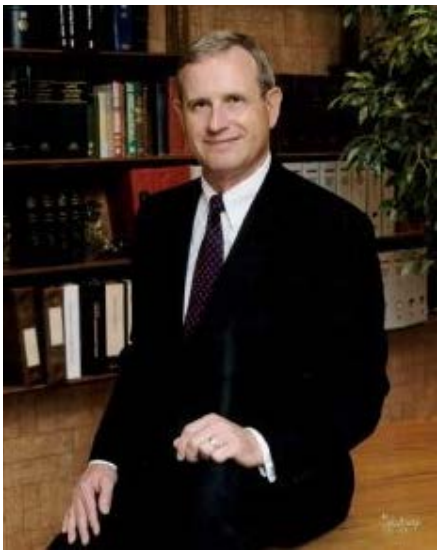
Proceedings of the Southern Weed Science Society 72nd Annual Meeting

Renaissance Convention Center Hotel and Spa
Oklahoma City, OK

February 03 – 06, 2019

Dedication Statement



Dr. John Ray Abernathy, 73, of Lubbock passed away Tuesday, September 18, 2018. He was born January 4, 1945 to the late George Raymond and Tommy Loys (Fewell) Abernathy in Altus, Oklahoma. John graduated from Altus High School in 1963. He married Cynthia Sue (Canady) Abernathy May 24, 1969 in Tulsa, Oklahoma.

John had a passion for agriculture, graduating from Oklahoma State University in 1969, where he received his Bachelor of Science and his Master of Science in Agronomy. He continued to further his education at the University of Illinois receiving his Ph. D. in Agronomy in 1972. John held several positions over the years, he worked at Texas A&M Agricultural Experiment Station in Lubbock as a Weed Scientist and as the Resident Director for a total of 24 years. He was an International Consultant of Weed Science and Research from 1985 - 2017 and was a board member for the National Farm Life Insurance Company from 1998 - 2017. He received many awards along the way including the Outstanding Young Weed Scientist Award from the Southern Weed Science Society in 1980 and the USDA Group Award for excellence as a member of the AG-CARES team. John was named Fellow in the Weed Science Society of America and accepted the Gerald W. Thomas Outstanding Agriculturist Award from Tech's Ag College. He received the West TX Ag Chemicals Institute Award for outstanding Contributions. He retired as the Dean of the Texas Tech University College of Agricultural Sciences and Natural Resources in 2003.

Those left to cherish his memory are his wife of 49 years, Cindy; daughters, Larisa Abernathy Weldon of Keller, Christy Diann Liles and husband Larry of Frisco; siblings, Larry and wife Lynn Abernathy of Vernon, Frances Abernathy and husband Craig Sterling of San Angelo; five grandchildren, Grayson, Peyton and Megan Weldon, Abigail and Alexis Liles.

A Celebration of Life service will be held at 11:00 a.m. Saturday, September 22, 2018 at Combest Family Memorial Chapel with burial to follow at Resthaven Memorial Park.

In lieu of flowers, memorial contributions may be made to the "Dean John R. Abernathy of the TTU College of Agriculture Memorial Scholarship", by check made out to the "Texas Tech Foundation" and mailed to the College of Agricultural Sciences and Natural Resources, Texas Tech University, PO Box 42123, Lubbock, Texas 79409-2123 or online at http://donate.give2tech.com/?fid+iA000302.

Table of Contents

ORAL ABSTRACTS:

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

Peter Dittmar

Dr. Peter Dittmar is an Associate Professor at the University of Florida Horticultural Sciences Department. His interest in agriculture began in Illinois on his family's farm and was an active member of 4-H, participating in horticulture, sheep, and poultry. Peter received a B.S. in Plant and Soil Sciences (2004) from Southern Illinois University-Carbondale. Then Peter attended North Carolina State University to complete a M.S. (2006) in Horticultural Sciences and Ph.D. (2010) under the mentorship of Dr. David Monks. Since joining the faculty at University of Florida, Peter has conducted 79 Extension meetings, published 33 journal articles, and mentored 9 graduate students. Peter's IR4 field lab has conducted 166 GLP protocols encompassing 17 crop groups and 69 active ingredients resulting in 34 registrations and 57 final reports submitted to the EPA.

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 University
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 University
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 University
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 University
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 University
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
2017	Wes Everman	North Carolina State Unviersity
2017	Hunter Perry	Dow AgroSciences
2018	Ramon Leon	North Carolina State University

Outstanding Educator Award

Larry Steckel

Larry Steckel was raised on a small family farm near Carrollton, Illinois. He received his B.S. in agronomy in 1987 from Western Illinois University and his M.S. in Weed Science from the University of Missouri in 1989. Larry then went on to work for Pioneer Hi Bred Int'l. where he worked for 10 years as an Agronomist. He left Pioneer to pursue a Ph.D. in the spring of 2000 and received his doctorate in 2003 from the University of Illinois. Larry joined the Department of Plant Sciences at the University of Tennessee in 2003 where he holds a weed science extension (75%) and research (25%) appointment. Dr. Steckel's extension/education efforts have been recognized formally several times with awards like the Cavendar award for outstanding extension publication from the UT Institute of Agriculture, Excellence in Extension Award from Gamma Sigma Delta, the Weed Science Society of America Extension award and most recently in 2018 the Association of Southern Region Extension Directors Runner-up Excellence in Extension Award . Dr. Steckel maintains an extensive applied research program that has focused on the biology and management of two troublesome glyphosate-resistant weeds, Palmer amaranth and horseweed. These two weeds cause Tennessee growers the most management challenges and is where the majority of his program efforts are directed. His research has been recognized by the National Conservation system Cotton and Rice Conference with the Conservation System Cotton Researcher of the Year award, the University of Tennessee Ag Research Impact award and he has received the Award of Excellence – Outstanding Paper award in 2017 and 2018 for manuscripts in Weed Technology as well as the Superior Paper Award for a manuscript in the American Society of Agriculture and Biological Engineers in 2018. Dr. Steckel has mentored 3 Masters Students and 4 Ph.D students to completion of their degrees. He is very proud of those students' accomplishments and believes this group of young pest management scientists will have a very positive impact on advancing agriculture as their careers mature.

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
2012	Gregory Mac Donald	University of Florida
2013	Tim Grey	University of Georgia
2014	Scott Senseman	University of Tennessee
2015	Nilda Roma-Burgos	University of Arkansas
2016	Katie Jennings	North Carolina State
2017	Jason Norsworthy	Univesity of Arkansas
2018	Stanley Culpepper	University of Georgia

Outstanding Graduate Student Award (MS)

Swati Shrestha

I am originally from Nepal where more than 70% of the population depend on Agriculture for livelihood. Interested in Agriculture and ways to enhance productivity, I gained BS in Agronomy from Institute of Agriculture and Animal Science, Nepal. With the aim to learn more about Biology and Ecology of Weeds and their management, I joined MS in Weed Science at Mississippi State University, under the guidance of Dr. Te-Ming (Paul) Tseng at. My masters research focused on Screening and characterization of weedy rice for herbicide tolerance and weed- suppressive potential. During my masters I have been recognized for numerous academic and extracurricular activities including Weed Science Society of America (WSSA) travel grant 2017, Gamma Sigma Delta Award of Merit Scholarship 2018. I have also secured second position in WSSA graduate student paper presentation 2017 and Mississippi State University Graduate student research symposium oral presentation 2018. Thus far, I have authorship on 1 book chapter, 3 peer reviewed publications (under review) and 8 scientific abstracts for professional meetings. Currently, I am working as a research assistant under Dr. Muthukumar Bagavathiannan at Texas A&M University where my research work focusses on understanding the mechanism of gene flow from Sorghum to Johnsongrass. In the future I aspire to work for industry doing applied reaearch that would ultimately help farmer's enhance productivity and profitability.

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
2017	John Buol	Mississippi State University
2018	Zachary Lancaster	University of Arkansas

Outstanding Graduate Student Award (PhD)

Nicholas Basinger

Nicholas Basinger was born in Charlotte, NC. Nicholas grew up surrounded by peach orchards in Greer, SC but found his love of agriculture while spending time on his grandparent's farm in Salisbury, NC. Nicholas graduated from Furman University with a B.S. in Health and Exercise Science in 2009, with hopes of becoming a physical therapist. After hiking the Appalachian Trail from Maine to Georgia, he decided not to follow his planned path to physical therapy school. At the suggestion of a friend, Nicholas spent two seasons on small organic and biodynamic farms in western North Carolina where he rediscovered his love of agriculture. Wanting to explore agriculture in greater depth Nicholas attended North Carolina State University in the Department of Horticultural Science where he conducted research in weed management systems in grapes, blackberries, and blueberries under the direction of Drs. Katie Jennings and David Monks. The focus of his M.S. thesis was identifying the optimal vegetation-free strip width for winegrape and blackberry production systems in the southeastern United States. After graduating with his M.S. in 2015, Nicholas continued working with Drs. Jennings and Monks on his Ph.D. and completed his degree in August 2018 under their direction. His dissertation research focused on interspecific and intraspecific competition of Palmer amaranth (*Amaranthus palmeri*) and large crabgrass (*Digitaria sanguinalis*) in soybean and sweetpotato. In addition to this work, he used ground-based hyperspectral remote sensing to identify spectral regions for differentiation of crop and weed species and weed density.

Nicholas has received a number of awards including Outstanding Graduate Student from the Weed Science Society of North Carolina, 6 first place awards for his research presentations, 3 first place awards for scientific poster presentations, and 6 scholarships through state, regional, and national societies. In addition, Nicholas has contributed to 5 peer-reviewed articles with several more article to be submitted, and 18 abstracts to scientific meetings. Nicholas has also had the pleasure to serve as the Vice President and President of the Weed Science Society of America Graduate Student Organization and serve on the Board of Directors for the Weed Science Society of North Carolina as the Student Representative. Through all of these experiences, Nicholas has found a love of weed science and the community surrounding the discipline. Nicholas began his post-graduate career at the University of Georgia-Athens as an Assistant Professor with a focus on weed ecology and biology in the Department of Crop and Soil Sciences. His appointment is 60% research and 40% teaching, allowing him to research novel approaches to integrated weed management in crop and non-crop areas while also sharing his love of weed science with students through teaching Weed Science and Herbicide Physiology. He looks forward to making significant contributions to the state, regional, national, and international weed science community.

Nicholas would like to dedicate this award to his wife Grace B. Tuschak who has supported and encouraged him to do his best in everything that he does, and to Drs. Katie Jennings and David Monks who cultivated him into the scientist he is today.

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
2017	Misha Manuchehri	Texas Tech University
2018	Sandeep Rana	Virginia Tech

Fellow Award

John Byrd

Frequent use of the business end of a hoe on the small tobacco, cotton and soybean farm in coastal South Carolina where Treflan was the only herbicide used may have helped John weed out other fields of study when he enrolled at Clemson University to pursue a B.S. in agronomy. While the thoughts of becoming a plant breeder. The realization scientists actually studied weeds was enlightening, but Drosophila fruit flies and Genetics 101 sealed the deal. Alan York went out on a limb, thanks to the persistence of John Harden, to allow him to pursue a M.S. degree at North Carolina State University which was completed in 1986 as well as provided the inspiration to pursue a career as an Extension Weed Specialist. He completed the Ph.D. under the direction of Harold Coble at North Carolina State University in 1989. His real weed control education started that same year when he was hired as the Extension Weed Specialist for horticulture, turf, cotton, and 4-H at Mississippi State University. As the sole Extension Specialist with weed science responsibility at Mississippi State University for nearly two decades, he has dealt with weed management questions and issues from homeowners, land managers and producers for a wide diversity of topics. He was promoted to Extension/Research Professor in 1998, has served on the graduate committees of 76 students, is Past President of Mississippi Association of County Agricultural Extension Agents, Mississippi Weed Science Society, and National Roadside Vegetation Management Associations. He has been active in the Southern Weed Science Society since 1986 having served as Chair of Graduate Student Contest, Site Selection, Endowment, Historical, Legislative and Regulatory, Continuing Education, and Constitution and By-Laws committees as well as service on many other committees. He is currently the SWSS Representative to the Weed Science Society of America. He and his wife Sylvia Howey Byrd have a small cow-calf operation where their two daughters have learned to use a hoe.

Fellow Award

Neil Rhodes

Neil Rhodes, a Tennessee native, is Professor and Extension Weed Management Specialist at the University of Tennessee in Knoxville. He received the B.S. and M.S. degrees in Plant and Soil Science from the University of Tennessee in 1977 and 1979, respectively. He then began pursuit of a PhD in Crop Science (major in Weed Science and minor in Entomology) under the direction of Dr. Harold Coble, graduating in 1982. He worked full time as an Extension Specialist in aquatic and non-cropland weed management while pursuing the Ph.D.

Following graduation, Dr. Rhodes worked for two years as a Field Development Representative for Rohm and Haas in Mississippi. In 1985 he returned to his native Tennessee to join the faculty of The University of Tennessee in Weed Science research and teaching. Beginning in 1990, Neil became Professor and Extension Weed Management Specialist with UT Extension. He has been responsible for the statewide educational program for weed management in all agronomic and horticultural crops, forages and aquatics. He led active applied research and demonstration programs across the state that focused on weed management in no-till cropping systems. In 2001 Neil assumed additional responsibilities at the University of Tennessee when he was selected as Head of the Plant Sciences Department and he served in that role through 2008 when he requested to return to the faculty ranks. He maintains active Extension and applied research programs in weed management in forages, tobacco, aquatics and increasingly in recent years, herbicide stewardship.

He is a Past-President of both the Tennessee Agricultural Chemical Association and the Tennessee Agricultural Production Association. He has been an active member of the Southern Weed Science Society and the Weed Science Society of America, serving on numerous committees in both societies over the years. In the Southern Weed Science Society (SWSS) he has chaired the Graduate Program Committee, the Endowment Committee, the Outstanding Graduate Student Award Committee, numerous paper sections and two symposia. Dr. Rhodes has received several awards, including being named the 2004 Outstanding Extension Weed Scientist by the Weed Science Society of America, and the 2008 Distinguished Service Award from the Tennessee Turfgrass Association. Also in 2008, Neil was named as winner of the Outstanding Alumnus Award from the College of Agriculture and Life Sciences at North Carolina State University. In 2018, Dr. Rhodes was the recipient of the Excellence in Regulatory Stewardship Award from the SWSS.

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	--
2017	James Holloway	Syngenta Crop Protection
2018	Scott Senseman	University of Tennessee
2018	Jerry Wells	Syngenta Crop Protection

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	--
2017	James Holloway	Syngenta Crop Protection

Excellence in Regulatory Stewardship Award

Patrick Jones

Patrick Jones, Deputy Director for Pesticide Programs at the NC Department of Agriculture & Consumer Service, Structural Pest Control and Pesticides Division has worked for the department for over 35 years in various positions including a pesticide inspector, field supervisor and enforcement manager. One of his focus items, is the outreach and education efforts to educate growers on the pollinator protection, FieldWatch Program implemented by NCDA&CS to enhance communication between growers, beekeepers, and applicators. As deputy director, he oversees pesticide registration, field compliance, enforcement and outreach programs focused on ensuring the safe use of pesticides in North Carolina. He has also served as the Region 4 Representative to SFIREG the State-FIFRA Issues Research and Evaluation Group, a network of state officials interested in Federal/State "co-regulation" of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and served as a member of the Pesticides Operation Management Working Committee under SFIREG. He is currently serving as an AAPCO (Association of American Pest Control Officials) member at large and has been very active in Regional and National training for pesticide inspectors. He is a graduate of N.C. State University with a degree in Agronomy.

Excellence in Regulatory Stewardship Award

Alan York

Alan York is a William Neal Reynolds Distinguished Professor Emeritus in the Crop and Soil Science Department at North Carolina State University (NCSU). He received his BS and MS degrees in Crop Science from NCSU and his PhD in agronomy from the University of Illinois.

A native of North Carolina, he returned to NCSU and served on the faculty for 38 years prior to his recent retirement. During his tenure at NCSU, his primary responsibility was weed science extension programs in corn, cotton, peanuts, small grains, and soybeans. He was widely respected by colleagues, growers, and industry for his knowledge, work ethic, and down-to-earth manner. Additionally, he was active in applied research, teaching, and graduate education. He taught an undergraduate weed science class for 28 years, and he served as major advisor for 31 graduate students who now occupy prominent positions in academia, industry, extension, and state government. He is an author on over 150 refereed papers, five book chapters, and countless extension publications.

Dr. York has served as an associate editor for Weed Technology, Journal of Cotton Science, and Peanut Science, Secretary-Treasurer for SWSS, CAST representative for SWSS, Chairman of the SWSS Endowment Foundation, and numerous SWSS committees.

Awards include Distinguished Service Award (SWSS), Weed Scientist of the Year (SWSS), Fellow (WSSA), Outstanding Extension Award (WSSA), Cotton Extension Education Award (Cotton Foundation), Outstanding Extension Service Award (NCSU), Outstanding Service Award (NC Cotton Producers Assoc. and NC Soybean Producers Assoc.), Career Achievement Award (Univ. Illinois Alumni Assoc.), Alexander Quarles Holladay Medal for Excellence (Board of Trustees, NCSU), White Gold Award (NC Cotton Producers Assoc.), and Order of the Long Leaf Pine (Governor of North Carolina).

Past Presidents of the Southern Weed Science Society

1948-49	C.A. Brown	1984-85	W.S. McIntire
1949-50	E.C. Tullis	1985-86	R.E. Talbert
1950-51	O.E. Sell	1986-87	H.M. LeBaron
1951-52	G.M. Shear	1987-88	R.L. Rogers
1952-53	D.A. Hinkle	1988-89	L.B. Gillham
1953-54	W.B. Ennis, Jr.	1989-90	L.R. Oliver
1954-55	W.C. Shaw	1990-91	J.R. Bone
1955-56	G.C. Klingman	1991-92	J.M. Chandler
1956-57	W.B. Albert	1992-93	J.L. Barrentine
1957-58	E.G. Rogers	1993-94	A.D. Worsham
1958-59	R. Behrens	1994-95	P.A. Banks
1959-60	V.S. Searcy	1995-96	S.O. Duke
1960-61	R.A. Darrow	1996-97	B.D. Sims
1961-62	W.K. Porter, Jr.	1997-98	R.M. Hayes
1962-63	J.T. Holstun, Jr.	1998-99	R.L. Ratliff
1963-64	R.F. Richards	1999-00	D.S. Murray
1964-65	R.E. Frans	2000-01	L.L. Whatley
1965-66	D.E. Wolf	2001-02	J.E. Street
1966-67	D.E. Davis	2002-03	J.W. Wells
1967-68	R.A. Mann	2003-04	W.W. Witt
1968-69	W.L. Lett, Jr.	2004-05	J.S. Harden
1969-70	J.B. Baker	2005-06	D.R. Shaw
1970-71	D.D. Boatright	2006-07	J.A. Driver
1971-72	J.R. Orsenigo	2007-08	D.W. Monks
1972-73	T.J. Hernandez	2008-09	A.M. Thurston
1973-74	A.F. Wiese	2009-10	D.B. Reynolds
1974-75	W.G. Westmoreland	2010-11	T.J. Holt
1975-76	P.W. Santlemann	2011-12	B.J. Brecke
1976-77	A.J. Becon	2012-13	T.C. Mueller
1977-78	G.A. Buchanan	2014-15	S.A. Senseman
1978-79	C.G. Parris	2015-16	B. Minton
1979-80	M.G. Merkle	2016-17	P. Dotray
1981-82	J.B. Weber	2017-18	G. Schwarzlose
1982-83	J.E. Gallagher	2018-19	B. Scott
1983-84	C.G. McWhorter		

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
2018	Timothy R. Murphy	University of Georgia
2019	Dr. John Ray Abernathy	Texas Tech University

List of SWSS Committee Members

January 31, 2019 - January 31, 2020

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	James Holloway	2020
President Elect	Eric Webster	2021
Vice-President	Clete Youmans	2022
Secretary-Treasurer	Jim Brosnan	2020
Editor	Muthu Bagavathiannan	2020
Immediate Past President	Bob Scott	2020

100b. ADDITIONAL EXECUTIVE BOARD MEMBERS

Member-at-Large - Academia	Jason Bond	2020
Member-at-Large - Industry	Greg Stapleton	2020
Member-at-Large - Academia	Todd Baughman	2021
Member-at-Large - Industry	Eric Castner	2021
Representative to WSSA	John Byrd	2020

100c. EX-OFFICIO BOARD MEMBERS

Constitution and Operating Procedures	Carroll Johnson	2020
SWSS Business Manager	Kelley Mazur	
Student Representative	Jordan Craft	2021
Newsletter Editor	Susan Scott	

101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

President	Donnie Miller	2020
Secretary	Hunter Perry	2021
	Gary Schwarzlose	2022
	Mike Lovelace	2023
	Greg MacDonald	2024
Graduate Student Rep	Maria Zaccaro	2020

101b. BOARD OF TRUSTEES - EX-OFFICIO

Darrin Dodds	Past President of Endowment Foundation Board of Trustees
Kelley Mazur	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.

Bob Scott*	2020	Barry Brecke	2020	Tom Mueller	2020
Daniel Stephenson	2020	Stanley Culpepper	2020	J. D. Green	2020

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

Barry Brecke*	2020	Scott Senseman	2021	John Byrd	2022
Renee Keese	2020	Brad Minton	2021	Neil Rhodes	2022

102b. Outstanding Educator Award Subcommittee

Tom Mueller*	2020	Nilda Burgos	2021	Larry Steckel	2022
Jason Norsworthy	2020	Peter Dotray	2021	Tim Grey	2022

102c. Outstanding Young Weed Scientist Award Subcommittee

Daniel Stephenson*	2020	Ramon Leon	2021	Peter Dittmar	2022
Drew Ellis	2020	Hunter Perry	2021	Jim Brosnson	2022

102d. Outstanding Graduate Student Award Subcommittee

Stanley Culpepper*	2020	Sandeep Rana	2021	Nicholas Basinger	2022
Jay McCurdy	2020	Muthu	2021	Kelly Backscheider	2022

102e. Excellence in Regulatory Stewardship Award Subcommittee

J. D. Green *	2020	David Jordan	2021	Gary Schwarzlose	2022
Larry Walton	2020	Cherilyn Moore	2021		

103. COMPUTER APPLICATION COMMITTEE (STANDING)

Shawn Askew *	2020	Jim Brosnan	2021	Shandrea Stallworth	2022
Dan Reynolds *	2020	Matt Goddard	2021	Gary Schwarzlose	2022
Kelley Mazur – SWSS Business Manager					

104. CONSTITUTION AND OPERATING PROCEDURES COMMITTEE (STANDING)

W. Carroll Johnson*	2020

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.

Clete Youmans *	2020
Eric Webster	2020
Jacob Reed	2020
Larry Steckel	2020
Jim Brosnan	2020
Muthu Bagavathiannan	2020
Phil Banks	2020
John Schultz	2021
Tom Barber	2021
Kelley Mazur – SWSS Business Manager	

106. GRADUATE STUDENT ORGANIZATION

President	Jordan Craft	Virginia Tech
Vice President	Lawson Priess	Arkansas
Secretary	Delaney Foster	Texas Tech
Weed Resistance & Technology Committee	DJ Mahoney	NC State
Endowment Committee	Maria Zaccaro	Arkansas
Social Chair/Student Program Committee	Hannah Wright	Arkansas

107. WEED RESISTANCE AND TECHNOLOGY STEWARDSHIP (STANDING)

Alabama	Steven Li		North Carolina	D. Spak
Arkansas	N. French J. Norsworthy		Oklahoma	T. Baughman
Florida	B. Brecke		Puerto Rico	W. Robles
Georgia	E. Prostko C. Johnson		South Carolina	M. Cutulle
Kentucky	J. Green		Tennessee	J. Holloway L. Steckel A. Mills
Louisiana	D. Stephenson		Texas	P. Dotray
Mississippi	H. Perry ** F. Carey * J. Bond		Virginia	S. Askew
Missouri	J. Heiser		Grad. Student	DJ Mahoney

108. HISTORICAL COMMITTEE (STANDING)

John Byrd *	2021
Andy Kendig	2022

109. LEGISLATIVE AND REGULATORY COMMITTEE (STANDING)

Angela Post *	Chair	2020
Lee Van Wychen	(ad hoc) WSSA Science Policy Director	2020
Janis McFarland	(ad hoc) Chair of the WSSA Science Policy Committee	2020
Greg Kruger	(ad hoc), EPA liaison	2020
Jason Bond	Member-at-Large - Academia	2020
Greg Stapleton	Member-at-Large - Industry	2020
Todd Baughman	Member-at-Large – Academia	2021
Eric Castner	Member-at-Large - Industry	2021
Bob Scott	Past President	2020

110. LOCAL ARRANGEMENTS COMMITTEE - (STANDING)

Darrin Dodds *	2020	Biloxi, MS (MS)
Jim Brosnan	2021	Knoxville, TN (SE)
TBD	2022	(SW)

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

Gary Schwarzlose	2020
Bob Scott	2021
James Holloway	2022
Eric Webster	2023

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.

