardgrass (*Echinochloa crus-galli* var. *crus-galli*)	13
	2008	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	9
	2010	rice flatsedge (*Cyperus iria)*	2
	2010	smallflower umbrella sedge (*Cyperus difformis)*	2
	2011	junglerice (*Echinochloa colona*)	2&7&26

	2011	Palmer amaranth (*Amaranthus palmeri*)	14
	2013	yellow nutsedge (*Cyperus esculentus)*	2
	2015	tall waterhemp (*Amaranthus tuberculatus*)	9
Florida	1985	American black nightshade (*Solanum americanum)*	*22*
	1996	goosegrass (*Eleucine indica*)	22
	2001	dotted duckweed (*Landoltia punctata)*	22
	2002	hydrilla (*Hydrilla verticillata)*	12
	2008	Palmer amaranth (*Amaranthus palmeri*)	2
	2013	Palmer amaranth (*Amaranthus palmeri*)	9
	2013	Palmer amaranth (*Amaranthus palmeri)*	2&9
	2014	ragweed parthenium *(Parthenium hysterophorus)*	9
Georgia	1992	goosegrass (*Eleucine indica*)	3
	1993	prickly sida (*Sida spinosa)*	2
	1995	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	1
	2000	Palmer amaranth (*Amaranthus palmeri*)	2
	2005	Palmer amaranth (*Amaranthus palmeri*)	9
	2008	Palmer amaranth (*Amaranthus palmeri*)	2&9
	2008	Palmer amaranth (*Amaranthus palmeri*)	5
	2008	large crabgrass (*Digitaria sanguinalis)*	1
	2009	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	1&2
	2010	Palmer amaranth (*Amaranthus palmeri*)	2&5&9
	2014	spotted spurge (*Chamaesyce maculata*)	2
Kentucky	1987	smooth pigweed (*Amaranthus hybridus)*	5
	1991	johnsongrass (*Sorghum halepense*)	1
	1992	smooth pigweed (*Amaranthus hybridus*)	2
	2001	horseweed (*Conyza candensis*)	9
	2004	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	1
	2005	giant ragweed (*Ambrosia trifida*)	9
	2006	common ragweed (*Ambrosia artemisiifolia)*	9
	2006	johnsongrass (*Sorghum halepense*)	2
	2010	tall waterhemp (*Amaranthus tuberculatus)*	9
	2010	Palmer amaranth (*Amaranthus palmeri*)	9
	2013	common chickweed (*Stellaria media)*	2

	2013	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	2
Mississippi	1989	common cocklebur (*Xanthium strumarium*)	2
	1991	johnsongrass (*Sorghum halepense)*	1
	1992	johnsongrass (*Sorghum halepense)*	3
	1994	common cocklebur (*Xanthium strumarium)*	17
	1994	goosegrass (*Eleucine indica*)	3
	1994	horseweed (*Conyza candensis*)	22
	1995	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	2
	1996	annual bluegrass (*Poa annua*)	5
	2003	horseweed (*Conyza candensis)*	9
	2005	Italian ryegrass (*Lolium perenne* ssp. *multiflorum)*	9
	2007	horseweed (*Conyza candensis*)	9&22
	2008	johnsongrass (*Sorghum halepense)*	9
	2008	Palmer amaranth (*Amaranthus palmeri*)	2&9
	2010	tall waterhemp (*Amaranthus tuberculatus*)	9
	2010	goosegrass (*Eleucine indica*)	9
	2010	giant ragweed (*Ambrosia trifida*)	9
	2011	barnyardgrass (*Echinochloa crus-galli* var. *crus-galli)*	1,2,7&26
	2012	spiny amaranth (*Amaranthus spinosus*)	9
	2014	common ragweed (*Ambrosia artemisiifolia*)	9
	2014	annual bluegrass (*Poa annua*)	2
Missouri	1992	common cocklebur (*Xanthium strumarium*)	2
	1994	barnyardgrass (*Echinochloa crus-galli* var. *crus-galli*)	7
	1994	tall waterhemp (*Amaranthus tuberculatus*)	2
	1994	tall waterhemp (*Amaranthus tuberculatus*)	5
	1996	common sunflower (*Helianthus annuus*)	2
	2002	horseweed (*Conyza candensis*)	9
	2004	common ragweed (*Ambrosia artemisiifolia*)	9
	2005	tall waterhemp (*Amaranthus tuberculatus*)	2,9&14
	2008	Palmer amaranth (*Amaranthus palmeri*)	9
	2009	giant ragweed (*Ambrosia trifida*)	9
	2009	tall waterhemp (*Amaranthus tuberculatus*)	2&9
	2010	annual bluegrass (*Poa annua*)	9