James Holloway (MS)	2020	Luke Etheredge (SW)	2022	Jim Brosnan (SE)	2024
Angela Post (SE)	2021	Andrew Price (MS)	2023	Ben McKnight	2025
Kelley Mazur – SWSS Business Manager					

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

Bob Scott*	2020

114. PROGRAM COMMITTEE - 2020 MEETING (STANDING)

Eric Webster *	2020
Clete Youmans	2021

115. PROGRAM COMMITTEE- 2021 MEETING (STANDING)

Clete Youmans *	2021
Elected VP (in-coming)	2022

116. RESEARCH COMMITTEE (STANDING)

Clete Youmans *	2020			
Alabama	Steven Li		North Carolina	W. Everman
Arkansas	N. Burgos		Oklahoma	T. Baughman
Florida	P. Dittmar		Puerto Rico	W. Robles
Georgia	E. Prostko		South Carolina	M. Marshall
Kentucky	T. Legleiter		Tennessee	L. Steckel
Louisiana	D. Miller		Texas	P. Dotray
Mississippi	J. Byrd		Virginia	S. Askew
Missouri	K. Bradley			

117. RESOLUTIONS AND NECROLOGY COMMITTEE (STANDING)

David Black *	2022	Ryan Edwards	2021	Michael Flessner	2020

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

Mississippi	D. Dodds **		Missouri	J. Heiser
Alabama	Steven Li		North Carolina	W. Everman
Arkansas	N. Burgos		Oklahoma	T. Baughman
Florida	G. MacDonald		South Carolina	M. Cutulle
Georgia	W. Vencill		Tennessee	T. Mueller D. Ellis
Kentucky			Texas	P. Dotray
Louisiana	E. Webster		Virginia	S. Askew
Mississippi	D. Reynolds		Puerto Rico	W. Robles

Ad Hoc – Current	Bruce Kirksey		Ad Hoc - Previous	Cheryl Dunne

119. STUDENT PROGRAM COMMITTEE (STANDING)

Kelly Backscheider *	2020	
Peter Eure	2021	
Tommy Butts	2022	
Hannah Wright	2020	Graduate Student Organization Rep. – Ex-officio member

120. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

Kelly Backscheider *	2020	Bob Scott	2021	Jacob Reed	2022
Tom Barber	2020	Peter Dotray	2021	Andy Kendig	2022

121. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

AL - Steve Li	2020		MO – Jim Heiser	2020
AR - Tom Barber	2020		NC – Angela Post	2020
FL - Calvin Odero	2020		OK - Todd Baughman***	2020
GA - Scott Tubbs	2020		SC - Alan Estes	2020
KY – Travis Legleiter	2020		TN – Bruce Kirksey *	2020
LA – Daniel Stephenson	2020		TX - Jacob Reed	2020
MS -Te-Ming Paul Tseng	2020		VA – Shawn Askew***	2020

*Chair
** Vice-Chair
***CEU's not provided by that state

SWSS Board of Directors Meeting

Sunday, February 3, 2019
Renaissance Convention Center. Oklahoma City, OK
4:00-5:00pm

Those in attendance included:

*Greg Breeden (acting secretary for J. Brosnan)	gbreeden@utk.edu
*Zach Lancaster	zdlancas@email.uark.edu
*Eric Webster	EWebster@agcenter.lsu.edu
*Carroll Johnson	Carroll.Johnson@ARS.USDA.GOV
*Bob Scott	bscott@uaex.edu
*Greg Stapleton	Gregory.stapleton@basf.com
*Jason Bond	jbond@drec.msstate.edu
*Todd Baughman	todd.baughman@okstate.edu
*John Byrd	jbyrd@pss.msstate.edu
*Kelley Mazur	kelley@imigroup.org
*James Holloway	james.holloway@syngenta.com
*Gary Schwarzlose	gary.schwarzlose@bayer.com

Meeting called to order by Bob Scott at 4:05 PM

Written copy of agenda distributed by Scott.

Scott asked if minutes were reviewed. Minutes were previously sent out to all BOD members for review via email on January 23rd, 2019. Holloway asked about Lee Van Wychen's contract and his work for SWSS. Many positive comments were shared and group aimed for more discussion to clarify his responsibilities at the summer BOD meeting. Holloway moved to approve minutes, seconded by Baughman. Motion passed.

Scott reviewed items voted on/approved via email during summer 2018. Scott commented that he liked that this summary was included in the minutes. Items voted on via email in summer 2018 included motion to fund weed contest; funding for keynote speaker ($1500) to OK State Cowboy Wrestling Club; SWSS Award Winners for the 2019 meeting; OGSA-MS scoring error corrected; Knoxville named host for 2021 meeting. Motion to approve email voting results by Webster. Seconded by Johnson. Motion passed.

Holloway shared specifics of 2019 program, including some issues related to administration of the title and abstract submission site. Discussion of how to fix these issues ensued. Consensus

was that the primary issue was related to papers being included in the student contest and the site not reflecting this distinction. Site administrator (Apex) is aware of the problem. Discussion ensued that the problem could be related to submissions being made after the deadline, as well as file size. Holloway has list of people that had issues before the deadline that will be added. Scott suggested we should take abstracts that had issues prior to deadline. Web browser issues were also mentioned as a potential source of the problem. Scott mentioned that the BOD needs more discussion on this issue and raised question if Apex can come to summer BOD meeting to discuss. Scott told Holloway to encourage chairs to be patient and expect some thumb drives. Scott moved to accept report, seconded, Motion passed.

Scott asked if any issues occurred with local arrangements – none were identified. Mobile application was discussed and consensus was that the Crowd Compass platform was operating nicer this year. Byrd asked about if it is time to discuss new apps for the meeting, including the idea of all societies using the same platform. Some discussion occurred but nothing is ready for BOD review at the current time.

Scott suggested that SWSS create a Twitter account. Idea posed that this account could be used to communicate deadlines, newsletters (that get lost in SPAM filters), and other relevant information to SWSS members. In short, an SWSS Twitter account would be another avenue to communicate relevant information to members. Scott asked BOD if the Computer Applications Committee (as well as Kelley) could manage the account until summer BOD meeting, posting only for information about the society. Baughman moved to create the account, Bond seconded, MP. Discussion on Twitter handle (@Southern Weed, @SWSS, etc.) @SWSS seems to be favorite but may not be available.

Motion to adjourn Bond 2nd Stapleton @5:03

SWSS Board of Directors Meeting

Monday, February 4, 2019
Renaissance Convention Center. Oklahoma City, OK
11:00am – 12:00pm

Attendees:

Greg Breeden (Acting Secretary for J. Brosnan); Carroll Johnson; Eric Webster; Clete Youmans; Lee Van Wychen; Todd Baughman; Zach Lancaster; Darrin Dodds; Eric Castner; Jacob Reed; James Holloway; John Byrd; Gary Schwarzlose; Kelley Mazur; Bob Scott; Greg Stapleton; Jason Bond;

Scott called meeting to order at 11:01 am

Awards Program Update – Schwarzlose

Scott asked if any updates from Awards Committee. None to report

Sustaining Membership Update- Mazur and Reed

Mazur mentioned $31,300 income from sustaining members of SWSS and that $6500 was not accounted for in that total due the change in account reporting years; once all funds are accounted for the total to SWSS should be $34,400. Reed commented that overall levels this year are similar to those in the past. Discussion that any level company can put up a display at the meeting. Discussion about having tiered levels of sustaining membership occurred; with no guidelines in the MOP, consensus was to only make suggestions to companies.

Reed proposed a new Sustaining Member concept to the BOD that includes free registrations for larger companies. Those with >$500 million revenue could contribute $3000 to SWSS to be included in this new grouping that includes free registrations.

Discussion occurred about having universities become sustaining members. Several commented that not all universities would be able to be included. Concept was proposed of $500-1000 contribution for universities to become sustaining members. Discussion ensued about where this funding would come from in the university—how high up the administrative ladder would it have to go? Baughman suggested the fee be set at $1000; however, Bond noted that the $1000 mark may lead to more administrative challenges.

Baughman motioned to create a new Sustaining Membership tier for companies with a $3000 contribution providing free meeting registration. Seconded by Holloway. Motion passed unanimously. Idea was posed to have a vote at the summer BOD meeting to include this new tier in the MOP.

Baughman made motion to request sustaining membership from universities. This motion was seconded by Webster. Holloway suggested SWSS should request funds for university sustaining members up to $1000. Motion passed unanimously. Idea was posed to have a vote at the summer BOD meeting to include this new tier in the MOP.

Endowment Committee Update - Darrin Dodds

Overall endowment funds are slightly down compared to previous year ($390,742 compared to ~$400,000); however, funds from the golf tournament are still being received and Dodds commented that on the whole the endowment is very sound.

Dodds commented that there was $750 request to the Endowment Board to acquire a speaker.

Discussion about BOD decision to have the endowment support the summer weed contest, particularly to purchase awards and plaques. Mazur reviewed minutes from the summer BOD meeting in June 2018. Minutes reflected that the BOD unanimously passed a motion that the endowment fund 50% of the 2018 summer weed contest ($14,000) as well as $3,500 for plaques and awards. Action on this is needed because the 2018 summer weed contest was $3,500 over budget. Dodds initiated discussion about how much of an endowment withdrawal would be okay with SWSS considering that SWSS is also responsible for awards and plaques at the upcoming 2019 Weed Olympics. Johnson reviewed MOP to make clear that this responsibility is included, as well as funding the Graduate Student Enrichment program ($4500 and $400 for plaques).

Discussion ensued about the target amount of funding that should be in the endowment. Holloway commented that the target is $500,000 and that the goal is to have interest fund student activities; however, this funding target is not included in the MOP. Dodds commented that the endowment includes 4 CDs that make 4.5%.

Dodds agrees to request $3500 from the Endowment Board (via email on February 4th, 2019) to cover the 2018 overage only; however the Endowment Board must approve the transaction. Dodds commented that the endowment will not be able to fund 50% of the summer weed contest at the present time

Discussion ensued about the auction. It was not setup as of 11:24am on February 4th, 2019. Consensus was that plans are in place for auction to move forward. Scott mentioned that overall meeting registrations were down and encouraged people to bid; however, hotel room benchmarks were met.

Other Business

Van Wychen talked about the SWSS logos and pins. Commented that some have no text. Van Wychen suggested that SWSS design an official logo.

Van Wychen suggested idea of a “Weed Bingo” game with weed images from the society, particularly 7 total weeds. A list will be sent to the BOD. Images will be used in a board game to be launched in late 2019. Scott asked what funds SWSS would receive for doing this; Van Wychen remarked that funds received would be reflective of how much SWSS initially contributed; however, no funding request is being made at the present time.

Byrd asked motioned to approve the 2018 SWSS Proceedings prepared by Bagavathiannan. Motion seconded by Johnson. Motion passed unanimously.

Lengthy discussion of what issues caused the 2018 Proceedings to be finished so late. Comments made about reports being late, particularly the weed resistance report, as a cause for the delay. However, it was also noted that the Editor failed to make requests for these reports in a timely manner. Baughman mentioned that reports can be added to the proceedings as an amendment to accelerate the process of getting them finished in a timely manner. Consensus agreement that having the proceedings finished so late was problematic. Discussion ensued about financial compensation to editor. Johnson reviewed MOP and determined that $750 compensation has been agreed upon in the past. Discussion also ensued about editor attendance at BOD meetings. Consensus agreement that editor should be in attendance and Holloway mentioned that he will discuss this with Bagavathiannan.

Holloway motions to adjourn the meeting. This was seconded and passed unanimously.

Scott adjourned meeting at 12:07 pm.

SWSS Executive Board Meeting
Renaissance Convention Center. Oklahoma City, OK

February 7, 2019

Board members in attendance were: John Byrd (Representative to WSSA); Jordan Craft (Graduate Student Rep); Javier Vargas (acting secretary for J. Brosnan); Gary Schwarzlose (Past, Past President);-Todd Baughman (member-at-large, academia); Jason Bond (member-at-large, academia); Eric Castner (member-at-large, industry); Carroll Johnson (Constitution and Operating Procedures); Bob Scott (Past-President); Kelley Mazur (SWSS Business Manager); James Holloway (President); Eric Webster (President Elect); Greg Stapleton (member-at-large, industry); Clete Youmans (Vice-President)

President Holloway distributed copies of the proposed agenda. Motion was made and seconded to approve the proposed agenda. Motion to approve the agenda passed unanimously.

Holloway requested minutes from BOD meetings earlier in the week. These were not available as J. Brosnan was not in attendance due to scheduling conflict with the Golf Course Superintendents Association Education Conference. They are being sent to J. Brosnan for compilation and will be distributed to the BOD via email for review and approval at the summer BOD meeting.

Financial Overview and Meeting Report - Mazur

Pre-registration as of February 2, 2019 at 8:50PM MST is 237 (88 Students, 148 Regular Members, 1 Spouse Registration). For the Sunday Student Mixer there are 67 registrants made of 9 Regular Members and 58 Students. 28 are registered for the Women's Networking Luncheon, 10 are Regular Members, and 18 are Students. 152 Registrants requested printed programs. The Endowment Golf Tournament has 7 participants, down by 15 from last year's 22 registrants. We are trending down on registrations as reported in the table below. James Holloway/ Syngenta Crop Protection supported the Graduate Student Mixer with $3000. The Women's Networking Luncheon is being sponsored by Kelly Bachscheider/Corteva Agriscience at $2500. Gary Schwarzlose/Bayer Crop Science sponsored the Student Quizbowl at $3000. I want to give a huge thank you to Gary Schwarzlose, James Holloway and Charlie Cahoon for their hard work; they have been very helpful to me.

Below is a summary of past meeting registration:

	Oklahoma City	*Atlanta*	*Birmingham*	*San Juan Joint*	*Savannah*
	2019	*2018*	*2017*	*2016*	*2015*
Members	169	246	224	652	270
Students	97	95	98	72	98
Total	237	341	322	724	362
Final	266	376	420	724	362

There were 241 title/abstract submissions. 105 of them were posters and136 papers. There seems to be an issue with loading abstracts and slides so an email was sent with instructions to lower file size on Saturday.

Financial Reports for Review:

Things to note are the low income of the annual meeting registration ($98,710.09 reported last year) and the sustaining membership. Income is split amongst multiple accounts which include awards, luncheons and endowment which can be reviewed for the sustaining membership report. The low number is also due to how the fiscal year lands, some members paid before the new fiscal year where $3500.00 was booked to 2017-18 fiscal year.

- Email has been an issue and I would like to propose that we move to using Mail Chimp to try and remedy the current problem. Also, creating a social media for the society will allow another avenue for information to be broadcasted. I recommend Twitter which can be up and running by this evening.

- IMI is moving all clients to Quickbooks Online due to desktop losing support. I am proposing that SWSS use the $17/month subscription that provides all the necessary reports as well as 3 users.

- The final number of registrants was 266 with 9 of those being no-shows. The breakdown of registrations was 97 Students and 169 Regular Members. Of the 105 Posters, 8 of them were no-shows and are being listed as NO-SHOW in wssaabstract.net. A survey will be going out to attendees from 2018 who did not register for the 2019 Annual Meeting, to gain data on why attendance was so low this year.

- The Summer Board meeting will be taking place the week of July 15th at Beau Rivage in Biloxi, MS.

Program Committee Update – Holloway and Webster

Discussion that overall everyone was satisfied with how things went in Oklahoma City. Scott commented that there was difficulty soliciting symposium topics. Suggested more on dicamba issues, weather apps, wildlife, etc. Holloway suggested that BOD members discuss symposium ideas at the summer BOD meeting. Kelley will be posting a form online to help with this.

No formal report on the 2020 Program Submitted.

Constitution and Operating Procedures Report- Carroll Johnson

The following are activities of the Constitution and Operating Procedures Committee during the previous twelve months. Each item was discussed with the SWSS Board of Directors at the summer 2018 meeting and approved. These changes were included in the revised Manual of Operating Procedures and uploaded to the website in August 2018.

- Replaced Tara Steinke with Kelley Mazur as SWSS Business Manager throughout the Manual of Operating Procedures.
- In the President MOP, the "Outstanding Education Display" award is mentioned. It was proposed that that award be deleted since it no longer exists.
- In the President MOP, there was a statement referring to the "Newsletter Editorial Committee". It was proposed that that statement be deleted since that committee no longer exists.
- In the President MOP and Long-Range Planning Committee MOP, there are conflicting statements regarding the membership and time of service on the Long Range Planning Committee. It was proposed that the President's MOP be revised to be the same as the Long-Range Planning Committee MOP, which was a more concise description.
- Graduate Student Organization approved a change in their MOP to clarify how their representative to the SWSS Endowment Foundation is chosen and length of term. The representative from the GSO will serve a two-year term and will be elected by a closed ballot. (The SWSS Board simply accepted their course of action and those changes to their MOP.)
- The Vice-President MOP and Program Committee MOP were revised for consistency. The proposed change to the Vice-President MOP stated that the officer serves as a member on the Program Committee. It is also proposed that the Program Committee MOP be revised to list the Vice-President be a standing member of the Program Committee. These changes would help the Vice-President become familiar with the program development processes which would be useful when advanced to President-Elect the following year.
- The SWSS Endowment Foundation MOP was been modified to clarify financial support to programs for graduate students. Paraphrased, the proposed revision states that the Endowment Foundation provides funds for the SWSS graduate student presentation/poster contest, Graduate Student Enrichment Scholarships, Outstanding Graduate Student Award(s), and as an alternate source of supplemental funding for the Weed Contest.

The Registration Fee MOP was modified to state that retirees who were previous recipients of SWSS Fellow, Distinguished Service Award, and Weed Scientist of the Year Award have conference registration fees waived. This policy was proposed and approved at the 2014 Summer Board meeting but was never included in the MOP since then.

Graduate Student Update - Craft

Craft commented that the graduate student luncheon went very well and students enjoyed the speaker from Colorado State who spoke about the topic of predatory journals. Over 60 students attended the luncheon from 14 universities. Crafted commented that minutes will be sent to Brosnan, Holloway, and Johnson. Holloway challenged the graduate student committee to develop new ideas for mixers.

Summer Weed Contest Report- Dodds – Discussion about whether SWSS will contribute funding for the 2019 WeedOlympics. This required a committee vote and results were not available as of February 7th. The Endowment Board did approve a request to cover the $3500 overage from the 2018 Summer Weed Contest. Follow-up with Dodds will be required for more information.

Old Business

Knoxville will host the 2021 meeting (January 24-28, 2021). Brosnan will be local arrangements chair. Need to ensure hotel room availability for Saturday, January 23rd.

Biloxi will host the 2020 meeting (January 26-30, 2020). A total of 20 rooms are on hold for Saturday evening.

New Business

Dates for the summer BOD meeting in Biloxi were discussed. Preference is for July 15th with June 17th as a backup. Mazur will check with the hotel about availability.

Discussion about the logo change and weed bingo concepts proposed by Van Wychen on February 4th, 2019.

Lengthy discussion of issues pertaining to slide uploading. Shawn Askew has volunteered to explore alternative options. There will be more discussion on this at the summer BOD meeting. Issues of the 50 MB upload limit and web traffic issues were discussion. Concept was posed to have a phone call with Apex at the summer BOD meeting and explore details of our current agreement with them about providing service. Having Shawn Askew also attend the summer BOD meeting was also suggested.

Several officer elections will be held during the 2019-2020 calendar year. These include:
Academia-at-large
Industry-at-large
WSSA Rep
Editor
Secretary

There was discussion about whether the MOP addresses missing BOD meetings, as well as a deadline for having the SWSS Proceedings completed. Motion made to have the SWSS

proceedings before the summer BOD meeting. Motion seconded and passed unanimously.

Discussion about increasing registration rates for regular members and students. Consensus was to take no action until final financial information from the meeting has been compiled. Idea was proposed to ask about banquet attendance when registering.

Mazur proposed that SWSS explore more robust email options, and suggested MailChimp. Motion made, seconded, passed unanimously.

Mazur proposed that SWSS move away from the desktop version of Quickbooks and begin using Quickbooks online. The fee for doing so is $17/month. Mazur commented that doing so would allow for better access to reporting functions and overall technical support. Motion made, seconded, passed unanimously.

Discussion about the mobile application for the meeting. Mazur commented that CrowdCompass is a multiple year agreement while Guidebooks is a year-to-year arrangement. She will check on pricing and report back to the BOD. Idea was proposed to have a presentation at the General Session on how to use the mobile application. Moreover, discussion was had about potentially using this for judging graduate student presentations.

Lee Van Wychen emailed the SWSS Science Policy committee on February 5th, 2019 about a petition to change certification rules for forests to enable field research on biotech (gene edited, genetically engineered) trees. Holloway forwarded this to for BOD discussion. Kelley will distribute to BOD for review. No action taken at the current time.

Discussion about how to handle title submitted that were not presented at the meeting. They cannot be deleted from the abstract submission site but can be edited. Suggest changing "Evaluations of…." to "NO-SHOW" and deleting abstract content.

Discussion about potentially moving the awards presentation with the banquet held earlier in the week. After the awards presentation, graduate students could immediately go to their luncheon. Additional discussion about moving mixers to Sunday evening to encourage more attendance, as well as having the graduate contest on Monday.

Idea proposed for historical committee to use social media, particularly new Twitter account, to keep in touch with retirees. -----
Meeting adjourned at 10:00am

2019 SWSS Meeting Business Managers Report

Report submitted by: Kelley Mazur

Annual Meeting:

Pre-registration as of February 2, 2019 at 8:50PM MST is 237 (88 Students, 148 Regular Members, 1 Spouse Registration). For the Sunday Student Mixer there are 67 registrants made of 9 Regular Members and 58 Students. 28 are registered for the Women's Networking Luncheon, 10 are Regular Members, 18 are Students. 152 Registrants requested printed programs. The Endowment Golf Tournament has 7 participants, down by 15 from last year's 22 registrants. We are trending down on registrations as reported in the table below. James Holloway/ Syngenta Crop Protection supported the Graduate Student Mixer with $3000. The Women's Networking Luncheon is being sponsored by Kelly Bachscheider/Corteva Agriscience at $2500. Gary Schwarzlose/Bayer Crop Science sponsored the Student Quizbowl at $3000. I want to give a huge thank you to Gary Schwarzlose, James Holloway and Charlie Cahoon for their hard work; they have been very helpful to me.

Below is a summary of past meeting registration:

	Oklahoma City 2019	*Atlanta 2018*	*Birmingham 2017*	*San Juan Joint 2016*	*Savannah 2015*
Members	169	246	224	652	270
Students	97	95	98	72	98
Total	(237)	341	322	724	362
Final	266	376	420	724	362

There were 241 title/abstract submissions. 105 of them were posters and136 papers. There seems to be an issue with loading abstracts and slides so an email was sent with instructions to lower file size on Saturday.

Financial Reports are Attached for Review:

Things to note are the low income of the annual meeting registration ($98,710.09 reported last year) and the sustaining membership. Income is split amongst multiple accounts which include awards, luncheons and endowment which can be reviewed for the sustaining membership report. The low number is also due to how the fiscal year lands, some members paid before the new fiscal year where $3500.00 was booked to 2017-18 fiscal year.

New Business:

Email has been an issue and I would like to propose that we move to using Mail Chimp to try and remedy the current problem. Also, creating a social media for the society will allow another avenue for information to be broadcasted. I recommend Twitter which can be up and running by this evening.

IMI is moving all clients to Quickbooks Online due to desktop losing support. I am proposing that SWSS use the $17/month subscription that provides all the necessary reports as well as 3 users.

Post Meeting Attendance:

The final number of registrants was 266 with 9 of those being no-shows. The breakdown of registrations was 97 Students and 169 Regular Members. Of the 105 Posters, 8 of them were no-shows and are being listed as NO-SHOW in wssaabstract.net. A survey will be going out to attendees from 2018 who did not register for the 2019 Annual Meeting, to gain data on why attendance was so low this year.

The Summer Board meeting will be taking place the week of July 15th at Beau Rivage in Biloxi, MS.

Local Arrangements Committee Report

Report submitted by: Baughman

The SWSS annual meeting was hosted during the week of 2/3/19 to 2/7/19 at the Renaissance Hotel and Convention Center. The local arrangements committee consisted of Todd Baughman, Kelley Mazur, Russ Perkins, Gary Schwarzlose, Robbie, Peterson, Bruce Steward, Luke Etheredge, Adam Hixon, Eric Castner, and Seth Byrd. The local arrangements committee was responsible for room setup, projectors, requisitioning poster boards through a local provider, meeting signage, and meals and meeting activities. A special thanks goes to Kelley Mazur, Russ Perkins, Gary Schwarzlose, and Robbie Peterson for their help with the meeting. Todd Baughman secured items for the graduate students quiz bowl participants from BASF, Bayer, and Corteva.

Weed Resistance and Technology Stewardship

Prepared by Andy Kendig, for Frank Carey

Attendance: Tagi should have sign in list.

The SWSS Weed Resistance and Technology Stewardship committee met at the annual SWSS meeting held in Oklahoma City on Monday, February 4, 2019. Chairman Frank Carey was not able to be present due to corporate conflicts in scheduling. Drs. Jason Bond and Vice-Chair Tagi Barapour of Mississippi State University presided in his stead. The following notes were taken during the meeting.

Dr. Tagi Barapour discussed AMAPA samples from MS and TN that were sent to Dr. Nilda Burgos to be screened for Liberty, Fomesafen and Metolachlor.

Dr. Jason Norsworthy discussed a UA survey of AMAPA focusing on mesotrione, tembotrione, metolachlor, trifluralin, glyphosate, fomesafen, imazethapyr, dicamba, glufosinate and atrazine. To date, no glufosinate resistance has been detected.

The United Soybean Board is funding multi state screening for resistance in AMAPA, AMATU/AMARU, and CONCA

Methodology of greenhouse screening was discussed- soil active herbicides are generally more active in the greenhouse. Depending on the active, 0.5X of a field rate may be needed to differentiate plant response in a greenhouse.

Dr. Jason Norsworthy reported that a paper on Group 15 resistant AMAPA is in final publication stages. The material is essentially resistant to metolachlor. It is also less sensitive to most other Group 15 chemistry with varying I_{50} values. The palmer results are generally consistent with the results on Group-15 resistant waterhemp that is reported in IL.

PPO resistance is widespread in Northeast Arkansas.

Andy Kendig reviewed various discussions regarding EPA PRN 2017-2 Guidance for herbicide resistant labeling, the SWSS “lists and discussions of suspected resistant weeds”, Industry concerns and a Crop Life America Response (with US HRAC endorsement). Industry, HRAC and CropLife support the concept of monitoring for suspected resistant weeds; however, the industry does not support the actual label language which is a rather burdensome, strict requirement to respond to all cases of suspected resistance with a significant reporting requirement, testing requirement and follow up requirement. The industry feels that we are doing this in-principle, but is concerned with the fact that the vast majority of performance failures are not resistance related. The SWSS discussions and listing of suspected resistant weeds is a valid tracking mechanism. As with the committee, HRAC feels that this should not be publicly “broadcast” conversely, the information should be shared within the scientific community- academic and industry.

Attendance was poor at the committee meeting. The committee is supposed to be comprised of an academic representative from each state and a representative from each manufacturer. There was one industry person and two states officially represented.

Long Range Planning Committee Report

Report by: Dotray

The Long Range Planning Committee did not meet in Oklahoma City during the SWSS annual meeting, but met the following week at the WSSA meeting in New Orleans, LA. Those attending included Gary Schwarzlose, James Holloway, Kelley Mazur (SWSS Business Manager), and Peter Dotray. Absent from this meeting was Bob Scott (President). Most of the discussion focused on ways to improve selection of meeting locations. The attendance at Oklahoma City was down approximately 100 members. A survey will be sent to members who did not attend the 2019 annual meeting to determine why they were absent from the Oklahoma City meeting. Likely reasons may include difficulty attending back-to-back weeks of SWSS and WSSA meetings in early February, industry travel restrictions, and/or the location of the southwest meeting at Oklahoma City. The Long Range Planning Committee discourages back-to-back weeks of meetings. When the SWSS Site Selection Committee is looking into locations three to five years ahead, possible joint conferences with WSSA, state agencies, and regional crop protection associations should be explored. Final Site Selection Committee decisions must continue to focus on lowest possible hotel costs (rooms, meeting space, food and beverage), but also should focus on membership tendencies based on historical attendance of cities previously visited. A calendar should be assembled to avoid industry planning meetings and annual meetings from other major professional organizations (including golf course and turf grass conferences). If meeting participation numbers continue to decline, adjustments in meeting space requirements must be reflected in the RFPs sent to future hotel sites.

Education Units – Estes

No report for 2019

Executive Director of Science Policy Report

SWSS Annual Meeting, Oklahoma City, OK. Feb. 4, 2019

Report by: Lee Van Wychen

2018 Farm Bill Signed Into Law in December: Some highlights/lowlights:

- Yes to reauthorization for the Foundation for Food and Agriculture Research (FFAR) at $185M

- No legislative fix for the duplicative National Pollutant Discharge Elimination System (NPDES) program permits

- No Congressional repeal of the 2015 Waters of the United States (WOTUS) rule

- No to legislative guidance to streamline the FIFRA-Endangered Species Act consultation process, but YES to the creation of FIFRA Interagency Workgroup composed of reps from USDA, Interior, Commerce, EPA and CEQ.

- No reauthorization of the Pesticide Registration Improvement Act (PRIA).

- Yes to addition of ag research grants for equipment (up to $500K).

- Yes to the use of "Categorical Exclusions" by the Forest Service and BLM for invasive weed control for the purpose of Sage Grouse and Mule Deer habitat restoration

- Yes to legalization of the commercial cultivation and sale of hemp, plus $2M/yr for hemp research.

- No to State Lead Agencies on FIFRA authority over local jurisdictions

- Yes to a new $50M/yr program called the Agriculture Advanced Research and Development Authority (AGARDA). Among its goals is a directive "to undertake advanced research and development in areas in which industry by itself is not likely to do so because of the technological or financial uncertainty". It will have its own director within USDA.

EPA Re-Registers Dicamba Through 2020: On Oct. 31, EPA extended the registration for two years for over-the-top use of dicamba in dicamba-tolerant cotton and soybean. The registration will automatically expire on December 20, 2020, unless EPA further extends the registration. Click HERE for details. **2019 – 2020 Dicamba Product labels**: Xtendimax with Vaporgrip (Updated since Nov. 1, 2018), Engenia, & Fexapan.

Dicamba federal register documents: Under "Supporting Documents" there are two documents: 1) **Dicamba Pesticide Use Limitation Areas - County list**; and 2) **The Scientific Basis for Understanding the Off-Target Movement Potential of Xtendimax**, which is a 46 pg document from Monsanto that tries to explain why (a) vapor drift occurring due to volatilization should not result in impacts off the treated field; and (b) spray drift will not occur past the label's required buffer distances in amounts that would have an adverse effect on plant height. Also, under the "Comments Section", there is a post from Oct. 31, 2018 titled "**Dicamba 2018 Comments**", which is 553 pages of documents that EPA received from stakeholders asking them to re-reregister, not re-register, etc. Pages 293-550 are just 1,000s of opposition signatures from the Pesticide Action Network (PAN) and Center for Biological Diversity (CBD). **Discussion of the FIFRA Section 24(c) process.** States have used the

Section 24(c) process to get both emergency uses of pesticides and to pass more restrictive state regulations of certain pesticides. However, there has been political pressure to roll back the Section 24(c) process to its original intent of allowing states only to secure emergency use exemptions of pesticides, but not to allow states to use the Section 24 (c) process to restrict the use of pesticides (i.e. dicamba). States can still be more restrictive of the federal label, but this takes time and money. **Dicamba Lawsuit Dismissed but Door Still Open**. The 9th Circuit Court of Appeals dismissed a lawsuit against dicamba on Jan. 10, but left open a door for the plaintiffs to expedite a new lawsuit in 2019. The original lawsuit, which was filed by four environmental groups in 2017, argued that the EPA's 2016 registration of XtendiMax for over-the-top use on soybean and cotton fields was unlawful. When that registration ended and EPA renewed the dicamba registration on Oct. 31, 2018, Monsanto and EPA argued that the court should dismiss the lawsuit as moot. The court agreed, but the panel of judges also ruled that the plaintiffs, National Family Farm Coalition et al., should be allowed to fast-track a new lawsuit based on the new 2018 dicamba registration.

Glyphosate: the WSSA Public Awareness Committee is working on a Fact Sheet on glyphosate safety and non-carcinogenicity. Will Bayer have a settlement of glyphosate lawsuits?

Atrazine: Ongoing registration review. Human health risk assessment comments were due Nov. 23. We will continue to work with the EPA to refine their environmental risk assessment.

Weed Genomics: There is a strong interest in funding for weed genomics work at USDA NIFA. For example, a better understanding of dioecy in certain weed species such as Palmer amaranth and waterhemp could lead to a NOVEL weed control approach in which a gene drive is used to manipulate gender ratios and drive the population to extinction, similar to the sterile insect technique used to eradicate the screwworm from the U.S. Pat Tranel, Illinois, will present a seminar to House and Senate Ag Committee staff on this concept.

New USDA NIFA Director: Dr. J. Scott Angle began his 6 yr term as NIFA Director on Oct. 29. He worked for 24 years as a professor of Soil Science and administrator for the Maryland Agricultural Experiment Station and Maryland Cooperative Extension.

Hutchins Re-nominated for USDA Chief Scientist Spot: Dr. Scott Hutchins cleared his Senate nomination hearing on Nov. 28, 2018, but when the 115th Congress expired on Jan. 3 and the 116th Congress began, Hutchins will have to go through the nomination process again. His final approval by the Senate was held up by a couple Senators who are ticked off at Sec. Purdue (and USDA) for moving NIFA and ERS outside of DC. Hutchins had nothing to do with that, but he happened to get caught in the political cross-fire. He was the Global Head of Integrated Field Sciences for Corteva.

USDA-ARS: Rosalind James, the National Program Leader (NPL) overseeing weed science moved into a different role on Nov. 23. We expect USDA to hire a new NPL to oversee weed science and definitely want this person to be a weed scientist (and not an entomologist). The USDA-ARS Crop Protection & Quarantine program (~$90M/yr) had a 5 yr review scheduled for Feb. 6., but that has been postponed to a later date due the partial gov't shutdown.

Alexandra Dapolito Dunn Approved for EPA's Top Chemical Safety Spot: Dr. Dunn was approved by the Senate on January 3, 2019 to lead EPA's Office of Chemical Safety and Pollution Prevention (OCSPP). This office oversees the Office of Pesticide Programs (OPP) that conducts the pesticide registration process. She is an environmental lawyer and law professor specializing in water quality issues. Alexandra was the Regional Administrator for EPA Region 1 (Northeast U.S.) and prior to that, served as executive director and general counsel for the Environmental Council of States (ECOS) as well as the Association of Clean Water Administrators.

Clean Bean Team: Carroll Moseley, Jill Schroeder, Heather Curlett (USDA-APHIS), Patsy Laird, Shawn Conley and I have been working to get the message out to commodity groups and farmers on recommended best practices for reducing weed seeds in U.S. soybean exports. Weeds and weed seeds are a serious phytosanitary concern and increases in herbicide-resistant weeds may be contributing to more weed seeds in harvested crops. We have a poster on this that will be at all the weed science meetings (including SWSS). Shawn Conley and I have also put together a symposium on this topic for the WSSA meeting in New Orleans.

USDA-NIFA Move from DC: In August, USDA announced that NIFA and ERS would be moving from D.C. While the new location for the agencies has yet to be determined, the timeframe for the move is expected to occur by the end of 2019. USDA's announcement of intent to move the agencies has garnered many concerns from the agricultural research community, including WSSA. However, the Science Policy Committee has not reached a consensus on either to support or oppose the move outright. WSSA did submit a letter to USDA Sec. Perdue with some concerns and questions. In October, USDA received 136 "expressions of interest" from various institutions and cities in 35 states to be the new host location for NIFA and ERS. NIFA Director Angle said he expects that to be narrowed down to 4 or 5 locations within a month and that approximately 50 of NIFA's 250 staff would remain in DC.

WSSA Rep for TAG-BCAW: In June, WSSA selected Dr. John Madsen to be WSSA's new rep for the Technical Advisory Group for Biocontrol Agents of Weeds (TAG-BCAW). However, Dr. Madsen was told by USDA-ARS that he cannot serve in this role. The next highest ranking candidate was Dr. Te-ming Paul Tseng, a weed physiologist at Mississippi State University. Paul was offered and has accepted this role. WSSA will re-evaluate on Mar. 1, 2020.

Syncing USDA Plants Database with WSSA Composite Lists of Weeds: At the WSSA Summer Board meeting, there was a motion to adopt the USDA Plants Database as the official source of weed nomenclature and taxonomy and discontinue WSSA's Composite List of Weeds. However, there are some issues with the USDA Plants Database that need to be resolved first. The USDA Plants Database gets 50,000 hits a day off the internet and is undergoing a major overhaul of its infrastructure and search capabilities. It's run by the USDA-NRCS out of Greenville, NC. The goal is for

WSSA to work with NRCS Plants Database team to get them to adopt the 3,000 plus "official" weed names on WSSA's Composite List of Weeds as the primary **common** name for that weed species on NRCS's Plants Database. In most cases, they are the same, but notable differences exist. For example the USDA Plants Database primary common name for Palmer amaranth is 'carelessweed'. For waterhemp, its 'roughfruit amaranth'. For giant foxtail, its 'Japanese bristlegrass'. USDA is willing to work with the weed science community to get these common names of weeds synced up and good progress is being made.

Science Policy Intern: WSSA has agreed to put forth $10K for an intern position to support the Executive Director of Science Policy (EDSP). An advertisement went out to all the National and

Regional Weed Science Societies.

Applications were due Feb. 1, 2019. I received six outstanding applications.

Weed Bingo proposal: I am finalizing details on a $10,040 proposal to the WSSA Board to produce 1,000 copies of "Weed Bingo" produced by http://lucybingogames.com/custom. Carroll Moseley and Eric Gustafson have been instrumental in helping me put this together. We would be seeking support and input from each of WSSA's affiliated weed science societies: APMS, CWSS, NCWSS, NEWSS, SWSS, and WSWS. We would need to select 42 species of weeds (total) and provide photos of each of them, plus provide 40-60 words of descriptive educational background for each species. The **draft list of species assigned to SWSS** is: Palmer amaranth, Benghal dayflower, yellow nutsedge, cogongrass, ivyleaf morningglory, kudzu, and common cocklebur. The goal is to sell each Weed Bingo game for $14.95 each + S&H, which is the same price as an existing "Bug Bingo" game.

"Executive Visits Day" for Weed Science Society Presidents in DC: I need to get the presidents from each of the weed science societies to fly into DC for a couple days and pound the pavement at USDA, EPA, DOI, etc. as well as on Capitol Hill. This would be a good project for a Science Policy Intern to help coordinate. ;-)

National Invasive Species Awareness Week (NISAW): February 25 – March 1, 2019. This is the 20th year of national invasive species/weeds events occurring. My co-host and organizer for NISAW is Rick Otis with the Reduced Risk for Invasive Species Coalition (RRISC). For the first time, we're **looking at two additional NISAW events**, one in April dealing with policy issues and one in June that will be hands-on in the field awareness. If you're interested in helping, please let me know!

Wild Spotter: Mapping Invasives in America's Wild Places: A new nationwide **citizen science** volunteer capacity- building program called Wild Spotter (https://wildspotter.org) has been launched that is designed to help locate and map aquatic and terrestrial invasive species in Wilderness Areas, Wild & Scenic Rivers, and other wild places across the 193 million-acre National Forest System. **I added APMS as a "partner"** (along with WSSA and the four regional weed science societies).

SWSS Logo: What is the official SWSS logo????? Does it need updating? (hint- YES) How about making lapel pins?

National Survey of Common and Troublesome Weeds: The 2018 survey **results for weeds in aquatic and non-crop areas** is posted at http://wssa.net/wssa/weed/surveys/. (SEE BELOW). The 2019 weed survey will focus on weeds in broadleaf crops, fruits and vegetables. I am working with Debalin Sarangi, a post doc at Texas A&M and Muthu Bagavathiannan to analyze and publish the weed survey data for agronomic crops from 2015 through 2017 in *Weed Science*.

SWSS Annual Meeting
Monday, February 4, 2019
Renaissance Convention Center. Oklahoma City, OK
5:00-6:00pm

Meeting Called to Order by Holloway at 5:13pm

Program Report – Holloway

Below is a summary of past meeting registration:

	Oklahoma City	*Atlanta*	*Birmingham*	*San Juan Joint*	*Savannah*
	2019	*2018*	*2017*	*2016*	*2015*
Members	169	246	224	652	270
Students	97	95	98	72	98
Total	237	341	322	724	362
Final	266	376	420	724	362

Need to ask Kelley for the final numbers as they increased after the Monday afternoon session

There were 241 title/abstract submissions. 105 of them were posters and 136 papers. There seems to be an issue with loading abstracts and slides so an email was sent with instructions to lower file size on Saturday.

Finance Committee Report – Webster

Present: Eric Webster (chair), James Holloway, Jacob Reed, Phil Banks, John Schultz, Tom Barber, and Kelley Mazur.

Financial reports presented for June 1, 2018 through February 1, 2019. Gross income is $85,516.91 with total expenses of $57,455.84. The net income for the SWSS is $28,061.07. All bank accounts, including checking, savings, RBC account, money market account and CDs, totaled $380,474.89. Accounts receivable totaled $19,400.00. These funds resulted in total assets of $400,546.89.

Site Selection Committee Report – Webster

Present: Eric Webster, James Holloway, Angela Post, and Kelley Mazur.

The 2020 and 2021, Annual Conference will be held January 26 through 30 at the Beau Rivage Resort and Casino in Biloxi, MS and at the Hilton Knoxville/Knoxville Convention Center in Knoxville, TN January 24 through 28, respectively. The 2020 meeting will be held in the central part of the SWSS, the 2021 meeting in the east. Sites selected to obtain bids were New Orleans, LA, Austin, TX, and Dallas, TX for the 2022 from the western region. Little Rock and Baton Rouge will serve as alternate sites.

Awards Committee Report - Schwarzlose

The Awards committee received a total of 23 nomination packets this year.
Winners were announced at the SWSS Awards Banquet on Wednesday, February 6, 2019 at the Renaissance Convention Center Hotel and Spa / Oklahoma City, OK. The 2018-19 SWSS Award Winners were:

Outstanding Educator Award (OEA):	Larry Steckel
Outstanding Young Weed Scientist (OYWSA) – Academia:	Peter Dittmar
Outstanding Young Weed Scientist (OYWSA) – Industry:	no packets were submitted
Outstanding Graduate Student Award (MS):	Swati Shrestha
Outstanding Graduate Student Award (PhD):	Nicholas Basinger
Excellence in Regulatory Stewardship Award (Joint Award) :	Alan York Patrick Jones
Fellow Awards:	John Byrd Neil Rhodes

Per the SWSS MOP, it states that "Each non-winning nomination packet (except the Outstanding Graduate Student Award) shall be forwarded to the business manager up to two years beyond the date of initial submission (maximum of three submissions). During September of the following year, the business manager shall forward the eligible nomination packets to the chairperson (Immediate Past President) of the Awards Committee."

Carryover nominations for the OEA, OYWSA-Academia, and Fellow Award were forwarded to the business manager for consideration in 2020.

Nominating Committee Report - Schwarzlose

There were two (2) SWSS Board of Directors positions that needed to be filled at the conclusion of the 2019 annual meeting. Two (2) candidates for each position were approved by the SWSS Executive Board at the 2018 summer board meeting in Oklahoma City.

The SWSS membership was provided the bios of each candidate and were directed to the SWSS website (user ID and password required) to cast an electronic vote by October 29, 2018.

The new officers were announced in the December 2018 SWSS Newsletter and are given below:

Vice-President: **Dr. Clete Youmans, BASF Corporation**

Endowment Foundation Board: **Dr. Greg MacDonald, University of Florida**

All officers have accepted the duties of the office and will begin their service on Thursday, February 7, 2019

SWSS Endowment Report – Dodds

SWSS Endowment Enrichment Scholars
2018 SWSS Endowment Enrichment Scholars were: 1. Zachary Lancaster – University of Arkansas; 2. Wykle Greene – Virginia Tech; and 3. Cole Smith – North Carolina State University. Checks have been mailed to all winners and each winner has been in contact with their respective host regarding dates for their experience.

SWSS Golf Tournament – Oklahoma City, OK
6 attendees participated in the SWSS golf tournament – revenue from the golf tournament are unknown at this time.

SWSS Silent Auction
A silent auction was held at the SWSS Annual Meeting in Oklahoma City – items including several books, a framed print donated by Dr. Doug Worsham, several yeti cups, laser pointers, garment bags, and other items were secured for the silent auction. Revenue from the silent auction is unknown at this time

SWSS Weed Contest Report – Dodds

The 2018 SWSS weed contest was held August 8th at the Memphis AgriCenter and hosted by Bruce Kirksey assisted by James Holloway and Shane Carver. The 2019 National Weed Science Contest will be held July 25th in Seymour, IL and will be co-hosted by Valent Corp., BASF, Bayer, and Corteva.

The organizers (Dawn Refsell) have requested financial support of the National Weed Science Contest from the SWSS. Dr. Refsell has asked the SWSS to contribute "the amount that is allocated per year to the SWSS summer weed contest". 2019 National Weed Contest Guidelines are included with this report (see attachment B). Dr. Refsell also indicated that she will seek support from other regional weed science societies as well.

Graduate Teams:
1. University of Kentucky
2. University of Georgia
3. Virginia Tech Team # 1
4. Virginia Tech Team # 2
5. Texas A & M Team # 1
6. Texas A & M Team # 2
7. Louisiana State University
8. University of Arkansas
9. North Carolina State University Team # 1
10. Mississippi State University Team # 1
11. Mississippi State University Team # 2

Undergraduate Teams:
1. University of Tennessee at Martin Team # 1
2. Texas A & M

Awards:	First name	Last name	Affiliation
Crop Response			
	Prabhu	Govindasamy	Texas A&M University-1
	Shawn	Beam	Virginia Tech-1
	Eric	Scruggs	Virginia Tech--Alt
Weed Identification			
	Zach	Lancaster	University of Arkansas
Farmer Problem			
	Hannah	Wright	University of Arkansas
Calibration			
	Zach	Lancaster	University of Arkansas
UG Individual			
3	Sarah	Dodd	University of Tennessee at Martin
2	Will	Singer	University of Tennessee at Martin
1	Delaney	Foster	Abraham Baldwin Ag College-UG
Grad Individual			
10	Eric	Scruggs	Virginia Tech--Alt
9	Lucas	Rector	Virginia Tech-1
8	Jacob	Richburg	University of Arkansas-Alt
7	Wykle	Greene	Virginia Tech-1
6	Matthew	Osterholt	Louisiana State University
5	Lawson	Priess	University of Arkansas
4	Hannah	Wright	University of Arkansas
3	Wyatt	Coffman	University of Arkansas
2	Shawn	Beam	Virginia Tech-1
1	Zach	Lancaster	University of Arkansas
Teams			
3	Louisiana State University		
2	Virginia Tech-1		
1	University of Arkansas		

Graduate Student Report- Z. Lancaster

Luncheon and Symposium Review
Special Speakers- Dr. Sarah Ward, Associate Professor Crop and Soil Science, "Predatory Publishing: Should You Worry"

- Predatory Journals
  - Low quality, author fees for open access, spam emails (flattering emails, wide scope, submit manuscript as email attachment, fast acceptance, no contact info)
  - Online only journals easier to create, cheaper
  - All open access, must impose author fees, false impact factors and indexing
  - Mirror legitimate journals – to verify conduct domain name search and view editorial board
  - 420,000 articles in 2014
- Good peer review improves paper
  - Permanent archiving sign of legitimate journal

Old Business:

Introductions and Officer Reports by Lancaster. Positive remarks for Sunday night symposium and encouraged more students to attend. Commented that golf attendance was down this year; suggests more participation next year and encouraged more students to learn about the SWSS Endowment as the interest from this pays for student events.

New Business:

President- Jordan Craft, Virginia Tech

Election of new officers (winner listed in bold)

a. Herbicide committee chair
a. Nominations
1. DJ Mahoney (NC State)
2. Mason Castner, (Arkansas)

DJ Mahoney, NC State (djmahone@ncsu.edu)

b. Social Chair/Student Event Committee:
a. Nominations
1. Hannah Wright (Arkansas)

Hannah Wright, Arkansas (hewright@uark.edu**)**

c. Secretary
Nominations:
1. Delaney Foster (Texas Tech)
2. Aniruddha Maity (Texas A&M)

Delaney Foster, Texas Tech (delaney.foster@ttu.edu)

d. Endowment Committee Chair (2-Year appointment) (Elect in 2020)
a. Nominations

1. Maria Zaccaro- Arkansas
2. Sean Beam- Virginia Tech
3. Ranjet Randhawa.- Florida

Maria Zaccaro – Arkansas (mzaccaro@uark.edu)

e. Vice-President

a. Nominations

1. Camp Hamel (University of Georgia)
2. Lawson Priess (University of Arkansas)

Lawson Priess- Arkansas (glpriess@uark.edu)

I. University Rep Nominations:

a. University of Arkansas: Mason Castner
b. Virginia Tech- John Brewer
c. Mississippi State- Jacob McNeal
d. Auburn- Katilyn Price
e. Georgia- Kaylee Easton
f. NC State- Eric Jones
g. Texas A&M- Cynthia Sias
h. University of Tennessee-Knoxville- Dallas Taylor
i. Florida- Ranjeet Randhawa
j. LSU- David Walker
k. Clemson-N/A
l. Texas Tech- Grace Augdone
m. Oklahoma State- Bradley Davis
n. U.C. Davis- Liberty Galvin

Legislative and Regulatory Affairs Report - Post

The following SWSS members were in attendance at our committee meeting

Name	Organization	Email	Phone
Angela Post	NC State University	angela_post@ncsu.edu	919-625-9850
Andy Kendig	ADAMA	Andy.kendig@adama.com	314-580-8202
Eric Castner	Corteva	Eric.p.castner@dupont.com	817-597-1852
Tommy Butts	University of Arkansas	tbutts@uaex.edu	501-804-7314
Peter Dittmar	University of Florida	pdittmar@ufl.edu	352-273-4771
Jason Bond	Mississippi State	Jason.bond@msstate.edu	622-686-9311
Gary Schwarzlose	Bayer	gary.schwarzlose@bayer.com	

There was not time to discuss all items presented in Dr. Lee van Wychen's Science Policy Report to the board. We discussed the fact the Extendimax materials were not available as experimental chemistries and formulations typically are for unbiased research to be completed by university professionals in a timely fashion to present to growers. Once materials were made available and issues with volatility and drift became a major concern, researchers who made their results public were targeted by company executives. The committee discussed comments that needed to be made surrounding this irresponsible activity in

order to protect our legacy as a professional organization presenting unbiased research results for the general public and the scientific community.