	2011	giant ragweed (*Ambrosia trifida*)	2&9
	2013	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	1&2
North Carolina	1973	goosegrass (*Eleucine indica*)	3
	1980	common lambsquarters (*Chenopodium album)*	5
	1980	smooth pigweed (*Amaranthus hybridu*)	5
	1990	Italian ryegrass (*Lolium perenne* ssp. *multiflorum)*	1
	1994	common cocklebur (*Xanthium strumarium*)	17
	1995	Palmer amaranth (*Amaranthus palmeri*)	2
	1995	annual bluegrass (*Poa annua*)	5
	1997	annual bluegrass (*Poa annua*)	3
	1999	common cocklebur (*Xanthium strumarium)*	2
	2003	horseweed (*Conyza candensis*)	9
	2005	Palmer amaranth (*Amaranthus palmeri*)	9
	2006	common ragweed (*Ambrosia artemisiifolia*)	2
	2006	common ragweed (*Ambrosia artemisiifolia)*	9
	2007	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	2
	2007	Italian ryegrass (*Lolium perenne* ssp. *multiflorum)*	1&2
	2009	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	9
	2015	common ragweed (*Ambrosia artemisiifolia*)	2&9&14
Oklahoma	1992	kochia (*Kochia scoparia)*	2
	1996	common cocklebur *(Xanthium strumarium)*	2
	2002	tall waterhemp (*Amaranthus tuberculatus)*	2
	2009	cheat (*Bromus secalinus)*	2
	2009	horseweed (*Conyza candensis)*	9
	2011	tall waterhemp (*Amaranthus tuberculatus)*	9
	2013	kochia (*Kochia scoparia*)	9
South Carolina	1974	goosegrass (*Eleucine Indica*)	3
	1985	common cocklebur (*Xanthium strumarium*)	17
	1989	Palmer amaranth (*Amaranthus palmeri)*	3
	1990	Italian ryegrass (*Lolium perenne* ssp. *multiflorum)*	1
	1997	Palmer amaranth (*Amaranthus palmeri)*	2

	2006	Palmer amaranth (*Amaranthus palmeri*)	9
	2010	Palmer amaranth (*Amaranthus palmeri*)	2&9
	2010	Italian ryegrass (*Lolium perenne* ssp. *multiflorum)*	1&2
Tennessee	1988	goosegrass (*Eleucine indica*)	3
	1991	common cocklebur (*Xanthium strumarium)*	17
	1992	common cocklebur (*Xanthium strumarium)*	2
	1994	Palmer amaranth *(Amaranthus palmeri)*	2
	1995	johnsongrass (*Sorghum halepense)*	1
	1998	common lambsquarters (*Chenopodium album)*	5
	1998	Palmer amaranth (*Amaranthus palmeri)*	3
	2001	horseweed (*Conyza candensis)*	9
	2006	Italian ryegrass (*Lolium perenne* ssp. *Multiflorum*)	1
	2006	Palmer amaranth (*Amaranthus palmeri*)	9
	2007	annual bluegrass (*Poa annua*)	3
	2007	giant ragweed (*Ambrosia trifida)*	9
	2007	tall waterhemp (*Amaranthus tuberculatus)*	2
	2009	Palmer amaranth (*Amaranthus palmeri*)	2&9
	2011	tall waterhemp (*Amaranthus tuberculatus*)	9
	2011	annual bluegrass (*Poa annua*)	9
	2011	goosegrass (*Eleucine indica*)	9
	2012	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	9
	2013	annual bluegrass (*Poa annua*)	2&5
	2015	Palmer amaranth (*Amaranthus palmeri*)	9&14
Tennessee	1988	goosegrass (*Eleucine indica*)	3
	1991	common cocklebur (*Xanthium strumarium)*	17
	1992	common cocklebur (*Xanthium strumarium)*	2
	1994	Palmer amaranth *(Amaranthus palmeri)*	2
	1995	johnsongrass (*Sorghum halepense)*	1
	1998	common lambsquarters (*Chenopodium album)*	5
	1998	Palmer amaranth (*Amaranthus palmeri)*	3
	2001	horseweed (*Conyza candensis)*	9
	2006	Italian ryegrass (*Lolium perenne* ssp. *Multiflorum*)	1
	2006	Palmer amaranth (*Amaranthus palmeri*)	9

	2007	annual bluegrass (*Poa annua*)	3
	2007	giant ragweed (*Ambrosia trifida)*	9
	2007	tall waterhemp (*Amaranthus tuberculatus)*	2
	2009	Palmer amaranth (*Amaranthus palmeri*)	2&9
	2011	tall waterhemp (*Amaranthus tuberculatus*)	9
	2011	annual bluegrass (*Poa annua*)	9
	2011	goosegrass (*Eleucine indica*)	9
	2012	Italian ryegrass (*Lolium perenne* ssp. *multiflorum*)	9
	2013	annual bluegrass (*Poa annua*)	2&5
	2015	Palmer amaranth (*Amaranthus palmeri*)	9&14
Texas	1989	perennial ryegrass (*Lolium perenne)*	2
	1991	barnyardgrass (*Echinochloa crus-galli* var.*crus-galli*)	7
	1993	Palmer amaranth (*Amaranthus palmeri*)	5
	1998	kochia (*Kochia scoparia*)	2
	2000	johnsongrass (*Sorghum halepense*)	2
	2006	tall waterhemp (*Amaranthus tuberculatus)*	9
	2011	Palmer amaranth (*Amaranthus palmeri*)	9
Virginia	1976	smooth pigweed (*Amaranthus hybridus)*	5
	1979	common lambsquarters *(Chenopodium album*)	5
	1993	Italian ryegrass *(Lolium perenne* ssp. *multiflorum)*	1
	1993	redoot pigweed (*Amaranthus retroflexus*)	5
	1994	smooth pigweed (*Amaranthus hybridus)*	2
	1995	johnsongrass (*Sorghum halepense)*	1
	2001	annual bluegrass (*Poa annua*)	5
	2003	shattercane *(Sorghum bicolor)*	2
	2005	horseweed (*Conyza candensis)*	9
	2008	common chickweed (*Stellaria media*)	2
	2011	Palmer amaranth (*Amaranthus palmeri)*	9

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