Only 5 of 12 important bills made it through prior to the partial government shutdown which impacted most notably for our society's interests: the USDA, the EPA and the department of the Interior. An infrastructure bill was also on the list, but is unlikely to make it through before presidential debates begin this summer for the 2020 election. This will make this bill essentially dead.

We discussed 2018 farm bill highlights surrounding funding opportunities: 1) Reauthorization of the FFAR; 2) AGARDA will be a $50 million dollar program with opportunities for weed science funding beginning in 2019 and authorized through 2023

We also discussed both glyphosate class action lawsuits in progress

We also discussed atrazine and updated the group that EPA is still working on the human health risk assessment.

NIFA will be relocated outside of the DC area. Several institutions have expressed interest in hosting NIFA at a new location, but it is unclear where the move will be to.

Lee also indicated his desire to get Weed Bingo manufactured as an educational tool for the society to use for the general public, K-12 education, and others. The committee looked at the general list of species Lee proposed and made a few suggestions.

See Dr. Lee Van Wychen's full science policy report to the board for additional details.

WSSA Representative Report

Report by: Byrd

Board of Directors meetings February 9, 10, 14, 2019, Sheraton, New Orleans, LA

WSSA 2019 Board of Directors

President: Larry Steckel lsteckel@utk.edu (731) 425-4705
President-Elect: Bill Curran wcurran@psu.edu (814) 574-0202
Vice-President: Anita Dille dieleman@ksu.edu (785) 532-7240
Past-President: Scott Senseman ssensema@utk.edu (865) 974-8033
Secretary: Darrin Dodds dmd76@pss.msstate.edu (662) 325-4072
Treasurer: Phil Banks marathonag@zianet.com (575) 649-7157
Director of Publications Sarah Ward sarah.ward@colostate.edu (970) 491-2102
Chair, Const. & Operating Proc Mark Bernards ML-Bernards@wiu.edu (309) 313-5918
Member-At-Large Dawn Refsell dawn.refsell@valent.com (816) 284-5615
Member-At-Large Bryan Young BryanYoung@purdue.edu (618) 713-6471
Graduate Student Rep Nick Steppig nsteppig@purdue.edu (618) 719-1315
Regional Reps
APMS Rob Richardson rob_richardson@ncsu.edu (919) 515-5653
CWSS Francois Tardif ftardif@uoguelph.ca (519) 824-4120
NCWSS Greg Elmore greg.a.elmore@monsanto.com (314) 694-1744
NEWSS RakeshChandran rakesh.chandran@mail.wvu.edu (304) 293-2603
SWSS John Byrd Jbyrd@pss.msstate.edu (662) 325-4537
WSWS Marty Schraer marty.schraer@syngenta.com (208) 250-0937
Executive DSP (ex-off) Lee Van Wychen Lee.VanWychen@wssa.net (202) 746-4686
Executive Secretary (ex-off) Eric Gustafson eric@imigroup.org (720) 318-0567

Annual meeting

2019 meeting attendance in New Orleans was 516 (reported 02/09/19) down approximately 200 from 2018. There are 121 students registered with 116 in paper and poster contests. This meeting had 474 posters and paper presentations (although several were not presented) and 6 symposia.

Executive Director, Eric Gustafson: 2020 meeting will be March 2-5 at Hyatt Regency in Maui, HI in conjunction with WSWS. 2021 meeting will be February 15-19 in San Antonio, TX; 2022 may be joint with Canadian Weed Science Society, and looking at Arlington, VA for January 30 to February 3, 2023. IMI contract is up for renewal. Currently, society management and meeting management are separate contracts, but will be combined in renewal. Problems with MemberClicks week prior to meeting, so switched back to Guidebook. WSSA also experienced issues with Apex upload system.

*Graduate Student Representative Jess Bunchek WSSA Enrichment Experience***:** 18 applicants by region Canada 0, NEWSS 1; NCWSS 4; SWSS 5, WSWS 8; 5 selected that gave presentation on experiences at annual meeting; Need coordination with regional societies to prevent student selection for double enrichment experiences. Students must request experience outside the region in which they attend graduate school. GSO will attempt to solicit applicants by March for 2019. New GSO representative is Nick Steppig from Purdue.

EPA Tour Planned by Greg Kruger (EPA liaison). Seven EPA (DC office personnel) and regional EPA office personnel will tour drift study site in Platte, NE, Kruger lab, southern NE to western IA. Reported as huge success. Plans underway for joint tour with entomology for 2019. Some discussion to contact regional societies for input to plan future WSSA sponsored tours.

*Finance report***:** Banks indicated investments were down in 2018 and likely will be in 2019. Raymond James is investment firm that handles WSSA assets. Sustaining members down, but other sustaining members have increased the level of donation. Motion approved to reduce assets in cash to 40 percent and increase equities to 60%. Banks will develop wording for MOP to guide future financial levels in checking versus other investments.

*Director of Publication Sarah Ward, Editor report***:** Impact factor up for all three journals. BioOne is biggest revenue source to Cambridge. Speculation for funding from journals in 2019 appears good.

Jim Kells (kells@msu.edu) was selected as the new NIFA Fellow (3 year renewable term). He is stepping down as Department Head at Michigan State, so Donn Schilling will continue to help at NIFA during the transition; priority funding for NIFA weed genomics and new technology for mechanical weed control. Secretary Perdue wants to move NIFA out of DC area. Moral among scientists and staff very low with many seeking other employment. Congress may block funding for relocation.

Janice McFarland (janis.mcfarland@syngenta.com) will be Director of Science Policy replacement.

*Executive Director Van Wychen***:** asked for funding to hire two Fellowships to help with various activities and data management. The two individuals will likely overlap for short duration. WSSA will provide funding to print 1000 copies of Weed Bingo and sell to regionals at cost plus 10% (if regionals want to purchase), then regionals can resell (suggested $14.95 + S & H). Weeds assigned to SWSS: Benghal dayflower, cogongrass, common cocklebur, hemp sesbania, ivyleaf morningglory, kudzu, and Palmer amaranth for photographs and brief description. Weed survey data for 2019 will be broadleaf crops, fruits, and vegetables. USDA Plants Database personnel are willing to work with WSSA to modify common weed names one their website to improve uniformity for weed recognition.

New Business

None to report

Motion to accept reports made by Mueller. Motion Passes Unanimously

Holloway adjourns meeting at 5:38pm

Endowment Committee Report

Report by: Darrin Dodds

Overall endowment funds are slightly down compared to previous year ($390,742 compared to ~$400,000); however, funds from the golf tournament are still being received and Dodds commented that on the whole the endowment is very sound.

Dodds commented that there was $750 request to the Endowment Board to acquire a speaker.

Discussion about BOD decision to have the endowment support the summer weed contest, particularly to purchase awards and plaques. Mazur reviewed minutes from the summer BOD meeting in June 2018. Minutes reflected that the BOD unanimously passed a motion that the endowment fund 50% of the 2018 summer weed contest ($14,000) as well as $3,500 for plaques and awards. Action on this is needed because the 2018 summer weed contest was $3,500 over budget. Dodds initiated discussion about how much of an endowment withdrawal would be okay with SWSS considering that SWSS is also responsible for awards and plaques at the upcoming 2019 Weed Olympics. Johnson reviewed MOP to make clear that this responsibility is included, as well as funding the Graduate Student Enrichment program ($4500 and $400 for plaques).

Discussion ensued about the target amount of funding that should be in the endowment. Holloway commented that the target is $500,000 and that the goal is to have interest fund student activities; however, this funding target is not included in the MOP. Dodds commented that the endowment includes 4 CDs that make 4.5%.

Dodds agrees to request $3500 from the Endowment Board (via email on February 4th, 2019) to cover the 2018 overage only; however the Endowment Board must approve the transaction. Dodds commented that the endowment will not be able to fund 50% of the summer weed contest at the present time

Discussion ensued about the auction. It was not setup as of 11:24am on February 4th, 2019. Consensus was that plans are in place for auction to move forward. Scott mentioned that overall meeting registrations were down and encouraged people to bid; however, hotel room benchmarks were met.

Other Business

Van Wychen talked about the SWSS logos and pins. Commented that some have no text. Van Wychen suggested that SWSS design an official logo.

Van Wychen suggested idea of a “Weed Bingo” game with weed images from the society, particularly 7 total weeds. A list will be sent to the BOD. Images will be used in a board game to be launched in late 2019. Scott asked what funds SWSS would receive for doing this; Van Wychen remarked that funds received would be reflective of how much SWSS initially contributed; however, no funding request is being made at the present time.

Byrd asked motioned to approve the 2018 SWSS Proceedings prepared by Bagavathiannan. Motion seconded by Johnson. Motion passed unanimously.

Lengthy discussion of what issues caused the 2018 Proceedings to be finished so late. Comments made about reports being late, particularly the weed resistance report, as a cause for the delay. However, it was

also noted that the Editor failed to make requests for these reports in a timely manner. Baughman mentioned that reports can be added to the proceedings as an amendment to accelerate the process of getting them finished in a timely manner. Consensus agreement that having the proceedings finished so late was problematic. Discussion ensued about financial compensation to editor. Johnson reviewed MOP and determined that $750 compensation has been agreed upon in the past. Discussion also ensued about editor attendance at BOD meetings. Consensus agreement that editor should be in attendance and Holloway mentioned that he will discuss this with Bagavathiannan.

Holloway motions to adjourn the meeting. This was seconded and passed unanimously.

Scott adjourned meeting at 12:07 pm.

Secretary- Treasurer's report

Minutes from the June 2018 Summer Board Meeting, as well as results of electronic voting from May 2018 - January 2019, were approved by the Board on 3 February 2019 and will be available later this year.

Student Program Report

Report submitted by: Cahoon

We had 2 MS poster, 2 PhD Poster, 3 MS paper, and 2 PhD paper sections with a total of 72 contestants. We had 45 judges. Peter Eure moderated the MS paper; Kelly Backshieder the PhD paper, and Zack Taylor the posters. We did have some students complain that they thought they were signed up for the contest but it was not reflected in the system. May need to check on this prior to future meetings. Contest winners are listed in the table below.

Section	Place	Student	University
MS POSTER SECTION 1	1st	Jake Patterson	Arkansas
	2nd	Diego Contreras	NC State
MS POSTER SECTION 2	1st	Pamela Lima	Arkansas
	2nd (TIE)	Savana Davis	Miss. State
	2nd (TIE)	Cynthia Sias	Texas A&M
PhD POSTER SECTION 1	1st	John Brewer	VA Tech
	2nd	Maria Zaccaro	Arkansas
PhD POSTER SECTION 2	1st (TIE)	Lucas Franca	Miss. State
	1st (TIE)	Bradley Wilson	OK State
	2nd	Spencer Samuelson	Texas A&M
MS PAPER SECTION 1	1st	Mason Castner	Arkansas
	2nd	John Seale	Miss. State
MS PAPER SECTION 2	1st	Jacob Richburg	Arkansas
	2nd	Nicholas Hurdle	Georgia
MS PAPER SECTION 3	1st	Hayden Quick	Miss. State
	2nd	Taylor Randell	Georgia
PhD PAPER SECTION 1	1st (TIE)	Kayla Eason	Georgia
	1st (TIE)	Jordan Craft	VA Tech
	2nd	Shandrea Stallworth	Miss. State
PhD PAPER SECTION 2	1st	Zach Lancaster	Arkansas
	2nd	Zachary Carpenter	Miss. State

Research Committee Report – Webster

No report for 2019

Newsletter Committee Report – Scott

No report for 2019

Proceedings Editor Report

Report submitted by: Muthu Bagavathiannan

Proceedings Editor's Report of the 2018 Meeting

The 2018 meeting was held at Hyatt Regency-Atlanta, GA during Jan 22-24, 2018. The 2018 Proceedings of the Southern Weed Science Society contained 429 pages, including 293 abstracts. By comparison, the 2017 Proceedings ot the Southern Weed Science Society contained 425 pages, including 229 abstracts (Birmingham, AL); the 2016 Proceedings of the Southern Weed Science Society contained 639 pages, including 505 abstracts (San Juan, PR); 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 293 titles (119 posters and 174 oral presentations) were submitted.

The 2018 Proceedings was dedicated to Dr. Timothy R. Murphy who was born in Knoxville, Tennessee on 12 August 1951. He was preceded in death by his parents, Richard Dennis Murphy and Frances Juanita Blazier Murphy. He received his B. S. from Berea College in 1975, his M. S. and PhD in 1979 and 1985, respectively, from Clemson University. Dr. Murphy was hired by the University of Georgia in 1985 and retired in 2007.

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, 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 August 2018.

Section	Number of Pages
SWSS 2018 Awardees	20
Past Presidents	1
List of Committees and Committee Members Jan 31, 2018– Jan 31, 2019	7
Minutes of Executive Board, Committee Reports, etc	40
Posters	132
Weed Management in Agronomic Crops (I & II)	33 (6&27)
Physiological and Biological Aspects of Weed Control	4
Educational and Regulatory Aspects of Weed Control	2
SWSS MS Oral Contest	33
SWSS PhD Oral Contest	28
Horticultural crops	10
Weed Mangement in Turf	13
Vegetation Management in Utilites, Railroads, Highway Rights of Way, Industrial Sites and Forestry	6
Weed Biology and Ecology	3
Dicamba Issues in the Mid-South	6
Pastures and Rangeland	6
Multiple Herbicide and Metabolic Herbicide Resistance: Where Are We?	4
New Technologies	11
Survey of Herbicide-Resistant Weeds	8
Registrants of 2018 Annual Meeting	13

Finances (if any) Requested: None

Respectively submitted,

Muthu Bagavathiannan, Proceedings Editor

End of report

Sustaining Membership Committee Report

Report by: Reed

Committee members attending the meeting were Jacob Reed (Chair), Peter Eure, Kelly Barnett Backscheider, Tom Barber, and Bob Scott. A brainstorming session took place to identify additional companies we should approach regarding sustaining membership. An additional 19 companies were identified and assigned to committee members to contact to ask for their support.

Two items were discussed and approved to present before the board.

1. A third tier of support ($3000) was suggested and approved in-committee for larger companies with annual sales >$500M. An incentive to have donors with donations >$3000 receive a free SWSS annual meeting registration was discussed and approved in-committee.
2. A recommendation to allow for and ask universities to contribute to the sustaining membership fund was discussed and approved in-committee.

A report was given to the committee explaining that $31,300 in sustaining member contributions has been collected to-date out of a total of $34,400 committed. This amount was compared to $33,000 contributed last year.

Peter Eure and Jacob Reed were scheduled as rotating off-committee, but both expressed interest in renewing their terms and serving again. Both term extensions were approved by the committee. Jacob Reed will continue as Sustaining Membership Committee Chair. Andy Kendig was added to the Sustaining Membership Committee as a member.

The committee recommends to the Board to consider and vote on the two items above, allowing the Sustaining Membership Committee to expand it’s ability to solicit support.

Necrologies and Resolutions

Necrology Report – Black

Seven necrology reports were submitted, Dr. Ralph Stanley Baker, Dr. Timothy R. Murphy, Dr. John Ray Abernathy, Dr. Michael Dyer Netherland, Stephen Dewayne Lee. Dr. John Clyde Banks, and Dr. Rupert DeWitt Palmer.

Dr. Ralph Stanley Baker, 90, died on March 27, 2018. He was born on August 1st, 1927 in LeRaysville, Pennsylvania. Ralph attended LeRaysville High School, followed by the University of Delaware and Purdue University. Upon completion of his PhD from Purdue University, Dr. Baker began his professional career at Mississippi State University.

Dr. Baker spent his entire professional career with Mississippi State University at the Delta Research and Extension Center in Stoneville, MS conducting research on weed control in cotton. Following retirement, he formed Weed Away, which serviced residential and commercial properties.

Dr. Baker is survived by his wife of 63 years Mary Beth Baker; two daughters Nancy Anderson and Diane Schallock (Mike) of Webster, North Carolina; Van Anderson of Okolona, Jane Anderson of Winston-Salem, North Carolina, Grant Schallock of San Antonio, Texas and Leslie Schallock of Staunton, Virginia; and one sister-in-law, Ruth Dickey of Marlton, New Jersey.

WHEREAS Dr. Baker served with distinction at Mississippi 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, Dr. Ralph Stanley Baker, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Timothy R. Murphy, 66, died April 13th, 2018. He was born on August 12th, 1951 in Knoxville, Tennessee. Timothy received his Bachelor of Science from Berea College in 1975, followed by his Master of Science and PhD in 1979 and 1985, respectively, from Clemson University. Following completion of his PhD, Dr. Murphy was hired by the University of Georgia, where he stayed employed until his retirement in 2007.

Dr. Murphy served as a technical specialist for weed science programs in turfgrass, roadsides, non-cropland, and forages in Georgia. Dr. Murphy was instrumental in the implementation of in-service training sessions for Georgia County agents conducting weed science instruction in many different settings; agronomic crops, horticultural crops, aquatics, turfgrass, non-cropland, and weed identification. Dr. Murphy received the Lifetime Achievement Award from the University of Georgia as well as the D. W. Brooks Award for Excellence in Extension in 1995,

which is the highest award for a University of Georgia faculty member in the College of Agricultural and Environmental Sciences.

Dr. Murphy was a long standing active member of the SWSS and WSSA. He was recognized by the Weed Science Society (WSSA) of America in 1999 receiving the Outstanding Extension Award. In 2002 he was elected to serve on the Southern Weed Science Society (SWSS) Board of Directors as WSSA representative. He was later recognized by receiving the Distinguished Service Award from the SWSS in 2009. Dr. Murphy was also part of the team of Georgia weed scientists who hosted the Southern Weed Science Society Weed Contest in 1993.

Dr. Murphy is survived by his wife, Marguerite J. Murphy; daughter, Molly Murphy; sisters, Alice Murphy Garrison, Helen Murphy Payton, Jeanie Murphy Hogg; brothers, Michael Murphy, Jim Murphy; and nieces and nephews.

WHEREAS Dr. Murphy served with distinction at the University of Georgia and,

WHEREAS Dr. Murphy 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, Dr. Timothy R. Murphy, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. John Ray Abernathy, 73, died Tuesday, September 18th, 2018. He was born January 4th, 1945 to the late George Raymond and Tommy Loys (Fewell) Abernathy in Altus, Oklahoma. John graduated from Altus High School in 1963. He married Cynthia Sue (Canady) Abernathy on May 24th, 1969 in Tulsa, Oklahoma.

John had a passion for agriculture, graduating from Oklahoma State University in 1969, where he received his Bachelor of Science and his Master of Science in Agronomy. He continued to further his education at the University of Illinois receiving his Ph. D. in Agronomy in 1972. Dr. Abernathy worked at Texas A&M Agricultural Experiment Station in Lubbock as a Weed Scientist and as the Resident Director for a total of 24 years. He retired as the Dean of the Texas Tech University College of Agricultural Sciences and Natural Resources in 2003. He was also an International Consultant of Weed Science and Research from 1985 - 2017 and was a board member for the National Farm Life Insurance Company from 1998 - 2017.

Dr. Abernathy received many awards along the way including the Outstanding Young Weed Scientist Award from the Southern Weed Science Society in 1980 and the USDA Group Award for excellence as a member of the AG-CARES team. John was named Fellow in the Weed Science Society of America and served as president of WSSA in 1991 – 1992. He accepted the Gerald W. Thomas Outstanding Agriculturist Award from Texas Tech's Ag College and received the West TX Ag Chemicals Institute Award for outstanding Contributions.

Dr. Abernathy is survived by his wife of 49 years, Cindy; daughters, Larisa Abernathy Weldon of Keller, Texas, Christy Diann Liles and husband Larry of Frisco, Texas; siblings, Larry and wife Lynn Abernathy of Vernon, Texas, Frances Abernathy and husband Craig Sterling of San Angelo, Texas; five grandchildren, Grayson, Peyton and Megan Weldon, Abigail and Alexis Liles.

WHEREAS Dr. Abernathy served with distinction at Texas A&M and Texas Tech University,

WHEREAS Dr. Abernathy 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, Dr. John Abernathy, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Michael Dyer Netherland, 54, died on October 16th, 2018. Mike was born on November 16th, 1969 in Huntington, Indiana. He attended high school at Eisenhower High School in Lawton, Oklahoma. He attended Cameron University in Lawton where he received his Bachelors of Science degree in Biology and Chemistry. Mike then attended Purdue University in West Lafayette, Indiana where he received his Master of Science degree in Botany in 1989.

In 1989, Mike joined the Chemical Control Technology Team as a Research Biologist with the United States Army Corps of Engineers, Engineer Research and Development Center, Environmental Laboratory in Vicksburg, Mississippi. In 1996 Mike move to Gainesville, Florida to pursue his PhD degree in Agronomy at the University of Florida.

In 1999, Dr. Netherland began his career with the SePRO Corporation as the Global Technology Leader in aquatics. In 2003 he returned to the U.S. Army Corps of Engineers and was assigned to work at the University of Florida Center for Aquatic and Invasive Plants where he has made many contributions in both research and education. He was a Courtesy Faculty Member at the University of Florida and possessed Adjunct Professorship appointments at North Carolina State University and Grand Valley State University, where he has advised 4 graduate students and served as committee member for 12 others. While in Florida he continued to lead many significant research programs such as the development of hydroacoustic vegetation monitoring, large-scale management of fluridone resistant hydrilla, developed new management strategies for invasive and hybrid watermilfoils, and assisted with the registration of several new aquatic herbicides. His efforts have been valued by researchers and practitioners throughout the U.S. and in many other countries including Australia, Canada, and New Zealand.

Dr. Netherland was elected to be President of the Aquatic Plant Management Society, and as such served as Program chair in 2013. He has been nominated for and won multiple awards,

including the Outstanding Research Contributor (2010), T. Wayne Miller Distinguished Service (2011), Outstanding Journal Publication (2014), and the President's Award (2016) from the Aquatic Plant Management Society. He was also asked to serve as Editor of the *Journal of Aquatic Plant Management* for six consecutive years. His achievements were also recognized on two occasions by the Northeast Chapter of the Aquatic Plant Management Society with the Aquatic Plant Research Award in 2007 for his work on the control of invasive watermilfoils and again in 2016, for research on monoecious hydrilla. In 2008, Mike received the Department of the Army's Commander Award for Civilian Service and the prestigious Federal Laboratory Consortium Award for excellence in technology transfer efforts related to aquatic plant management.

Dr. Netherland is survived by his wife of 31 years Marci Love Netherland of Gainesville, FL; son Luke Dyer Netherland of Gainesville, FL; daughter Sarah Love Netherland of Ft. Meyers, FL; parents Dr. Edwin Lane Netherland and Joelene Wisel Netherland of Lawton, OK; and 3 sisters.

WHEREAS Dr. Netherland served with distinction for the United States Army Corps of Engineers,

WHEREAS Dr. Netherland 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, Dr. Michael Dyer Netherland, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Stephen Dewayne Lee, 63, died on November 27, 2018. He was born on October 28th, 1955 in Kansas City, Missouri. Steve attended Harrison High School in Harrison, Arkansas. Followed high school Steve married Arleen Risley in 1976. Steve attended the University of Arkansas where he attained his Bachelors of Science degree in Agronomy in 1978, followed by his Masters of Science degree in Weed Science in 1980.

In 1980 Steve began his career as an agronomist for Mobile Chemical Corporation. He also worked for several other companies including Rhone Poulenc Ag Company, BASF, Cerex Agri and Bayer/ Monsanto.

Steve is survived by his wife of 42 years Arleen Risley Lee; two sons Zach Lee (Shari) and Tyler Lee (Melissa); his brother Keith Lee; and his parents Jim and Shirley Lee.

WHEREAS Steve served with distinction for Bayer Crop Science and,

WHEREAS Steve 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, Mr. Stephen Dewayne Lee, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. John Clyde Banks, 72, died on December 27th, 2018. He was born on March 22nd, 1946 in Cordell, Oklahoma and was raised on a dry land cotton farm near Dill City, Oklahoma. After high school, J.C. attended Cameron University in Lawton, Oklahoma where he met his future wife Ruth Renee' Dowlen. They were married on June 3rd, 1967.

J.C. received his Bachelor of Science, Master of Science, and PhD degrees from Oklahoma State University. Upon graduating from Oklahoma State University in 1974, J.C. joined Eli Lilly & Co. and worked in Lubbock, McAllen, and Dallas, TX. He then moved to Greenfield, Indiana serving as a regional representative covering the North Central United States.

In 1988, J.C. left Eli Lilly & Co. and became the Oklahoma State Cooperative Extension Cotton Specialist based out of Altus, Oklahoma. In 1991 he became the State Cotton Specialist in the Plant and Soil Sciences Department of Oklahoma State University. In 1996 J.C. became the director of Oklahoma State Universities Southwest Research and Extension Center at Altus, OK. J.C.'s responsibilities included managing the Altus center and statewide responsibility for research and extension/education programs in all aspects of cotton production. When JC retired in 2010, he and his wife Renee' moved to Creede, CO.

He served on several SWSS committees and was very active in the Beltwide Cotton Conference.

Dr. Banks is survived by his wife of 21 years Renee', son Kenny Banks and daughter Diana Collier. J.C. had two granddaughters, two grandsons and one great grandson.

WHEREAS Dr. Banks served with distinction at Oklahoma State University and,

WHEREAS Dr. Banks 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, Dr. John Clyde Banks, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Rupert DeWitt Palmer, 89, died on January 14th, 2019. He was born on January 28th, 1928 at his parents' home in Winston County, Mississippi. Rupert married his wife Reida Wilkie White on August 22nd, 1954, and they were married for 62 years.

Rupert attended East Central Junior College in Decatur, Mississippi where he received his Associates degree in Agriculture in 1949. He later attended Mississippi State University in Starkville where he received his Bachelor of Science degree in Agriculture Administration in 1952, followed by his Master of Science degree in Agronomy in 1954. Rupert then he moved to Baton Rouge, Louisiana to pursue his PhD in Botany from Louisiana State University.

After receiving his PhD from LSU in 1959, Dr. Palmer started his employment as an Associate Professor of Agronomy at Mississippi State University where he taught undergraduate and graduate level courses in Weed Science, as well as serving as major professor to graduate students pursuing degrees in Weed

Science. In 1966 Dr. Palmer began his employment as an Extension Weed Scientist with the Texas Agricultural Extension Service in the Department of Soil and Crop Sciences with Texas A&M University. Dr. Rupert retired from Texas A&M in 1989.

Rupert served in the United States Army Medical Corp and was stationed at Fort Chaffee, Arkansas. His name is listed on the Wall of Honor in Veterans Park, College Station, Texas.

Dr. Palmer was preceded in death by his parents James Thomas Palmer and Coley Ree (Miles) Palmer; his wife Reida; his brothers Haron and Joel; and his sisters Frances R. Humphries and Merry Z. Rainey.

He is survived by his son Robert T. Palmer (Lorraine); his daughter Regina P. Wheaton (William); five grandchildren; and his brothers James O. Palmer and Petus T. Palmer.

WHEREAS Dr. Palmer served with distinction at Mississippi State University and Texas A&M University and,

WHEREAS Dr. Palmer 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, Dr. Rupert DeWitt Palmer, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Turney was preceded in death by his parents, his first wife Sadie Marie Tate, a daughter, Kaye Marie Hernandez, a granddaughter, Rachel Ann Maurer, brothers Travis, Theo, Teme, Thomas, and sisters Lily Peterson and Murley LeBlanc.

WHEREAS Mr. Hernandez served with distinction with the E. I. DuPont and Company and,

WHEREAS Mr. Hernandez 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, Turney John Hernandez, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

2019 MEETING ABSTRACTS

GROW: A SCIENCE BASED RESOURCE TOOL FOR INTEGRATED WEED MANAGEMENT. C.G. Rubione*[1], M.J. Vangessel[1], L.M. Lazaro[2], S. Mirsky[3], K. Pittman[4], M.L. Flessner[5], M.V. Bagavathiannan[6]; [1]University of Delaware, Georgetown, DE, [2]Louisiana State University, Baton Rouge, LA, [3]USDA, Beltsville, MD, [4]Virginia Tech, Blacksburg, VA, [5]Virginia Tech PPWS Dept., Blacksburg, VA, [6]Texas A&M University, College Station, TX (1)

ABSTRACT

Weed management has always been challenging, but the recent evolution and spread of herbicide-resistant biotypes has added additional management considerations. Integrated weed management (IWM) is a multi-tactic approach for controlling herbicide-resistant weeds while minimizing the risk of new herbicide-resistant biotypes and stopping the spread of current infestations. IWM allows growers to use multiple tactics (chemical, cultural, mechanical, biological, and prevention) to manage weeds, and in turn improving management of herbicide-resistance biotypes and overall weed control**.**

GROW, is a web-based resource for IWM providing science-based information to manage herbicide-resistant weeds as well as other problematic weeds. Understanding weed behavior is a key starting point. This website provides users with information on weed biology and ecology for key weed species, as well as Apps for identification and scouting material. Website users will have direct access to a variety of resources to develop integrated weed management programs for their specific needs.

Two new Apps are being developed for GROW. One will help farmers and dealers select herbicides base on both effectiveness and rotation of herbicide mechanism of action. The second App is an integrated approach for Palmer Amaranth Management (PAM). In addition, state extension websites, newsletters, Ag journals, scientific papers, and a broad range of tactics adapted to various regions of the country are available in the ***"Weed Management Toolbox"*** tab.

GROW's main objective is to promote and increase IWM adoption. It is committed to providing resources to help farmers and crop advisors to develop their own suite of sustainable weed management practices.

GROW is a first step towards "Getting Rid of Weeds" through Integrated Weed Management.

http://integratedweedmanagement.org/

RESIDUAL OVERLAY OF CLOMAZONE PLUS PENDIMETHALIN WITH OTHER RESIDUAL HERBICIDES LABELED IN RICE. M.J. Osterholt*[1], E. Webster[1], B. McKnight[2], S. Rustom[2], C. Webster[3], D.C. Walker[2]; [1]Louisiana State University, Baton Rouge, LA, [2]LSU AgCenter, Baton Rouge, LA, [3]LSU, Baton Rouge, LA (2)

ABSTRACT

A study was conducted at the Louisiana State University Agricultural Center's H. Rouse Caffey Rice Research Station (RRS) in 2017 and 2018 to evaluate a pre-packaged mixture of clomazone plus pendimethalin should be applied delayed preemergence (DPRE) or postemergence (POST) within a herbicide residual overlay with saflufenacil, clomazone, or quinclorac. POST applications included penoxsulam or halosulfuron in combination with the second residual application. No differences were observed with barnyardgrass control at 14 DAT with 92 to 98% control. At 42 DAT, barnyardgrass treated with clomazone plus pendimethalin in combination with either clomazone or quinclorac at either timing controlled barnyardgrass 95 to 96%. However, when saflufenacil was applied PRE regardless of the POST herbicide or when saflufenacil was applied POST with halosulfuron resulted in reduced barnyardgrass control, 78 to 81%, compared with control with all other residual combinations, 95 to 96%. Yellow nutsedge and rice flatsedge control increased when treated with halosulfuron compared with penoxsulam across all evaluation dates. At 28 and 42 DAT, Texasweed treated with saflufenacil PRE regardless of POST applications was controlled 83 and 87%, and this was greater than clomazone or quinclorac applied PRE regardless of POST herbicide program.

EVALUATION OF HERBICIDE OVERLAP IN PROVISIA RICE. B. McKnight*[1], E. Webster[2], R. Levy[3], S. Rustom[1], C. Webster[4], M.J. Osterholt[2], D.C. Walker[1]; [1]LSU AgCenter, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA, [3]LSU AgCenter, Alexandria, LA, [4]LSU, Baton Rouge, LA (3)

ABSTRACT

Provisia is a new herbicide resistant rice technology that was first commercially available to growers for Midsouth production in 2018. The herbicide resistant rice and the herbicide are collectively known as Provisia. Provisia herbicide is quizalofop, an ACCase inhibiting herbicide that controls annual and perennial grasses. Weedy rice, a complex of red rice, red rice outcrosses, and F_2 hybrids, is a troublesome pest in Louisiana rice production. Weedy rice resistant to the imidazolinone herbicides have made management increasingly difficult. BASF developed Provisia as a tool for growers to combat severe infestations of weedy rice resistant to imidazolinone herbicides. Currently, only one Provisia variety, 'PVL01', is commercially available to growers. Field studies were conducted in 2018 at the LSU AgCenter H. Rouse Caffey Rice Research Station near Crowley, LA on a Crowley silt loam soil. The focus of this research is to evaluate Provisia herbicide injury on 'PVL01' rice following two consecutive quizalofop applications at various labeled rates to simulate application overlap.

Following soil preparation, 'PVL01' rice was drill-seeded at 67 kg ha^{-1} on 19-cm rows. Experimental design was a randomized complete block design with four replications and plot size was 1.5 by 5.1 m^2. Pendimethalin and quinclorac was applied DPRE across all plots for weed control at 1120 and 420 g ai ha^{-1}, respectively. Provisia herbicide was applied in a sequential program at 100 fb 138, 120 fb120, and 138 fb 100 g ai ha^{-1}, and in a single application at 240 g ai ha^{-1}. In sequential programs the first treatment was applied to 2- to 3-leaf rice fb treatments applied to 4- to 5-leaf rice. Treatments of 240 g ai ha^{-1}were applied at either the 2- to 3-leaf or the 4- to 5-leaf growth stage and represented the maximum labeled rate of Provisia in a single application. Within each of the programs, one treatment was applied in a single pass and two separate treatments were overlapped by a consecutive pass at either the 2- to 3-leaf or 4- to 5-leaf growth stage to simulate an application overlap at those timings. 'PVL01' injury from Provisia herbicide was evaluated at 14 DA 2- to 3-leaf applications and 14 DA 4- to 5-leaf applications. Rice plant height was recorded at 14 DA 2- to 3-leaf applications, 28 DA 4- to 5-leaf applications, and immediately prior to harvest. Rice grain was harvested with a small plot combine and final rough rice grain weight was adjusted to 12 % moisture.

At 14 DA 2- to 3-leaf applications, visual injury was 16 to 40% on rice not treated with a Provisia overlap treatment. Injury was 41 to 70% on rice treated with an overlap application of Provisia herbicide. The most severe visual injury observed, 70%, was on rice overlapped with the 240 g ai ha^{-1} rate. At 14 DA 4- to 5-leaf applications, injury on rice treated with a single pass of any Provisia rate had completely dissipated. Injury of rice treated with an overlap application at the 2- to 3-leaf timing was 6 to 21%, indicating recovery from herbicide injury was occurring. Rice treated at the 4- to 5-leaf application timing was injured 6 to 23% at this evaluation timing. At 14 DA 2- to 3-leaf applications, rice treated with an overlap rate of 240 g ai ha^{-1} was shorter than rice receiving any other rate. By the last height evaluation, immediately prior to harvest, no differences in rice plant height was observed from any herbicide treatment.

HERBICIDE RESISTANT PALMER AMARANTH (AMARANTHUS PALMERI) IN ROW CROP PRODUCTION SYSTEMS IN TEXAS. V. Singh*[1], R. Garetson[1], S. Singh[1], P.A. Dotray[2], M. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas Tech University, Lubbock, TX (4)

ABSTRACT

A state-level survey was conducted across major row-crop production regions of Texas to document the level of sensitivity of Palmer amaranth to glyphosate, atrazine, pyrithiobac, tembotrione, fomesafen, and dicamba. A total of 137 to 161 Palmer amaranth populations were evaluated for sensitivity to the recommended field rate (1X) of the above herbicides, and rated as resistant (≤ 49% injury), less sensitive (50 to 89% injury), or susceptible (90 to 100% injury). For glyphosate, 62, 19, 12.5, and 12.5% of the populations from the High Plains, Central Texas, Rio Grande Valley, and Lower Gulf Coast, respectively, were resistant. Resistance to atrazine was more common in Palmer amaranth populations from the High Plains, with 16% of the populations classified as resistant and 22% as less sensitive. About 90% of the populations from the High Plains that exhibited resistance to atrazine POST application also were resistant to atrazine PRE. Of the 160 populations tested for pyrithiobac, about 99% were resistant or less sensitive, regardless of the location. No resistance was found for fomesafen, tembotrione, or dicamba. However, 22% of the populations from the High Plains were less sensitive to tembotrione, with two populations showing high survival at the 1X rate (but killed at 2X; 1X = 93 g ai/ha), illustrating the background variability in sensitivity to tembotrione across regional scales. For dicamba, three populations, all from the High Plains, exhibited less sensitivity at the 1X rate (controlled at the 2X rate; 1X = 560 g ae ha^{-1}), also indicating the existence of variability in sensitivity to this herbicide. One population exhibited multiple resistance to three herbicides with distinct sites of action (SOA) involving ALS-, EPSPS-, and PSII-inhibitors. Palmer amaranth populations exhibited reduced sensitivity to about 15 combinations of herbicides involving up to five SOAs.

EVALUATION OF ADJUVANTS ON QUIZALOFOP ACTIVITY IN PROVISIA RICE WHEN MIXED WITH ALS HERBICIDES. C. Webster*[1], E. Webster[2], B. McKnight[3], S. Rustom[3], D.C. Walker[3], M.J. Osterholt[2]; [1]LSU, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA, [3]LSU AgCenter, Baton Rouge, LA (5)

ABSTRACT

A study was conducted in 2017 and 2018 at the Research Station near Crowley, Louisiana to evaluate the influence of different adjuvants in overcoming the antagonism of quizalofop when mixed with bispyribac. Plot size was 1.5 by 5.1 m with eight, 19.5 cm drill-seeded rows of ACCase resistant (ACCase-R) (*Oryza sativa* L.) 'PVL01' long grain rice. Imidazolinone resistant awnless red rice (*O. sativa* L.) was broadcast at 50 kg ha^{-1} across the entire research area, and the area was naturally infested with barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.]. A BASF supplied crop oil concentrate (COC-BASF), (Dash), a crop oil concentrate (COC-Helena), (Agri-Dex), and a silicon based adjuvant (SBA), (Dyne-A-Pak) were evaluated for their potential to overcome antagonism of quizalofop.

The study was a randomized complete block with a three-factor factorial arrangement of treatments with four replications. Factor A consisted of postemergence (POST) applications of quizaolofop at 0 and 120 g ha^{-1}. Factor B consisted of POST applications of bispyribac at 0 and 34 g ai ha^{-1}. Factor C consisted of no adjuvant, COC-BASF, COC-Helena, or a SBA. All adjuvants were applied at a rate of 1% v v^{-1}. Herbicide applications were applied to the rice at the three- to four-leaf stage. Visual evaluations for this study included barnyardgrass and red rice control at 14 and 28 days after the initial treatment (DAIT). Immediately following the 28 DAIT rating date, a second application of quizalofop was applied at 120 g ha^{-1}. Control data were analyzed using the Blouin's augmented mixed model to determine synergistic, antagonistic, or neutral responses for herbicide mixtures by comparing an expected control calculated based on activity of each herbicide applied alone to an observed control of given herbicide mixtures.

Synergistic interactions were observed at 14 DAIT for red rice control when quizalofop was mixed with bispyribac plus SBA or COC-BASF with an observed control of 92 and 95%, compared with an expected control of 88%, respectively. At 14 DAIT, antagonism of quizalofop for barnyardgrass control occurred when mixed with bispyribac plus COC-Helena, SBA, or COC-BASF with an observed control of 43, 63 and 86%, respectively, compared with an expected control of 95%. Synergistic interactions were observed at 14 DAIT for red rice and barnyardgrass control when quizalofop was mixed with all adjuvants evaluated; however, antagonism of quizalofop was observed when mixed with bispyribac with no adjuvant.

At 28 DAIT, a neutral interaction was observed for barnyardgrass control when quizalofop was mixed with bispyribac plus COC-BASF with an observed control of 91%, compared with an expected control of 97%. However, antagonistic interactions were observed at 28 DAIT for barnyardgrass control when quizalofop was mixed with bispyribac plus COC-Helena or SBA. Neutral interactions were observed at 28 DAIT for all mixtures evaluated for red rice control.

In conclusion, these results indicate that the antagonism of quizalofop when mixed with bispyribac plus COC-BASF at 14 DAIT was overcome at 28 DAIT with a neutral interaction for

barnyardgrass control. The addition of COC-BASF into a mixture of quizalofop plus bispyribac provided the most consistent control of red rice with a synergistic and neutral interaction at 14 and 28 DAIT, respectively. These results suggest that incorporating COC-BASF into a mixture of quizalofop plus bispyribac will offer the most beneficial mixture for barnyardgrass and red rice control in the Provisia rice system.

COMPARISON OF VARIOUS WATER AND TANK CLEANER RINSE SEQUENCES FOR EFFECTIVE REMOVAL OF DICAMBA FROM CONTAMINATED SPRAYER SYSTEMS. Z.A. Carpenter*, D.B. Reynolds, A.B. Johnson; Mississippi State University, Mississippi State, MS (6)

ABSTRACT

While the release of dicamba tolerant soybeans will aid growers in weed control, it will also present several challenges. Glyphosate is 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 therefore can be difficult to completely remove from sprayer components. Synthetic auxins are also highly active on some plant species at very low concentrations. The objective of this study was to determine if the use of multiple rinses utilizing a tank cleaner resulted in more complete removal of dicamba from contaminated sprayer systems compared to the standard water-cleaner-water procedure. Field experiments were conducted in 2017 and 2018 in Brooksville and Starkville, MS. A small-scale sprayer was designed to replicate the cleanout procedures used on commercial sprayers. The system was first contaminated with dicamba (Xtendimax) at 560 kg ae ha^{-1} and rhodamine WT dye at 0.2% v/v. Following contamination, a three-rinse cleanout was conducted, with treatments consisting of each possible combination of cleaner (C) (Wipeout, Helena) and water (W) rinses. During each rinse, the solution was recirculated through the system for 15 minutes and samples were collected for both field and lab analysis. Once the sprayer was cleaned using the triple rinse procedure it was filled with an 867 g ae ha^{-1} rate of glyphosate (Roundup Powermax), and another sample was collected. All samples were sprayed over actively growing non-dicamba tolerant soybeans (*Glycine max* L.) at the R1 growth stage. Visual ratings for phytotoxicity were taken 7, 14, 21, and 28 DAT 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 cleanout efficacy. Plants were harvested at the end of the growing season for yield. All data were analyzed in SAS 9.4 using the PROC GLIMMIX procedure. Means were separated using Fisher's Protected LSD at α=0.05. Data reveal that no differences exist among cleanout sequences in terms of visual plant injury, percent height reduction and percent yield reduction at 28 days after treatment (DAT) relative to the untreated check. At the glyphosate rinse timing all sequences yielded less than 13% visual injury and were not different than the untreated check. During the first rinse plant height reductions average 35% across all sequences. Following the first rinse no differences in plant height reduction exist among sequences compared to the untreated check. Yield reductions at the glyphosate rinse were less than 11%, and no differences were present among sequences and the untreated check. HPLC analysis show a reduction in dicamba concentration following each rinse, and by the third rinse all samples had less than 1 part per million (PPM) dicamba remaining, with no differences among sequences. Results from this study indicate that addition of multiple cleaner rinses does not improve cleanout efficacy, and that a three rinse cleanout utilizing only water rinses performed as well as all other sequences containing commercial tank cleaners.

GLYPHOSATE-RESISTANT RAGWEED PARTHENIUM (PARTHENIUM HYSTEROPHORUS L.) CONFIRMED IN TEXAS, USA. S. Singh*[1], V. Singh[1], N. Subramanian[1], J. McGinty[2], M. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX; [2]Texas A&M AgriLife Research, Corpus Christi, Texas (7)

ABSTRACT

Ragweed parthenium (*Parthenium hysterophorus* L.) is a troublesome and noxious weed in Texas. This species has been mostly colonizing roadsides but in-field infestations are increasingly common, with some biotypes suspected to exhibit resistance to glyphosate. A field survey was conducted across the Lower and Upper Gulf Coast regions of Texas in 2017 and a total of 30 populations were collected for resistance testing. Bioassays were conducted at the Norman Borlaug center greenhouse facility at Texas A&M University, College Station. First, seedlings (4-6 leaf) were treated with recommended field rate (1x) of glyphosate (868 g ae ha^{-1}). The initial screening was then followed by a dose-response assay with eight rates (0.125, 0.25,0.5, 1, 2, 4, 8, and 16x) for the highly resistant ragweed parthenium population and six rates (0.125, 0.25, 0.5, 1, 2, and 4x) for the susceptible standard (SUS). The dose-response experiment was conducted in a completely randomized design with 3 replications and 15 plants per replication, and the experiment was repeated over time. Plant injury was recorded at 21 days after treatment on a scale of 0-100% where 100% indicates complete plant death. Forty-six percent of the populations (14 of 30) were completely controlled with glyphosate. Seven populations had an average injury of 85%, whereas the remaining 9 populations had survivors with different levels of injury ranging from 35 - 70%. In the dose-response assay, the glyphosate-resistant (GR) population had an ED_{50} value of 2,387 g ha^{-1} that corresponds to a 40-fold resistance level compared to SUS. Further, the resistant plants had 10-75 more copies of the 5-enolpyruvylshikimate-3-phosphate synthase (*EPSPS*) gene compared to SUS. However, partial sequence analysis of *EPSPS* in the GR population did not reveal any of the known resistance-conferring mutations. Results confirm the occurrence of glyphosate resistance in ragweed parthenium populations in Texas and highlight the need for proactive measures for resistance management.

RICE TOLERANCE TO SEQUENTIAL APPLICATIONS OF FLORPYRAUXIFEN-BENZYL.

H.E. Wright*[1], J.K. Norsworthy[1], G.L. Priess[1], R.C. Scott[2], T. Barber[3], J. Ellis[4]; [1]University of Arkansas, Fayetteville, AR, [2]Univ of Arkansas Coop Extn, Lonoke, AR, [3]University of Arkansas, Lonoke, AR, [4]Dow AgroSciences, Sterlington, LA (8)

ABSTRACT

Florpyrauxifen-benzyl is a synthetic auxin herbicide from Corteva Agriscience™ released for commercial use in 2018. It has a unique site of action which allows it to control troublesome weeds in rice production such as barnyardgrass (*Echinochloa crus-galli*) and hemp sesbania (*Sesbania herbacea*). However, little research has been conducted to determine varietal responses to florpyrauxifen-benzyl. Field trials were conducted in 2018 at the Pine Tree Research Station (PTRS) and the Rice Research and Extension Center (RREC) to evaluate varietal tolerance to sequential applications of florpyrauxifen-benzyl. A long grain cultivar, “CL111”, a medium grain cultivar, “CL272”, and a hybrid cultivar, “CLXL745”, were used in this experiment. Once rice reached the 2- to 3-leaf growth stage, florpyrauxifen-benzyl was applied at 30 or 60 g ai ha^{-1}. A second application was made 4, 11, 14, and 20 days after the first application at RREC and 5, 13, 18, and 21 days at RTRS at 30 or 60 g ai ha^{-1}. Visible injury ratings were taken 2 weeks after the second application and yield data were collected at harvest. The hybrid variety was injured as much as 63% injury, while the long grain cultivar was injured no more than 12%. Yields for the hybrid variety at PTRS were lower than the nontreated control for all application timings. At RREC there was no difference in yield between the nontreated and treatments where the second application was made 4 days after the first. However, yields of all other timings were significantly lower. Results from these experiments indicate that more time between applications results in less injury and the herbicide may pose a greater risk for injury to hybrid than in-bred long grain or medium grain varieties.

UTILIZING HERBICIDE RESISTANT COTTON TO CONTROL PPO-RESISTANT PALMER AMARANTH POSTEMERGENCE. W. Coffman*[1], T. Barber[2], J.K. Norsworthy[1], M.C. Castner[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (9)

ABSTRACT

Since the discovery of PPO (protoporphyrinogen oxidase) inhibitor-resistant Palmer amaranth (*Amaranthus palmeri*) in Arkansas, it has been observed that some populations of PPO-resistant Palmer amaranth are harder to control with herbicides labeled for postemergence (POST) use in cotton (*Gossypium hirsutum*). To determine if herbicides commonly used postemergence (POST) in cotton were still viable control options for PPO-resistant Palmer amaranth, a non-irrigated field experiment was conducted in Marion and Crawfordsville, AR in 2018. The experiment evaluated the efficacy of dicamba, 2,4-D, and glufosinate applied in combination with *S*-metolachlor, acetochlor, or dimethenamid-P. All plots were non-crop and contained 7.5- to 10-cm tall Palmer amaranth at Marion and 10- to 13-cm tall Palmer amaranth at Crawfordsville at the time of treatment. Both locations were arranged as a randomized complete block with four replications. Visible Palmer amaranth control was evaluated at 2 and 4 weeks after treatment (WAT) and Palmer amaranth density m^{-2} at 4 WAT was measured by counting surviving plants in two 0.5 m^{-2} quadrats. In addition to analysis of variance, orthogonal contrasts were conducted to determine if adding a chloroacetamide herbicide to any treatment affected Palmer amaranth control or density. Applications were made late in the day at Crawfordsville, which likely caused an overall reduction in Palmer amaranth control, especially with glufosinate, compared to 2,4-D and dicamba. At Marion, treatments were applied mid-day and greater control with all treatments was observed. All treatments, except 2,4-D, 2,4-D + acetochlor, and glufosinate + acetochlor, provided greater than 90% Palmer amaranth control 4 WAT. At Marion, dicamba and dicamba + acetochlor provided 94% control 4 WAT, which was the highest numerical value for weed control at that rating. At Crawfordsville, dicamba + acetochlor again provided the highest numerical value for weed control 4 WAT at 71%. Contrasts showed that there was no benefit to adding a chloroacetamide herbicide to any of the foliar-active herbicides tested. New Palmer amaranth emergence was likely limited due to a lack of rainfall at both locations during this experiment.

EVALUATION OF WEED CONTROL PROGRAMS IN GRAIN SORGHUM WITH MINIMAL OR NO ATRAZINE. J.T. Richburg*[1], J.K. Norsworthy[1], Z.D. Lancaster[1], J. Patterson[2]; [1]University of Arkansas, Fayetteville, AR, [2]Auburn University, Auburn, AL (11)

ABSTRACT

Atrazine has a high efficacy on a broad-spectrum of weeds, as well as utility when applied preemergence or postemergence, which has built atrazine as a foundational herbicide in corn. In 2016, over 35 million kilograms of atrazine were applied to United States croplands. The extensive use of this herbicide by growers has led to traces of atrazine being found in groundwater, surface water, and aquifers. Given these findings, the EPA is considering banning or limiting atrazine use to only 560 g/ha/year, potentially taking away a valuable tool for growers. Hence, research was initiated in Fayetteville, AR in 2017 and 2018 to explore different corn herbicide regimes with little or no atrazine. Various preemergence and postemergence herbicides were applied alone or in combination with atrazine at 560 g $ha^{-1}$to Roundup Ready/Liberty Link corn directly after planting or at 30 cm corn, respectively. Each postemergence treatment was mixed with labeled rates of glyphosate and glufosinate to resemble practical treatments that are common in Arkansas. Palmer amaranth control and visible injury ratings were collected throughout the year, and grain yield was collected at harvest. Palmer amaranth control never fell below 95%, so it was not formally analyzed. All other data were subjected to analysis of variance by year given the two unique environments. In both years, saflufenacil plus dimethenamid caused higher injury than *S*-metolachlor 14 days after the preemergence application. In 2017 and 2018, thiencarbazone plus isoxaflutole caused 15 and 11% injury, respectively, which was higher injury than all other treatments. Postemergence atrazine had no effect on injury in either year. Corn yield in 2018 was not affected by any factor. In 2017, preemergence herbicide, postemergence herbicide, and atrazine all had an effect on yield, with bicyclopyrone plus mesotrione plus *S*-metolachlor-containing treatments all yielding >12,000 kg ha^{-1}. Based on this research, Palmer amaranth can be controlled at this location without atrazine, and there are herbicide options available that while slightly injuring the corn, will not cause yield loss. Future research should be focused on testing these treatments on a more diverse weed population.

GROWER PERSPECTIVES AND PRACTICES ON PASTURE AND HAYFIELD WEED MANAGEMENT IN VIRGINIA. W.C. Greene*[1], M.L. Flessner[2], K. Pittman[3]; [1]Virginia Tech, Virginia Tech, VA, [2]Virginia Tech PPWS Dept., Blacksburg, VA, [3]Virginia Tech, Blacksburg, VA (12)

ABSTRACT

Weed management is a critical component of pasture and hayfield management in order to maximize desirable forage production, animal performance, and economic return. To more effectively serve producers a survey was conducted by Virginia Cooperative Extension (VCE) across the state of Virginia to gain insight on the weed management practices, issues that growers consider most problematic, and growers' preferred source of information. The survey was conducted between December 2016 and June 2017 with 155 respondents from 65 counties. Growers were asked to provide input on topics such as: most troublesome weed species, desirable forage species, types of livestock managed, number of acres managed, weed control practices, frequency of herbicide applications, sources of weed control information, as well as questions related to extension outreach such as preferred method of receiving information, and the importance of certain issues to producers. Nearly 40% of respondents were responsible for managing less than 500 acres with 41% of respondents being beef cattle producers. The two most troublesome weeds, by a wide margin, were horsenettle and various thistles. Routinely scouting pastures and applying herbicides were the two most commonly implemented weed control practices by producers, used by 79 and 86% of respondents, respectively. Only 13% of respondents reported making herbicide applications prior to emergence, in anticipation of weed problems from the previous years, whereas 45% of respondents reported making herbicide applications after noticing germinating weeds and waiting a short time for more to germinate. The most preferred methods of receiving weed control information were through extension efforts such as field days, demonstrations, and extension publications. The results of this survey will be helpful in prioritizing VCE research needs and extension delivery methods, ultimately to best serve producers throughout the Commonwealth.

HERBICIDE CARRYOVER TO VARIOUS FALL PLANTED COVER CROP SPECIES.

L.S. Rector*[1], M.L. Flessner[2], K. Pittman[1], K.W. Bamber[1], S.C. Beam[1]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech PPWS Dept., Blacksburg, VA (13)

ABSTRACT

Higher cover crop biomass, which is achieved most effectively through an early planting date, is positively correlated with greater summer annual weed control. However, planting early increases the risk for herbicides used during the cash crop growing season to persist in the soil and reduce cover crop establishment. Research was conducted to evaluate the potential for various herbicides to carryover and injure common cover crops used in Virginia.

Studies were conducted in Blacksburg, Virginia on a Ross silt loam and Suffolk, Virginia on a Kenansville loamy sand in 2016 and 2017. A randomized split block design with 4 replications was utilized with herbicide as the main plot and cover crop species as the sub plot. Plots were 3 by 9.1 m and contained two rows each of 10 different cover crops drilled at 16.5 cm apart. Herbicides that are typically or must be applied before crop emergence (PRE) were applied on ~June 1st, and residual herbicides that can be applied after crop emergence (POST) were applied on ~July 1st. Treatments were applied to bare ground using a 4 nozzle 1.83 m hand boom. Cover crops were planted September 1st. Cover crop species were wheat, barley, cereal rye, oats, annual ryegrass, forage radish, Austrian winter pea, crimson clover, hairy vetch, and rapeseed. Treatments consisted of a nontreated control and 30 herbicides: 12 PRE herbicides and 18 POST herbicides. PRE treatments were atrazine, simazine, bicyclopyrone + mesotrione + *S*-metolachlor, pyroxasulfone, saflufenacil, isoxaflutole + thiencarbazone-methyl, linuron, metribuzin, sulfentrazone, flumioxazin, and fluometuron. POST treatments were mesotrione, acetochlor, *S*-metolachlor, dimethenamid-*P*, pendimethalin, clopyralid, primisulfuron-methyl, prosulfuron, topramezone, tembotrione, rimsulfuron, trifloxysulfuron, chlorimuron-ethyl, cloransulam-methyl, fomesafen, thifensulfuron-methyl, and imazethapyr. Cover crop visible injury was assessed by species 3 and 6 weeks after planting (WAP) on a 0 (no injury) to 100% (complete necrosis) scale. Cover crop biomass for 0.6 row meters was collected 6 WAP. Data were analyzed using JMP Pro 14 and subject to ANOVA. Due to a high amount of 0s in the visible injury ratings, preventing normality of the data, a 0, no injury, or 1, some injury, was assigned to all data points and generalized using a linear model with a binomial distribution and logit link to determine if there was a significant difference in treatments with injury and those without injury. Means for the visible injury were then separated using Tukey's $HSD_{(\alpha=0.1)}$. Means for cover crop biomass were separated using Dunnett's $Test_{(\alpha=0.1)}$ with the nontreated as the control group. Data is presented by location to capture the difference in soil type.

Crimson clover, forage radish, and canola showed the greatest visible injury among all cover crop species. Fomesafen at 0.4 kg ai ha^{-1} resulted in the greatest visible injury (24%), followed by trifloxysulfuron at 0.01 kg ai ha^{-1} (23%), on forage radish 3 WAP at Suffolk. Fomesafen (24%) was the only treatment that injured forage radish at Suffolk in 2017 6 WAP, and fomesafen resulted in the highest injury at 58% on forage radish at Kentland in 2017 6 WAP. Atrazine at 2.2 kg ai ha^{-1} resulted in 20% injury on forage radish at Kentland in 2016 6 WAP. Mesotrione at 0.1 kg ai ha^{-1} (21%) and trifloxysulfuron (26%) resulted in greater than 20% injury on crimson clover at Suffolk 3 WAP. At Suffolk in 2017 6 WAP, trifloxysulfuron resulted in

30% injury on crimson clover. Prosulfuron at 0.03 kg ai ha^{-1} resulted in 21% injury on canola at Suffolk 3 WAP. There was no significant difference detected in cover crop biomass.

CRITICAL PERIOD FOR WEED CONTROL IN FLUE-CURED TOBACCO. M. Inman*, M. Vann, D. Jordan; North Carolina State University, Raleigh, NC (15)

ABSTRACT

Field studies were conducted in North Carolina to determine the critical period for weed control (CPWC) in flue-cured tobacco. In removal (REM) treatments, weeds were allowed to compete with tobacco for 0, 2, 4, 6, 8, and 10 weeks after planting (WAP) and tobacco was kept weed-free for the remainder of the season. In the establishment treatments (EST) tobacco was maintained weed free until 0, 2, 4, 6, 8, and 10 weeks WAP; following this weeds were allowed to establish and compete for the remainder of the season. The crop was subjected to standard management practices; aside from herbicides and cultivation. The experimental design was a randomized complete block design with four replications. Natural weed infestations (broadleaf and grasses) were used for studies. The predicted CPWC in flue-cured tobacco was found to be from 4.5 and 6.5 WAT in mixed populations of both grass and broadleaf weed species. No difference in yield was observed when flue-cured tobacco was weed-free for the first 6 WAT or when weeds were removed at 6 WAT and kept clean for the remainder of the season. Yields were similar when weeds were not removed until 8 and 10 WAT compared to the season long weedy treatment. Trends with crop value and quality are consistent with trends associated with yield. In general, trends with total alkaloids and reducing sugars were similar to that of yield; higher the yield, the higher nicotine content with lower reducing sugars. The lower the yield, the lower the nicotine and higher reducing sugars. This is expected as tmts with lower yield were subjected to more weed competition; potentially reducing light and nutrient availability to the tobacco plant.

SOFT RUSH (JUNCUS EFFUSUS) MANAGEMENT IN CARPETGRASS PASTURES.

R. Strahan*[1], E.K. Twidwell[1], A.L. Granger[2], M. Voitier[1]; [1]LSU AgCenter, Baton Rouge, LA, [2]LSU AgCenter, Abbeville, LA (16)

ABSTRACT

Soft rush (*Juncus effuses*) is a clump-forming perennial plant that often infests low lying areas in Louisiana pastures. This species is commonly referred to as bull rush. It grows to a height of 2 to 5 feet, and reproduces by seeds and rhizomes. It is not a palatable species for livestock to consume. Common control methods include clipping and herbicide treatment. Clipping has been shown to provide a moderate level of control, but is not a long-term solution. Improving soil drainage has also shown to be an effective method of control, but is often cost prohibitive.

Limited research has been conducted on control of soft rush with herbicides. The objective of this study was to compare 7 herbicide treatments for control of soft rush in a pasture in southwest Louisiana composed primarily of carpetgrass (*Axonopus affinis*).

The site was a pasture located near Abbeville, LA in Vermillion Parish. Four herbicides applied broadcast included 2,4-D at 2 qt/A and 4 qt/A, sulfosulfuron at 2oz/A and halosulfuron at 2 oz/A. Three herbicide treatments spot applied on individual soft rush clumps included 2,4-D at 2% and 4% v/v, and glyphosate at 2% v/v.

Herbicides were applied on July 24, 2018. The broadcast herbicide treatments were applied using a CO2-powered backpack sprayer with an 8 ft boom and calibrated to deliver 18 GPA. Plot size was 15 ft x 50 ft. The experimental design was a randomized complete block with three replications. Percent soft rush control was determined at 36 and 77 days after treatment (DAT). Data were analyzed using ANOVA and means were separated using Fisher's Protected LSD (P=0.05).

Spot treatment of soft rush with either glyphosate or 2,4-D herbicides provided better control than broadcast applications. Spot applied 2,4-D at 4% provided significantly better control than the 2% rate at both rating dates. Broadcast applications of 2,4-D, halosulfuron, and sulfosulfuron did not provide satisfactory control of soft rush. Thorough soft rush coverage was difficult to achieve with broadcast applications, whereas spot herbicide treatments allowed for better weed coverage and improved herbicide efficacy.

THE INFLUENCE OF SEQUENTIAL ORDER OF ENLIST DUO, ENLIST ONE, AND LIBERTY ON PALMER AMARANTH CONTROL. D.C. Foster*[1], P.A. Dotray[1], K.R. Russell[1], M.L. Lovelace[2]; [1]Texas Tech University, Lubbock, TX, [2]Corteva agriscience, Lubbock, TX (17)

ABSTRACT

The southern United States produces approximately 90% of the U.S. cotton (Webster 2012), with the Texas High Plains region being the largest contiguous cotton producing region. Since 2011, Texas cotton production has been threatened by glyphosate-resistant Palmer amaranth which has led Texas producers to begin looking for alternatives to glyphosate-based systems (International Survey of Herbicide Resistant Weeds). Previous research has shown that sequential applications of 2,4-D, 2,4-D + glyphosate, and glufosinate have achieved Palmer amaranth control of >80% when applied to weeds 3 inches (Merchant et al. 2014). In 2018, a field experiment was conducted in a fallow, non-crop area in Lubbock, Texas to determine the efficacy of 2,4-D + glyphosate (Enlist Duo), 2,4-D choline (Enlist One), and glufosinate (Liberty 280 SL) on Palmer amaranth control at different weed heights when sequential order was varied. The population of Palmer amaranth resistant to glyphosate was approximately 20% at this site with a population density of >20 plants per square foot. When applications were initiated at 3-6-inch weeds, Enlist Duo and Liberty were more effective than Enlist One. All combinations of Enlist Duo, Liberty, and Enlist One controlled 3 to 6-inch weeds >90% except Enlist Duo followed by (fb) Enlist One and Enlist One fb Enlist One when evaluated 10 days after the sequential application. When evaluated 21 days after the sequential application, Enlist Duo fb Enlist Duo or Liberty, Enlist One fb Enlist Duo, and Liberty fb Enlist Duo controlled 3 to 6-inch Palmer amaranth >90%. Enlist Duo was more effective than Liberty and Enlist One at controlling 10 to 12-inch Palmer amaranth when evaluated 10 days after the initial sequential application. Only Enlist Duo fb Enlist Duo or Liberty and Liberty fb Enlist Duo controlled Palmer amaranth >90% when applied to 10-12-inch weeds. Enlist Duo fb Enlist Duo, Liberty, or Enlist One was the only sequential combination to control 10 to 12-inch Palmer amaranth >90% in this evaluation. Regardless of weed size, Enlist Duo and Liberty in either sequential order was effective at controlling Palmer amaranth. These two modes of action systems would be a suitable best management practice for herbicide resistant weed management when used in conjunction with soil residual herbicides.

A WEED SCIENCE SHORT COURSE FOR MODES OF ACTION AND HERBICIDE RESISTANCE. T. Mueller*; University of Tennessee, Knoxville, TN (18)

ABSTRACT

Weed control has faced many challenges over the years, and herbicides have greatly aided farmers and others in their efforts to reduce weed's negative effects. In broad acre crops, Glyphosate Resistant (GR) varieties have been commonly used in overly simple weed control regimes in soybeans, cotton, corn and other crops. The widespread occurrence of GR weeds has reduced the utility of GR crops, and has resulted in a renewed interest in alternate herbicide chemistries.

This poster details an educational short course to be held in 2019 that covers the various modes of action and also herbicide resistance to those various chemicals. Practical aspects of herbicide use and optimization of weed control strategies are important topics extensively covered in this course.

DICAMBA BEHAVIOR UNDER CONTROLLED CONDITIONS. T.I. Clark*, T. Mueller; University of Tennessee, Knoxville, TN (19)

ABSTRACT

Dicamba use in the United States greatly increased in 2017 and 2018 due to the need to control glyphosate-resistant weed species in dicamba-tolerant soybean and cotton cultivars. While good weed control was common, there were incidents of off-target movement of dicamba onto non-target plants. This report examines factors that affect the possible movement of dicamba following an application. Dicamba emissions following application appear to be directly related to temperature, with more dicamba emissions detected as the temperature increases. There also appears to be a minimum temperature of ~ 15°C where dicamba emissions from all formulations essentially cease to occur. The addition of glyphosate to dicamba formulations decreased the spray mixture pH and increased the observed dicamba emissions when compared with each dicamba formulation alone. The BAPMA and DGA + vapor grip formulations resulted in reduced emissions compared with DGA formulations. These data suggest emissions from the dicamba applied could contribute to dicamba movement from the point of application. Dicamba emissions can be reduced by avoiding high temperatures and not adding glyphosate to spray mixtures.

ALLELOPATHIC RICE VARIETIES FOR WEED SUPPRESSION: FIELD OBSERVATIONS. S.E. Abugho*[1], J. Samford[2], A.M. McClung[3], X. Zhou[4], M. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Research, Sealy, TX, [3]USDA-ARS, Stuttgart, AR, [4]Texas A&M AgriLife Research, Beaumont, TX (21)

ABSTRACT

Weed management is a continuous challenge in organic rice production. Allelopathic rice varieties may be a useful tool for weed suppression in organic rice, but their utility is not well studied under field conditions. Field experiments were conducted in the summers of 2017 and 2018 at the David Wintermann Rice Research and Extension Center, Eagle Lake, TX to determine the allelopathic potential of four rice varieties (Jasmine 85, Rondo, PI 312777 and PI 338046), in comparison with Cocodrie (local inbred) and XL 753 (hybrid variety). The experiment was conducted in a randomized complete block design with four replications. Hemp sesbania (*Sesbania herbacea*), barnyardgrass (*Echinochloa crus-galli*), large crabgrass (*Digitaria sanguinalis*) and broadleaf signalgrass (*Urochloa platyphylla*) were the dominant weeds in the study site. Weed cover (100% = weedy and 0% = weed-free) was obtained at 35, 45, 60, 75, and 90 days after planting (DAP). Weed biomass and rice grain yield were documented at harvest. Relative grain yield was calculated for each rice variety based on the yield obtained in the respective weed-free check. Across the two years, the least weed infestation was recorded from PI312777 (42 to 55% weed coverage) and PI338046 (32 to 66%) at 45 DAP. In contrast, XL 753 had the most weed density (76 to 100%) at 45 DAP. Further, PI 312777 had the greatest yield relative to the weed-free plots with 42% and 56% in 2017 and 2018, respectively. Results illustrate the weed suppressive potential of the PI rice varieties; they can be used as an integrated weed management tool in organic and conventional rice production systems. Further research is warranted to fully characterize and improve the yield potential of these varieties.

HYBRIDIZATION BETWEEN GRAIN SORGHUM AND JOHNSONGRASS: PRELIMINARY FINDINGS. S. Shrestha*, C. Sias, S. Ohadi, W. Rooney, G. Hodnett, M. Bagavathiannan; Texas A&M University, College Station, TX (23)

ABSTRACT

Cultivated sorghum and its weedy relative johnsongrass have the potential to cross-pollinate and produce viable hybrids. Several novel traits are being introduced into sorghum through transgenic or non-transgenic methods. The longevity and value of these traits in sorghum may be jeopardized if they are transferred to its weedy relatives, especially johnsongrass. However, knowledge is very limited on the frequency of outcrossing between the two species, particularly when johnsongrass is the pollen recipient. Field and greenhouse experiments were conducted at Texas A&M University to estimate the rate of outcrossing between grain sorghum and johnsongrass. Seeds harvested from Johnsongrass growing in Inzen™ (ALS-inhibitor resistant) grain sorghum fields in 2017 were planted in progeny rows during summer of 2018, and sprayed with nicosulfuron (ALS-inhibitor herbicide) at three- to four-leaf seedling stage. Survivors from the herbicide spray were transplanted into pots and sprayed again to confirm their survival to nicusulfuron. Polymerase chain reaction (PCR) assays were carried out to positively confirm the hybrids based on the presence of mutations specific to the Inzen ™ sorghum. Results confirmed the occurrence of the $Trp_{574}Leu$ mutation (one of the two mutations present in Inzen™) in survivors. Controlled crosses were conducted in the greenhouse where johnsongrass was treated with trifluromethanesulfonamide to induce male sterility. Male sterile Johnsongrass was then pollinated with pollen from eleven different sorghum genotypes. Mean seed set across all the genotypes was 0.045% and seed set with Inzen™ as pollen donor was 0.057%. Findings confirm the occurrence of hybridization between sorghum and johnsongrass with johnsongrass as the female parent/pollen recipient. In the future it is important to evaluate morphological and fitness characters of these hybrids. This information should also be considered while developing weed management strategies for sorghum and gene flow mitigation strategies should be considered.

SWEET POTATO RESPONSE TO SELECTED HERBICIDES. S. Chaudhari*[1], K.M. Jennings[2], M. Shankle[3], S.C. Smith[2], M.D. Waldschmidt[2], L. Moore[2], K.C. Sims[2]; [1]NCSU, Raleigh, NC, [2]North Carolina State University, Raleigh, NC, [3]Mississippi state university, Pontotoc, MS (24)

ABSTRACT

Many sweetpotato growers rely on flumioxazin (PPO herbicide) for weed control. With recent confirmation of PPO-resistant Palmer amaranth and common ragweed in North Carolina, herbicides with different mechanisms of action for weed control in sweetpotato are needed. Therefore, a study was conducted in North Carolina in 2018 to determine sweetpotato tolerance to eight herbicides applied at three application timings. In addition, studies were conducted in Mississippi in 2017 to determine the effect of glufosinate PREPLANT or POST-directed on sweetpotato. In NC, herbicide treatments included halauxifen 5 g ai/ha PREPLANT, and halauxifen 5 g/ha, bentazon 840 g/ha, tembotrione 92 g/ha, topramezone 19 g/ha, pyroxasulfone 60 g/ha, pyroxasulfone + fluthiacet 73+2.3 g/ha, pendimethalin 800 g/ha, and oryzalin 1120 g/ha applied 5 or 11 d after sweetpotato transplanting (DAP). Crop oil concentrate at 1% v/v was included with halauxifen, bentazon, and topramezone. Methylated seed oil at 1% v/v was included with tembotrione while nonionic surfactant at 0.25% v/v was include with pyroxasulfone + fluthiacet. In the glufosinate study, treatments included glufosinate at 0.65 and 1.31 kg ai/ha 2 wk before transplanting (WBP), and POST-directed at 0.65 followed by (fb) 0.65 kg/ha and 1.31 fb 1.31 kg/ha applied with a hooded sprayer in row middles. POST-directed 1 fb POST-directed 2 treatments were applied 11 days apart with the second application occurring before plants began to spread into the row middles. A weed-free check was included for comparison. In NC study, injury (stunting, chlorosis, and chlorosis) ranged from 3 to 15% from halauxifen, bentazon, tembotrione, topramezone applied 5 DAP at 1 wk after transplanting (WAP). However, injury was transient, and ≤ 3% stunting was observed 8 WAP. No differences in yield were observed among treatments. The percent incidence of internal necrosis was < 3% in no.1 roots on a severity scale of ≤ 1 regardless of herbicide or application timing. In the glufosinate study, no injury to sweetpotato was observed from glufosinate PREPLANT. However, injury was observed from glufosinate at 0.65 fb 0.65 kg/ha and 1.31 fb 1.31 kg/ha. Although no.1 and marketable yields were greatest in the weed-free check but no differences were observed among all treatments.

EFFECT OF SOIL-APPLIED HERBICIDE TIMING ON COVER CROP ESTABLISHMENT . J. Calhoun*[1], D.B. Reynolds[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (25)

ABSTRACT

Greenhouse trials were conducted in 2018 at the R.R. Foil Plant Science Research Center in Starkville, MS to investigate the timing effect of soil-applied herbicide on establishment of common cover crop species. Flats were prepared with field soil and placed in a greenhouse and subjected to 25/30 C° diurnal temperatures and 12 hour photoperiods. Soil flats were randomly assigned a treatment of herbicide and application timing. Herbicides consisted of fomesafen, pendimethalin, pyroxasulfone, S-metolachlor, acetochlor, dimethenamid, flumioxazin, clomazone, metribuzin, and sulfentrazone at recommended rates by Mississippi State Extension for medium soil types. Application timing consisted of 60, 30, 15, and 7 days before planting (DBP). Treatments were applied using a compressed air track sprayer calibrated to deliver 140 L ha^{-1} using XR11002 nozzles. Evaluations consisted of visual injury every seven days for 28 days and plant biomass 28 DAT. Plant biomass was regressed using R (version 0.98.1091, RStudio Inc., Boston, MA) and the resulting functions were used to estimate the number of days prior to planting that PRE applications resulted in no more than 10% biomass reduction. Radish crops were most sensitive to applications of flumioxazin with 10% reduction occurring at 31 days before planting (DBP). Radish crops were most tolerant to S-metolachlor with 10% reduction occurring with applications at 20 DBP. Rye crops were the most consistent with respects to sensitivity of herbicide application timing. For pyroxasulfone, fomesafen, flumioxazin, and S-metolachlor, application timings ranged from 30-34 days before planting to cause 10% biomass reduction. Application timings of flumioxazin, pyroxasulfone, fomesafen, and S-metolachlor to cause 10% biomass reduction in *Brachiaria* spp. occurred at 53, 35, 34, and 18 DBP respectively.

SPRAY VOLUME AND APPLICATION RATE OF TRIFLOXYSULFURON AFFECTS LONG-TERM DALLISGRASS CONTROL. G.M. Henry*[1], K.A. Tucker[1], J.T. Brosnan[2], G. Breeden[3]; [1]University of Georgia, Athens, GA, [2]Univ. of Tennessee, Knoxville, TN, [3]University of Tennessee, Knoxville, TN (27)

ABSTRACT

Dallisgrass (*Paspalum dilatatum* Poir.) is a problematic rhizomatous perennial weed of managed turfgrass throughout the southern United States. The presence of dallisgrass reduces turfgrass aesthetics and playability due to wide leaf blades, a clump-like growth habit, and prolific seedheads. Field experiments were conducted at the Pine Hills Golf Club (PHGC) in Winder, GA and East Tennessee AgResearch & Education Center (ETREC) in Knoxville, TN during 2016 and 2017. Research was conducted on mature infestations of dallisgrass present within bermudagrass (*Cynodon* spp.). Plots (1.5 x 1.5 m) were arranged in a randomized complete block (RCB) design with 4 replications. Herbicides were applied with a CO2 powered backpack sprayer calibrated to deliver either 407, 814, or 1,628 L ha^{-1} at 221 kPa. Herbicide treatments were initiated on September 23, 2016 at PHGC and September 20, 2016 at ETREC. Sequential applications were made on October 20, 2016 and April 7, 2017 at PHGC with sequential applications made on October 17, 2016 and April 4, 2017 at ETREC. Treatments consisted of Monument (trifloxysulfuron) at 28, 56, and 112 g ai ha^{-1} applied alone or in combination with A13617 at 35, 70, and 140 g ai ha^{-1}, respectively, at 407, 814, and 1,628 L ha^{-1}, respectively; and Tribute Total (thiencarbazone + foramsulfuron + halosulfuron) at 136 g ai ha^{-1} plus ammonium sulfate (AMS) at 1.68 kg ha^{-1} at 407 L ha^{-1}. All treatments were applied with a methylated seed oil (MSO) at 0.5% v/v. An untreated check was added for comparison. Visual ratings of % dallisgrass cover were recorded at 0, 6, and 32 weeks after initial treatment (WAIT) and converted to % control by comparing back to % cover ratings at trial initiation (0 WAIT). Analysis was conducted separately for locations. Control data were subjected to analysis of variance in SAS using error partitioning appropriate to a RCB design in the general linear models procedure. Treatment means were separated using Fisher's protected least significant difference (LSD) test at $\alpha = 0.05$. Initial dallisgrass control (6 WAIT) was greatest in response to treatments applied at spray volumes of 814 and 1,628 L ha^{-1} at both locations (≥ 64%, regardless of treatment). Control with Tribute Total 6 WAIT was 57 to 71%, regardless of location. Long-term control (32 WAIT) was greatest in response to Monument at 112 g ai ha^{-1} + A13617 at 140 g ai ha^{-1} + MSO sprayed at a volume of 1,628 L ha^{-1} (90 to 92%, regardless of location). All other Monument treatments that were sprayed at volumes of 407 and 814 L ha^{-1} resulted in dallisgrass control ≤ 78%, regardless of location 32 WAIT. Control with Tribute Total 32 WAIT was only 40% at PHGC, while control at ETREC was 84%. Use of higher rates of Monument and higher spray volumes improved dallisgrass control. This may be attributed to an increase in dallisgrass coverage during application.

HERBICIDE DESICCATION STRATEGIES FOR REDUCED SKINNING INJURY ON SPRING FRESH MARKET POTATO. F. Souza Krupek, P.J. Dittmar*, L. Zotarelli, S. Sargent, D. Rowland; University of Florida, Gainesville, FL (28)

ABSTRACT

Potato skin free-of-blemishes is still one of the major challenges that Florida potato growers deal with to deliver a consistent and marketable fresh produce. Field trials were established during the Spring of 2017 and 2018 in Hastings, FL, to evaluate the effect of desiccation timing interval on tuber yield, skin-set, and postharvest quality attributes of table-stock potato cultivars. The experiment was conducted using a split-block design, including three cultivars (‘Soraya’, ‘Red LaSoda’, and ‘Peter Wilcox’) as main plots, and three levels of diquat application timing (7, 14, and 21 days before harvest [DBH]), with four replicates. Results suggested under conditions of non-extreme rainfall events between vine kill and harvest, yield substantially increase with each weekly delay in time of vine desiccation, from 21 to 7 DBH. The high incidence of skinning injury (17 %) and the low torsional force (0.561 N·m) required do cause skinning injury when plants are not desiccated is an indication of low physical maturity level. The percentage of the tuber periderm with abrasion-type injuries increased with each weekly delay in time of vine kill, from 21 to 7 DBH. ‘Peter Wilcox’ was the most susceptible to skinning injury, following by ‘Soraya’ and ‘Red LaSoda’. Late single diquat application, 7 DBH, resulted in high losses in tuber quality during 21-day storage at 10 °C, 80-85% RH (high cumulative weight loss and incidence of vascular discoloration). Improved harvest and storage quality of fresh market potato resulted from tubers harvested more than 7 days after vine desiccation.

EVALUATION OF SOYBEAN FOR HORMETIC RESPONSE TO EXTREME LOW-DOSES OF DICAMBA. M.C. Castner*[1], J.K. Norsworthy[1], J.T. Richburg[1], M.M. Houston[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, ayetteville, AR (29)

ABSTRACT

Dicamba is a synthetic auxin herbicide commonly used in the Midsouth primarily for burndown applications or for postemergence control of broadleaf weeds in monocot crops. Broadleaf crops such as non-dicamba-resistant (DR) soybean are highly susceptible to sublethal concentrations of dicamba, which has recently been a major concern for Midsouth producers choosing to plant non-DR soybean varieties in proximity to DR cultivars. Despite the potential for dicamba to cause widespread injury to soybean at minimal rates, several studies suggest a hormetic response may be observed with extreme low-dose concentrations of dicamba. In order to evaluate soybean response to several sublethal concentrations of dicamba, a weed-free experiment was conducted in Fayetteville, Arkansas in 2018. Dicamba rates of 0.112, 0.056, 0.028, 0.014, and 0.0093 g ae ha^{-1} were applied at two growth stages, V3 and R1. Treatments were arranged as a two-factor factorial, with the first factor being dicamba rate, and the second factor being growth stage. At 21 days after treatment (DAT) when dicamba injury is optimal, a main effect of dicamba rate was documented. No more than 18% injury was observed at the highest rate of dicamba (0.112 g ae ha^{-1}). None of the R1 applications demonstrated a significant increase in visual injury regardless of rate. Biomass taken 28 DAT for V3 and R1 applications indicated no statistical differences with either dicamba rate or growth stage applied. Linear regression analysis was used for yield as well as several yield components such as pods per main stem and pods per branch. All three analyses failed to show any evidence that would suggest a hormetic or positive growth response.

IMPACT OF NITROGEN RATE AND TIMING ON WEED AND MUSKMELON EMERGENCE AND GROWTH. A. Buzanini, P.J. Dittmar*; University of Florida, Gainesville, FL (30)

ABSTRACT

Nitrogen is the mineral element that plants most require to a good productivity, knowing that, the farmers always apply N supplemental fertilization. However, this may stimulate the growth of the weeds than the crop growth, and consequently the extent that advantage for light and water. The objective of this study is to evaluate the response of N rates in three different application time for Cantaloupe melon and three weeds species (*Cyperus rotundus*, *Digitaria sanguinalis*, and *Amaranthus* spp). A greenhouse study was conducted at the Plant Science Research and Education Unit in Citra, FL. The treatments were factorial design with 4 Nitrogen rates and 3 application timing in a randomized complete block with 4 replications. The 4 N rates were 0, 50, 100 and 150 lb/acre, and the applications timing were at plating, at 50% at planting and 50% at 3 weeks after the planting, and at 3 weeks after planting. Data collected were seeding emergence at 3, 6, 9 and 12 days after planting, height at 3 and 6 weeks after planting and dry shoot mass at 9 weeks after planting. Data were analyzed with analysis of variance and means were separated with Fisher's Protected LSD. For the melon, analyzing all the evaluation, the N rates 100 and 150 lb/acre applied at the planting time, are the best for the emergence and growth of melon. For *Cyperus rotundus*, the results have some differences from the begin of the study to the end, started with some variations about rates and time and over with the conclusion that the rate is most important than application time.

PREPLANT KOCHIA CONTROL IN ENLIST COTTON. U. Torres*[1], P.A. Dotray[1], K.R. Russell[1], G.K. Flusche Ogden[1], M.L. Lovelace[2]; [1]Texas Tech University, Lubbock, TX, [2]Corteva agriscience, Lubbock, TX (31)

ABSTRACT

Kochia (*Bassia scoparia L.*) is an annual weed native to central and eastern Europe and Asia. In the United States, kochia populations have been established throughout the western and northern states and are especially prevalent in arid to semi-arid regions like the Texas Southern High Plains. Kochia is difficult to control if not managed early in the growing season. There are reports that some areas may contain herbicide-resistant populations, which adds to the complexity of designing effective and season-long weed management systems. With the introduction of the Enlist™ technology system in 2017 by Corteva Agriscience™, growers have more options to control troublesome broadleaf weeds preplant and in-season. The objective of this study was to evaluate preplant herbicide treatments for control of kochia in an Enlist™ cotton system. The study was conducted at the Texas A&M AgriLife Research and Extension Center in Lubbock, TX. Seven treatments (Valor SX® at 0.064 lb ai/A plus 2,4-D Amine at 1.0 lb ai/A; LeadOff® at 0.031 lb ai/A plus 2,4-D Amine; Starane® Ultra at 0.14 lb ai/A plus 2,4-D Amine; Valor SX® plus Roundup PowerMAX® at 1.4 lb ae/A; LeadOff® plus Roundup PowerMAX®; Starane® Ultra plus Roundup PowerMAX®; and FeXapan™ at 0.5 lb ae/A plus Roundup PowerMAX®) were applied with a CO_2 pressurized backpack sprayer 45, 30, and 15 days before planting. Kochia was controlled ≥92% at planting following all 45 and 30 DBP treatments except Valor SX® plus Roundup PowerMAX®. Only FeXapan™ + Roundup PowerMAX® controlled kochia ≥90% at planting when applied 15 days before planting. FeXapan™ + Roundup PowerMAX® injured cotton (delayed emergence, reduced stand, plant stunt, visual phytotoxicity), which was not surprising since the planted technology was Enlist™ cotton and this treatment was included for efficacy comparisons only. No other treatment caused cotton injury. Blanket in-season treatments included Enlist Duo® early-postemergence, cultivation, and diuron postemergence-directed to control kochia and other weeds in-season. No differences in lint yield were observed following any preplant treatment.

ON A KNIFE EDGE: CONSERVATION AGRICULTURE AND TROUBLESOME WEED CONTROL. A.J. Price*; USDA-ARS, Auburn, AL (32)

ABSTRACT

Conservation tillage, after being widely adopted in the past few decades, is now threatened by the development of herbicide resistant weeds. Of the 157.7 million ha of cropland across the United States (U.S.) in 2012, approximately 127.5 million ha were harvested. Roughly 44% of total cropland area used conservation tillage practices, including no-tillage. In 1989, there were approximately 0.34 ha of conservation tillage for every hectare of conventional tillage, including reduced tillage. By 2012, the ratio had grown to 1.64 ha of conservation tillage for every hectare of conventional tillage. New technology, such as herbicide-resistant crops, greatly helped to increase the adoption rate of conservation tillage practices, yet current herbicide-resistant and troublesome weed challenges are a real and expanding threat to conservation tillage. Producers are faced with difficult management decisions regarding herbicide-resistant and troublesome weeds. Despite many of these ha currently being under United States Department of Agriculture (USDA) – Natural Resources Conservation Service (NRCS) conservation program contracts, the difficulty of controlling herbicide-resistant weeds places many ha at risk of being converted to higher-intensity tillage systems. The shift to higher-intensity tillage facilitates burial of small weed seed and/or the increase of pre-emergence and pre-plant incorporated herbicide activity to control problematic weeds, especially in dry-land crop production. However, in the past decade in the U.S., there has been a renewed interest in cover crops and their management for both carbon sequestration and agronomic purposes. Starting in the mid-1990s, scientists at the USDA – Agriculture Research Service (ARS) National Soil Dynamics Laboratory in Auburn, Alabama initiated research using a Brazilian style cover crop management technique utilizing a roller-crimper, in conjunction with herbicides, to terminate mature cover crops. High residue cover crops are increasingly being incorporated into integrated pest management recommendations to help alleviate herbicide resistance selection pressure through their weed suppressive characteristics.

EVALUATION OF FLURIDONE IN PEANUT. K.J. Price*, S. Li; Auburn University, Auburn, AL (33)

ABSTRACT

As PPO and ALS inhibitor resistant weed species continue to expand in the southeast, peanut producers need to utilize a new mode of action to control these weeds and prevent further resistance from developing. Fluridone, a PDS carotenoid biosynthesis inhibitor, has a mode of action new to peanut but not currently labeled in peanut. Further research needs to be conducted on peanut response and tolerance to fluridone to determine if it is a viable option for weed control in peanut. Therefore, the objective of this study was to evaluate Georgia 06G peanut tolerance to fluridone alone and tank mixes with frequently used preemergent herbicides. In 2018, field studies were conducted in Henry and Escambia County in Alabama. Herbicide treatments included fluridone at 168 and 336 g ai ha^{-1} on its own as well as tanked mixed with flumioxazin, diclosulam, acetochlor, and pendimethalin at 1X and 2X of the label rates. Experiments were conducted as completely randomized block designs with 4 replications at each location. Henry County was under irrigation while Escambia County was dryland. Peanuts were planted June 6 and June 5, 2018 in Henry and Escambia County, respectively. Treatments were applied the day for planting with Teejet TTI110025 nozzles calibrated at 20 GPA output with a hand held boom. Peanut growth parameters including stand count, plant heights and widths were collected 3 and 7 weeks after planting as well as yield of each plot at harvest. Fluridone did not cause any significant reductions of stands or plant height and width reductions. Fluridone also did not cause any significant yield loss at either location. Overall, our data suggests Georgia 06G is tolerant to fluridone up to 336 g ai ha^{-1} and is a promising option for tank mixing with other preemergent herbicides for weed control in peanut.

BROADLEAF WEED CONTROL IN RICE WITH SAFLUFENACIL-BASED HERBICIDE MIXTURES. H.M. Edwards*[1], B. Lawrence[1], T.L. Sanders[2], J.D. Peeples Jr.[3], N.G. Corban[1], J.A. Bond[4]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University: Delta Research & Extension Center, Stoneville, MS, [3]Delta Research and Extension Center, Stoneville,, MS, [4]Delta Research and Extension Center, Stoneville, MS (34)

ABSTRACT

Although grass species are often the most troublesome weeds of rice (*Oryza sativa* L.) in the midsouthern U.S., broadleaf weeds species can also be problematic. Halosulfuron plus prosulfuron (Gambit) is an acetolactate synthase (ALS) herbicide for broadleaf and sedge control in rice, corn (*Zea mays* L.), and grain sorghum (*Sorghum bicolor* L.). Saflufenacil (Sharpen) applied preplant or PRE has become a foundation treatment for Palmer amaranth (*Amaranthus palmeri* S. Wats.) control in Mississippi rice. Mixtures of halosulfuron plus prosulfuron with saflufenacil could improve spectrum of control with PRE treatments. Research was conducted to compare residual control of broadleaf weeds with halosulfuron plus prosulfuron or imazosulfuron applied with different rates of saflufenacil.

Research was established in 2018 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate residual control of broadleaf weeds with PRE applications of different herbicide mixtures. The soil texture was a Sharkey clay with a pH of 7.5 and 2.4% organic matter. Treatments were arranged in a two-factor factorial within a randomized complete block design with four replications. Factor A was ALS herbicide and consisted of no ALS herbicide, halosulfuron plus prosulfuron at 0.099 lb ai/A and imazosulfuron (League) at 0.3 lb ai/A. Factor B was saflufenacil rates of 0, 0.022, 0.045, and 0.067 lb/A. All treatments included glyphosate (Roundup Powermax II) at 1.13 lb ae/A, clomazone (Command) at 0.375 lb ai/A, methylated seed oil at 1% v/v, and ammonium sulfate at 2.5% v/v. Control of Palmer amaranth, hemp sesbania [*Sesbania herbacea* (P. Mill.) McVaugh], and ivyleaf morningglory (*Ipomoea hederacea* Jacq.) was visually estimated 21 d after treatment (DAT). Data were subjected to ANOVA and means were separated with Fisher's protected LSD at $p \leq 0.05$.

Palmer amaranth control 21 DAT was ≤71% with halosulfuron plus prosulfuron or imazosulfuron applied alone. The addition of saflufenacil at 0.022, 0.045, and 0.067 lb/A improved Palmer amaranth control with both ALS herbicides. However, mixtures of halosulfuron plus prosulfuron with all three rates of saflufenacil controlled Palmer amaranth similar to the same saflufenacil treatments applied alone. Saflufenacil at 0.067 lb/A was required for Palmer amaranth control ≥84% with imazosulfuron-based treatments. Halosulfuron plus prosulfuron or imazosulfuron alone controlled more hemp sesbania than all three rates of saflufenacil alone. Hemp sesbania control was greater following halosulfuron plus prosulfuron alone compared with imazosulfuron alone. The addition of any rate of saflufenacil to halosulfuron plus prosulfuron did not improve hemp sesbania control over the ALS herbicide alone. Additionally, hemp sesbania control was reduced when all rates of saflufenacil were added to imazosulfuron. Mixtures of imazosulfuron with saflufenacil at any rate controlled more hemp sesbania than the same rates of saflufenacil applied alone. However, control with these mixtures was ≤59% and less than that from mixtures of halosulfuron plus prosulfuron with

saflufenacil. Similar to hemp sesbania, halosulfuron plus prosulfuron alone controlled ivyleaf morningglory better than imazosulfuron alone. Compared with the ALS herbicides applied alone, ivyleaf morningglory control was not improved with any mixture of saflufenacil and halosulfuron plus prosulfuron or when saflufenacil at 0.022 or 0.045 lb/A was added to imazosulfuron. Saflufenacil at 0.067 lb/A was required with imazosulfuron for ivyleaf morningglory control similar to that observed with mixtures of halosulfuron plus prosulfuron with any rate of saflufenacil.

Saflufenacil at 0.045 lb/A is recommended PRE with glyphosate and clomazone for residual control of Palmer amaranth in Mississippi rice. In the current research, saflufenacil at 0.045 lb/A controlled Palmer amaranth and ivyleaf morningglory 91 and 89%, respectively, 21 DAT. However, hemp sesbania control was only 33% with saflufenacil at 0.045 lb/A. Control of hemp sesbania and ivyleaf morningglory were optimized following halosulfuron plus prosulfuron alone; however, Palmer amaranth control with that treatment was only 71%. A mixture of halosulfuron plus prosulfuron with saflufenacil at 0.045 lb/A was required for control of all three species evaluated. Mixtures of imazosulfuron with saflufenacil should be avoided where hemp sesbania is problematic.

RAINFALL TIMING EFFECTS ON PRE-EMERGENCE HERBICIDE EFFICACY IN SOYBEAN. P.H. Urach Ferreira[1], L.H. Merritt*[1], D.B. Reynolds[1], T. Irby[1], W.L. Ralston[2], G. Kruger[3], J. Ferguson[1]; [1]Mississippi State University, Mississippi State, MS, [2]Bear's Best Atlanta, Suwanee, GA, [3]University of Nebraska-Lincoln, North Platte, NE (35)

ABSTRACT

Pre-emergence (PRE) herbicide weed control success is affected by environmental factors, namely rainfall. Two greenhouse experiments were conducted in 2017 and in 2018, studying the effect of simulated rain at two, four and eight days after herbicide application (DAA). Applications were made over weed species treated with five PRE herbicides and sprayed with three different nozzle types. The five herbicide treatments used were clomazone at 1122 g ha^{-1}, imazethapyr at 70 g ha^{-1}, metribuzon at 701 g ha^{-1}, pendimethalin at 1062 g ha^{-1}, and pyroxasulfone at 178 g ha^{-1}. Nozzles tested were: XR 11002, ULD 12002, and TTI 11002. Water was applied using the rainfall simulator in a research track sprayer at 10 mm and three timings were tested: 2 DAA, 4 DAA, and 8 DAA. Herbicide type was significant for grass and broadleaf control. For grass control, all herbicides produced significantly lower dry weights compared to the untreated check across rainfall timings. Clomazone had the lowest dry weight but was not significantly different than the other herbicides. For broadleaf control, pendimethalin had the least effect on dry weight biomass at the 2 and 4 DAA rainfall timings. Rainfall timing had a significant effect on broadleaf weed control, but not on grass control. The 8 DAA rainfall timing resulted in the lowest dry weights compared to the 2 DAA rainfall timing. Nozzle type had no significant effect on grass and broadleaf dry weights which showed that droplet size was not a factor in herbicide efficacy across rainfall timings.

PEANUT RESPONSE TO MULTIPLE SIMULATED OFF-TARGET EVENTS OF DICAMBA + GLYPHOSATE. E.P. Prostko*; University of Georgia, Tifton, GA (36)

ABSTRACT

Cotton and peanuts are the major row crops grown in Georgia. Since both are grown in close proximity, off-target movement of pesticides is a concern. In 2017 and 2018, XtendFlex® (dicamba-tolerant) varieties were planted on 65% and 81% of the total cotton acreage. Previous research has demonstrated that peanuts have adequate tolerance to single exposure events of low rates of dicamba or glyphosate. However, limited research has been conducted on multiple exposure events with combinations. Therefore, the objective of this research was to evaluate the response of peanuts to multiple low rate applications of dicamba + glyphosate tank-mixtures. A small-plot, replicated field trial was conducted in 2018 at the UGA Ponder Research Farm near Ty Ty, Georgia. 'GA-06G' peanut were planted in twin rows on April 30. In a randomized complete block design with 4 replications, dicamba (Xtendimax® with VaporGrip®) + glyphosate (Roundup PowerMax®) were applied at 1/50th X rates at various timings including the following: 30 days after planting (DAP), 60 DAP, 90 DAP, 30 + 60 DAP, 30 + 90 DAP, 60 + 90 DAP, and 30 + 60 + 90 DAP. 1X rates of Xtendimax® 2.9SL and Roundup PowerMax® 5.5SL are 22 oz/A and 32 oz/A, respectively. Peanut stages of growth at the time of application were as follows: 30 DAP = V6; 60 DAP = R3-R4 (beginning pod to full pod); and 90 DAP = R6 (full seed). All treatments were applied using a CO_2-powered, backpack sprayer calibrated to deliver 15 GPA @ 45 PSI and 3.5 MPH using 11002AIXR nozzles. The plot area was maintained weed-free using a combination of hand-weeding and labeled herbicides (bentazon, diclosulam, imazapic, paraquat, pendimethalin, s-metolachlor, and 2,4-DB). All data were subjected to ANOVA and means separated using Tukey's HSD Test (P=0.10). At 1/50th X rates, only typical dicamba injury symptoms were observed (stem epinasty, leaf strapping, and leaf rolling). Peanut stunting was ≤ 10%. Dicamba symptomology was less obvious as the season progressed. At 108 DAP, only peanuts that received 90 DAP applications were exhibiting dicamba injury symptoms. Peanut yields were not significantly reduced by dicamba + glyphosate combinations. However, peanut grade was reduced (2.6-3.0%) with dicamba + glyphosate applied at 60 and 60 + 90 DAP.

EFFICACY OF ENLIST DUO, ENLIST ONE, AND FEXAPAN FOR CONTROL OF GLYPHOSATE-RESISTANT PALMER AMARANTH. T. Bararpour*[1], R.R. Hale[2], L. Walton[3], J.A. Bond[2]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Corteva Agriscience™, Agriculture Division of DowDuPont™, Indianapolis, IN (37)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) control has become a major problem because of its tendency to evolve herbicide resistance, resulting in reduced herbicide options for weed control in many crops. A field study was conducted in 2018 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate the efficacy of Enlist Duo, Enlist One, and FeXapan for control of glyphosate-resistant (GR) Palmer amaranth. At the time of herbicide applications there were three Palmer amaranth sizes: 3- to 4-, 5- to 6-, and 7- to 8-inches. Treatments were arranged in a randomized complete block design. Herbicide treatments included: 1) Enlist Duo (2,4-D choline + glyphosate) at 56 fl oz/A; 2) Enlist Duo at 75 fl oz/A; 3) Enlist One (2,4-D choline) at 32 fl oz/A + Liberty (glufosinate) at 29 fl oz/A; 4) Enlist One + Durango DMA (glyphosate) at 32 fl oz/A; 5) Enlist One + Liberty + EverpreX (*S*-metolachlor) at 16 fl oz/A; 6) Roundup WeatherMax (glyphosate) at 32 fl oz/A; 7) Liberty; 8) FeXapan (dicamba) at 22 fl oz/A + Roundup WeatherMax; 9) Roundup WeatherMax + FeXapan + EverpreX; 10) Enlist One; and 11) FeXapan. A nontreated check was included.

Roundup WeatherMax did not provide any level of GR Palmer amaranth control (0%). All treatments provided 90 to 100% control of 3- to 4-inch glyphosate-resistant (GR) Palmer amaranth except Liberty treatment (84%) by 5 wk after treatment (WAT). Treatments 3, 8, 9, and 11 were the only treatments that provided > 90% control of 5- to 6-inch GR Palmer amaranth. All other treatments provided 83 to 88% control of 5- to 6-inch Palmer amaranth except treatment 1 (79%), and treatment 7 (69%). Glyphosate-resistant Palmer amaranth ≥ 7 inches were difficult to control. Only treatments 9 provided 89% (highest) control of 7- to 8-inch GR Palmer amaranth 5 WAT. Palmer amaranth (≥ 7 inches) control was 63, 71, 76, 69, 75, 0, 55, 79, 73, and 81% for treatments 1,2, 3, 4, 5, 6, 7, 8, 10, and 11, respectively. Overall, Roundup WeatherMax + FeXapan + EverpreX was the best treatment for GR-Palmer amaranth (< 6-inch) control.

EFFICACY OF ENLIST DUO, ENLIST ONE, AND FEXAPAN FOR CONTROL OF GLYPHOSATE-RESISTANT HORSEWEED. T. Bararpour*[1], R.R. Hale[2], L. Walton[3], J.W. Seale[1], H.M. Edwards[1], J.D. Peeples Jr.[4], T. Sanders[5]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Corteva Agriscience™, Agriculture Division of DowDuPont™, Indianapolis, IN, [4]Delta Research and Extension Center, Stoneville,, MS, [5]Mississippi State University, Stonevill, MS (38)

ABSTRACT

Horseweed (*Conyza canadensis*) is a winter annual weed that is problematic in many agricultural systems, particularly no-till systems. In Mississippi, there are populations of horseweed that are resistant to glyphosate or paraquat, or both. A field study was conducted in 2018 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate pre-plant burndown herbicides on horseweed control. At the time of herbicide applications there were three horseweed sizes: 3- to 4-, 5- to 6-, and 7- to 8-inches. Treatments were arranged in a randomized complete block design. Herbicide treatments included: 1) Enlist Duo (2,4-D choline + glyphosate) at 56 fl oz/A; 2) Enlist Duo at 75 fl oz/A; 3) Enlist One (2,4-D choline) at 32 fl oz/A + Liberty (glufosinate) at 29 fl oz/A; 4) Enlist One + Durango DMA (glyphosate) at 32 fl oz/A; 5) Enlist One + Liberty + EverpreX (*S*-metolachlor) at 16 fl oz/A; 6) Roundup WeatherMax (glyphosate) at 32 fl oz/A; 7) Liberty; 8) FeXapan (dicamba) at 22 fl oz/A + Roundup WeatherMax; 9) Roundup WeatherMax + FeXapan + EverpreX; 10) Enlist One; and 11) FeXapan. An untreated check was included.

All treatments provided 93 to 100% control of 3- to 4-inch horseweed by 7 wk after treatment (WAT). Treatments 8 and 9 were the only treatments that provided 100% control of 5- to 6-inch horseweed. All other treatments provided 89 to 98% control of 5- to 6-inch horseweed except treatment 7 (86%) and treatment 10 (85%). Horseweed ≥ 7 inches were difficult to control. Only treatments 8 and 9 provided 95 to 100% control of 7- to 8-inch horseweed 7 WAT. Horseweed (≥ 7 in) control was 76, 78, 74, and 72% for treatments 3, 5, 7, and 10, respectively. All other treatments provide 81 to 90% control of horseweed (≥ 7 in) 7 WAT. Overall, treatment 8 (FeXapan + Roundup WeatherMax) and 9 (Roundup WeatherMax + FeXapan + EverpreX) provided 100% control of 3- to 6-inch horseweed (prevented horseweed seed production). Also, these treatments provided 95 (trt. 8) and 100% (trt. 9) control of 7- to 8-inch horseweed.

EVALUATION OF RESIDUAL HERBICIDES FOR BROAD SPECTRUM WEED CONTROL IN MISSISSIPPI PEANUT. T. Bararpour*[1], J. Gore[1], R.R. Hale[2], D. Cook[3]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University, Stonevill, MS (39)

ABSTRACT

Weed control is one of the greatest problems facing peanut (*Arachis hypogaea*) producers because weeds interfere with peanut for light, moisture, and nutrients. A field study was conducted in 2018 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate residual herbicides for broad spectrum weed control in Mississippi Peanut. Peanut (Georgia-D6G) was planted at a seeding rate of 8 seeds ft^{-1} on May 09, 2018 and emerged on May 15. Plot size was 13 ft wide by 20 ft long. The plot area contained Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), broadleaf signalgrass (*Urochloa platyphylla*), barnyardgrass (*Echinochloa crus-galli*), velvetleaf (*Abutilon theophrasti*), and hemp sesbania (*Sesbania herbacea*). The study was designed as a randomized complete block with 16 treatments and four replications. Treatments were as follows: 1) Prowl (pendimethalin) at 2 pt/A; 2) Valor (flumioxazin) at 2 oz/A; 3) Valor at 3 oz/A; 4) Dual Magnum (*S*-metolachlor) at 1.5 pt/A; 5) Dual Magnum at 2 pt/A; 6) Warrant (acetochlor) at 2 qt/A; 7) Zidua SC (pyroxasulfone) at 2.5 fl oz/A; 8) Zidua SC at 3 fl oz/A; 9) Strongarm (diclosulam) at 0.3 oz/A; 10) Strongarm at 0.45 oz/A; 11) Valor at 3 oz/A + Dual Magnum at 1.5 pt/A; 12) Zidua SC at 2.5 fl oz/A + Dual Magnum at 1.5 pt/A; 13) Warrant at 2 qt/A + Dual Magnum at 1.5 pt/A; 14) Strongarm at 0.45 oz/A + Dual Magnum at 1.5 pt/A; 15) Valor at 3 oz/A + Zidua SC at 2.5 fl oz/A; 16) nontreated check. All treatments applied preemergence (PRE).

There was no peanut injury from any herbicide applications from 1 to 10 weeks after emergence (WAE). All herbicide treatments provided 84 to 97% control of barnyardgrass except treatments 2 and 3 (78 to 79%) at 6 WAE. Treatments 5 and 12 provided excellent control (98 to 99%) of broadleaf signalgrass. Valor alone applications provided only 76 to 80% (lowest) control of broadleaf signalgrass. All other treatments provided to 80 to 95% broadleaf signalgrass control. All treatments provided 84 to 100% (not significant = NS) control of pitted morningglory, 95 to 100% (NS) control of prickly sida, and 86 to 100% (NS) control of velvetleaf. Hemp sesbania control was 69, 93, 99, 81, 91, 91, 88, 85, 84, 95, 85, 85, 90, 93, and 98% from treatment 1 through 15 at 6 WAE, respectively. Palmer amaranth was a difficult weed to control. Treatment 1 through 15 provided 63, 80, 81, 66, 68, 45, 61, 73, 68, 34, 86, 73, 61, 66, and 86% at 6 WAE, respectively. Based on this study, treatments 11 (Valor + Dual Magnum), 12 (Zidua SC + Dual Magnum), and 15 (Valor + Zidua SC) were the best applications in terms of longer residual activity and broad spectrum weed control.

USING PESTICIDES WISELY. A.S. Culpepper*[1], J.C. Vance[2], T. Gray[3], R. Keigwin[4]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Tifton, GA, [3]Georgia Department of Agriculture, Atlanta, GA, [4]U.S. EPA, Washington, DC (40)

ABSTRACT

Georgia is unique in that it grows over 40 high value vegetable and fruit crops alongside numerous agronomic crops including auxin-tolerant cotton and soybeans. Mitigating pesticide off-target movement across these dynamic cropping systems is challenging. In 2013, the University of Georgia (UGA) teamed up with the Georgia Department of Agriculture (GDA) and created a training titled "Using Pesticides Wisely" or UPW to first educate agronomic farmers in a face-to-face classroom setting helping them to better understand the proper approach when using all pesticides wisely. Secondly, UGA Extension agents made an aggressive effort to communicate those same pesticide stewardship goals with applicators in "one-on-one" or small group trainings at respective farms.

During 2015, 2016, 2017, and 2018, 45 classroom trainings were conducted across Georgia. Trainings consisted of UGA Extension conducting a one hour training on the latest data available to mitigate off-target movement for all pesticides, followed by 3 industry partners speaking 15 minutes each about their respective technologies, and concluded with the GDA speaking for 15 minutes about pesticide rules and regulations critical to Georgia agriculture. Over 4,000 growers, consultants, industry members, and others in the agricultural community were trained as a result. With greater than 75 percent of attendees responding to a survey, over 99 percent of Georgia growers noted the required classroom training was worth their time and over 98 percent of them also believed the training would help them improve on-target pesticide applications.

In 2017 and 2018, UGA Cooperative Extension agents conducted "one-on-one" trainings to reinforce the classroom trainings, and more importantly, meet with pesticide applicators on a local and personal level. These trainings were conducted by over 45 Extension agents from 42 offices across Georgia. By the end of 2018, agents trained over 1000 pesticide applicators providing them a unique opportunity to learn about pesticide stewardship and UGA Extension.

A 67% reduction of pesticide drift complaints was noted by the UGA Cooperative Extension Service since the UPW trainings began in 2015. Worthy of mentioning is that the adoption of the auxin-based technologies occurring during 2017 and 2018 had minimal influence on overall complaints; even though it is estimated that nearly 1 million acres of agronomic land was treated with 2,4-D or dicamba in-season during 2017, with this value likely doubling for 2018. Paraquat, dicamba, and 2,4-D were the most common active ingredients noted with the survey.

Additionally in 2017, when over 2,700 official investigations into auxin off-target movement deposition occurred there were none in Georgia. Once again during 2018, Georgia was extremely successful with no confirmed auxin drift complaints by the GDA. One of the most important factors influencing this success has been the cooperative effort of growers, applicators, regulators, Extension agents, consultants, scientists, and local industry partners. This cooperative effort has helped growers better achieve their goal of making on-target pesticide applications.

EFFICACY OF WEED MANAGEMENT PROGRAMS CONTAINING RESICORE IN MID-SOUTH CORN. R.R. Hale*[1], T. Bararpour[2], L. Walton[3], J.A. Bond[1], H.M. Edwards[2], J. Mccoy[1], B.K. Pieralisi[1], J.D. Peeples Jr.[4], T.L. Sanders[5]; [1]Delta Research and Extension Center, Stoneville, MS, [2]Mississippi State University, Stoneville, MS, [3]Corteva Agriscience™, Agriculture Division of DowDuPont™, Indianapolis, IN, [4]Delta Research and Extension Center, Stoneville,, MS, [5]Mississippi State University: Delta Research & Extension Center, Stoneville, MS (41)

ABSTRACT

Herbicide options for Mississippi corn producers are limited for controlling troublesome weeds such as broadleaf signalgrass (*Brachiaria platyphylla*), Palmer amaranth (*Amaranthus palmeri*), and pitted morningglory (*Ipomoea lacunosa)*. Weed control is essential for obtaining high quality grain and high yields. A field study was conducted at the Delta Research and Extension Center, in Stoneville, MS, to evaluate the efficacy of weed management programs containing Resicore (acetochlor + mesotrione + clopyralid) in Mid-South corn. Corn (Pioneer P1637 YHR) was planted on bed with 102-cm row spacing with a seeding rate of 8 seeds m^{-1} on April 12, 2018 and emerged on April 24. The experiment was arranged as a randomized complete block design with six treatments and four replications. All herbicide rates are in kg ai ha^{-1}. Treatments for the study were as follows: 1) EverpreX (*S*-metolachlor) at 1.07 PRE followed by (fb) Resicore at 1.16 + AAtrex (atrazine) at 1.68 + Roundup PowerMax (glyphosate) at 1.26 at V3; 2) EverpreX PRE fb Realm Q (rimsulfuron + mesotrione) at 0.109 + AAtrex 1.68 + Roundup PowerMax at V3; 3) EverpreX + AAtrex at 1.12 PRE fb Resicore + AAtrex at 1.68 + Roundup PowerMax at V3; 4) Resicore + AAtrex at 1.68 + Roundup PowerMax at V3; 5) Dual II Magnum (*S*-metolachlor) at 1.07 + AAtrex at 1.12 PRE fb Halex GT (*S*-metolachlor + mesotrione + glyphosate) at 2.2 at V3; and 6) nontreated check. All herbicide applications at V3 contained non-ionic surfactant (NIS) at 0.25% (v/v) and were applied on May 10.

No injury was observed for any treatment at 5 and 7 wk after emergence (WAE). All herbicide treatments provided 98 to 100% control of broadleaf signalgrass, Palmer amaranth, and pitted morningglory at 5 WAE. Broadleaf signalgrass control was 98, 96, 98, 95, and 98% from the application of treatments 1 through 5, respectively (7 WAE). Palmer amaranth control was 98, 100, 98, 97, and 95% from the application of treatments 1 through 5, respectively (7 WAE). For pitted morningglory, excellent control (100%) was observed for all treatments at 7 WAE. Treatments 1 through 6 provided 12,172, 11,869, 11,699, 10,161, 11,339, and 7,637 (nontreated check) kg ha^{-1} corn yield, respectively. Therefore, Resicore may be a viable option for corn producers in Mississippi.

EVALUATION OF PRE AND POST APPLICATIONS OF METRIBUZIN IN CORN.

R.R. Hale*[1], T. Bararpour[2], B.R. Golden[1], J.W. Seale[2], B. Lawrence[2], B.K. Pieralisi[1], J. Mccoy[1], N.G. Corban[2]; [1]Delta Research and Extension Center, Stoneville, MS, [2]Mississippi State University, Stoneville, MS (42)

ABSTRACT

Weed control in corn (*Zea mays*) is important for Mississippi producers to obtain high yields. Weed interference decreases the quality of grain and could lead to economic losses. Due to the increase in evolution of herbicide-resistant weeds, herbicide options for producers are decreasing. A field study was conducted at the Delta Research and Extension Center, in Stoneville, MS, to evaluate preemergence (PRE) and postemergence (POST) applications of metribuzin (Sencor) in weed control programs and corn tolerance. Corn (Pioneer P1637 YHR) was planted on bed with 102-cm row spacing with a seeding rate of 8 seeds m^{-1} on April 12, 2018 and emerged on April 24. The experimental design of the study was a randomized complete block design with 14 treatments and four replications. All herbicide rates are in kg ai ha^{-1}. Treatments in the study were as follows: 1) Dual II Magnum (*S*-metolachlor) at 1.4 + AAtrex (atrazine) at 1.12 PRE followed by (fb) AAtrex at V3-V4; 2) Sencor at 0.31 PRE fb AAtrex at V3-V4; 3) Sencor at 021 PRE fb AAtrex at V3-V4; 4) Sencor at 0.16 PRE fb AAtrex at V3-V4; 5) Halex GT (mesotrione + *S*-metolachlor + glyphosate) at 2.22 + AAtrex at V3-V4; 6) Zidua (pyroxasulfone) at 0.12 + Sencor at 0.31 + Armezon (topramezone) at 0.018 + Roundup PowerMax (glyphosate) at 1.26 at V3-V4; 7) Zidua + Sencor at 0.21 + Armezon + Roundup PowerMax at V3-V4; 8) Zidua + Sencor at 0.16 + Armexon + Roundup PowerMax at V3-V4; 9) Sencor at 0.31 + Armezon + Roundup PowerMax at V3-V4; 10) Zidua + Armezon + Roundup PowerMax at V3-V4; 11) Sencor at 0.21 + Armezon + Roundup PowerMax at V3-V4; 12) Sencor at 0.16 + Armezon + Roundup PowerMax at V3-V4; 13) Dual II Magnum + Sencor at 0.21 PRE fb AAtrex at V3-V4; 14) Dual II Magnum + Sencor at 0.21 PRE fb Halex GT at V3-V4; 15) "weed-free" check; and 16) nontreated check. All herbicide applications at V3-V4 contained crop oil concentrate (COC) at 1% (v/v) and were applied May 14.

At 6 wk after emergence (WAE), corn injury was highest (14%) for treatment 6 (not significant). There was no corn injury from any herbicide treatment by 12 WAE. All herbicide treatments provided 93 to 100% control of pitted morningglory (*Ipomoea lacunosa*) and prickly sida (*Sida spinosa*). Broadleaf signalgrass (*Brachiaria platyphylla*) control was 95, 76, 82, 87, 93, 97, 98, 98, 85, 98, 85, 83, 98, and 100% from the application of treatments 1 through 14, respectively (6 WAE). Palmer amaranth (*Amaranthus palmeri*) control was 98, 100, 96, 95, 97, 100, 99, 97, 90, 95, 88, 80, 100, and 99% from the application of treatments 1 through 14, respectively (6 WAE). For yield, treatments 1 through 15 provided 10,360, 9,479, 14,428, 10,275, 13,247, 15,032, 12,840, 12,023, 12,888, 10,993, 13,792, 12,849, 12,743, 12,649, and 17,539 ("weed-free" check) kg ha^{-1} (not significant). For the nontreated check, there was a 78% yield reduction compared to the weed-free check. Therefore, Sencor could be another herbicide option for weed control in Mississippi corn.

ITALIAN RYEGRASS (LOLIUM MULTIFLORUM) TIMING OF REMOVAL EFFECTS ON CORN (ZEA MAYS L.) IN MISSISSIPPI. M.T. Wesley Jr.*[1], J.A. Bond[2], E.J. Larson[3], D.B. Reynolds[4], J. Ferguson[4]; [1]MIssissippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University, Starkville, MS, [4]Mississippi State University, Mississippi State, MS (43)

ABSTRACT

A field study was conducted to determine the effects of Italian ryegrass (*Lolium perenne ssp. multiflorum*) removal timing on corn (*Zea mays* L.) productivity in Mississippi. The study was conducted at the Black Belt Research Station in Brooksville, Mississippi and included 10 different timings: 90 days before planting (DBP), 69, 56, 44, 30, 22, 15, 8, at planting, and 34 days after planting, arranged in a Randomized Complete Block design with four replications. Treatment timings were the events where Italian ryegrass was sprayed at different dates relative to corn planting. The study also included an untreated check and a weed-free check. The earliest treatment was sprayed on January 5th, 2018. The latest treatment was sprayed May 7th, 2018. *S*-metolachlor plus atrazine plus mesotrione plus bicylopyrone (Acuron) at 1,952 g ai ha^{-1} and paraquat (Gramoxone SL 2.0) at 2,270 g ai ha^{-1} were used in this study. Paraquat was not included in the tank mixture after corn emerged. All treatments were applied using a four-nozzle boom sprayer at 4.3 km h^{-1}, a carrier volume of 140 L ha^{-1}, and a pressure of 276 kPa. Plots measured three by nine meters, and DeKalb 70-27 hybrid seed corn was planted on bedded, 97 cm spaced rows at 69,200 seeds ha^{-1} on April 5th, 2018. Corn development was assessed throughout the growing season by obtaining plant height measurements and leaf chlorophyll readings. Corn was harvested on August 6th, 2018, and yield was recorded and analyzed. The 90 DBP treatment resulted in the highest average corn yield of 8,970 kg ha^{-1}, while the at planting treatment yielded an average of 7,165 kg ha^{-1}, resulting in an average daily yield loss of 20 kg ha^{-1} during this time period. This data highlights the effects of Italian ryegrass removal timing on corn productivity in Mississippi.

PREPARATION OF SICKEPOD EXTRACT WITH POTENTIAL USE AS AN EFFECTIVE DEER REPELLENT. Z. Yue*, T. Tseng; Mississippi State University, Mississippi State, MS (44)

ABSTRACT

Deer browsing of row crops such as soybean is a perceived problem in the US, and the annual deer damage on row crops is estimated around $4.5 billion in the US. Strategies to prevent deer damage on food crops, such as soybean, include fencing and repellent application. Fencing is expensive and labor intensive, and effectiveness of repellents depends on many factors, among which active ingredient is the key. There are numerous commercial brands of deer repellents in the market, and the primary active ingredients of these repellents include either putrescent egg, ammonium fatty acids, or capsaicin. Among the different commercial deer repellents available, only Hinder (ammonium fatty acid) is currently authorized by EPA to apply on food crops such as soybean. Sicklepod extract in our study was shown to be more effective than Hinder in protecting soybean from deer damage. In addition, sicklepod seed extract is commonly used as health tea, can be taken through human mouth, and is organic with no artificial ingredients; thus having the potential of being authorized by the EPA for application on food crops, such as soybean. Our efforts extended the application range of anthraquinone-based repellent to deer, a common problem throughout the United States. Sicklepod fruit meal was extracted with water-methanol four times, and the fresh extract was concentrated on a hot plate (low gear) to 10% volume. Hydrolysis and analysis of this extract showed total anthraquinone derivatives was at a 100 ppm level with aglycone/glycoside ratio at 1:1. Additionally, the extract was confirmed to be stable for at least 24 months. This is the first report of an anthraquinone-based deer repellent sourced from sicklepod seeds.

SCREENING WEEDY RICE (ORYZA SATIVA SPP.) GERMPLASM FOR TOLERANCE TO VARIOUS ABIOTIC STRESSES. S.D. Stallworth*[1], T. Tseng[1], B.C. Schumaker[2], S. Shrestha[2], A. Tucker[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (45)

ABSTRACT

Rice (*Oryza sativa*) is a staple food for more than 3.5 billion people worldwide. Yield levels in Asia have tripled and are expected to increase by 70% over the next 30 years due to population growth. In the US, Arkansas accounts for more than 50% of rice production. Over the last 68 years, rice production has continued to grow in Mississippi, placing it in fourth place after Arkansas, Louisiana, and California. Due to increasing rice acreage, regionally, and worldwide, the need to develop abiotic stress tolerant rice has increased. Unfortunately, current rice breeding programs lack genetic diversity, and many traits have been lost through the domestication of cultivated rice. A possible solution to this problem is to use weedy rice (Oryza sativa spp.), a noxious weed with the increased competition when compared to cultivated rice and of the same genus and species as rice, to discover genes related to cold (18C), heat (38C), and complete submergence stress tolerance. In this study, a population of 54 weedy rice accessions were screened for tolerance to the above stresses and characterized based on height and biomass reduction when compared to the untreated control. These screenings demonstrated that approximately 20% of the weedy rice population outperformed the untreated control, rice breeding lines, and rice cultivars with less than 20% height reduction and less than 40% biomass reduction. In the cold study, 59% of the WR population had less than 20% reduction in height when compared to the highest reduction in rice breeding lines (70%). Similar results were observed during the submergence treatment as well. The heat study only revealed four WR lines with 20% or less height reduction compared to 32 lines demonstrating tolerance in the cold study. Only one WR accession, #9, showed increased tolerance to two or more stress and will be intensely tested to uncover mechanisms of tolerance. These results can further be used in a genome-wide association study to identify single nucleotide polymorphisms associated with extreme stress tolerance.

GENOMICS REGIONS ASSOCIATED WITH ALLELOPATHY IN WEEDY RICE. B.C. Schumaker*[1], S. Shrestha[1], T. Tseng[2], N.R. Burgos[3], S.D. Stallworth[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]University of Arkansas, Fayetteville, AR (46)

ABSTRACT

Rice provides up to 50% of the dietary caloric supply for an estimated 520 million people worldwide. Increasing productivity of rice production is paramount to meet the demand of a growing global population. The most significant yield constraint in rice production is weed competition. Weeds are successful in the field in part because of their genetic diversity, allowing them to adapt and thrive in various environments. Weedy rice is one of the most problematic rice weeds, exhibiting characteristics that suggest a vast germplasm of potential traits for cultivated rice crop improvement. One such trait exhibited in weedy rice is allelopathy. Allelopathy is defined as any detrimental effect by one plant on another through the production of chemical compounds that escape into the environment. Incorporation of allelopathic traits into cultivated rice lines may improve growth habits and assist in overcoming yield losses due to weeds. The overall objective of this study is to evaluate the genetic diversity among selected weedy rice accessions, cultivated rice (CL163, REX) and allelopathic rice (RONDO, PI312777, PI338047), using 30 SSR markers. Nei's genetic diversity among weedy rice (0.4) was found to be higher than cultivated rice (0.24) but less than allelopathic rice (0.56). Population structure and genetic relationship regarding allelopathic potential was evaluated. No distinction was observed between allelopathic and non-allelopathic weedy rice accessions. Accession B2 was found to be genetically distinct than the other weedy rice accessions and possessed high allelopathic potential. This information will be helpful for ongoing rice breeding efforts.

WEED CONTROL PROGRAMS IN CENTIPEDEGRASS AND ZOYSIAGRASS LAWNS UTILIZING PYRIMISULFAN AND PENOXSULAM. P. McCullough*; University of Georgia, Griffin, GA (47)

ABSTRACT

Field experiments were conducted in Georgia to evaluate year-long weed control programs in 'TifBlair' centipedegrass and 'Zeon' zoysiagrass utilizing pyrimisulfan + penoxsulam (EH1580) in rotation with other herbicides. In centipedegrass, fall applications of Kerb SC at 2.5 pt/acre tank-mixed with Katana at 2.5 oz/acre, Princep 4L at 64 oz/acre, or Switchblade at 2.5 pt/acre provided all excellent control (>90%) of field madder in spring and increased turf cover by approximately twofold from the nontreated. Spring preemergence programs consisting of Barricade or Specticle Flo applied with Speedzone Southern or Switchblade, followed by summer treatments of EH1580 at 105 g ai/ha or Speedzone Southern at 4 pt/acre, provided 100% control of white clover throughout the summer and excellent control of fragrant kyllinga. Late summer treatments of Speedzone or Avenue South helped extend control of broadleaf weeds by December, and improved centipedegrass from 63% cover of the nontreated to 99%.

In the zoysiagrass trial, fall programs consisting of Katana at 2.5 oz/acre tank-mixed with Barricade 4L at 24 oz/acre, Kerb SC at 2.5 pt/acre, or Specticle Flo at 6 oz/acre provided excellent control of white clover and field madder in spring. Preemergence programs with Barricade or Specticle Flo in spring followed by EH1580, Katana, Surge, or Avenue South in summer provided excellent control of smooth crabgrass, Virginia buttowneed, white clover, and fragrant kyllinga. Late summer treatments of Q-4 Plus or Surge at 8 pt/acre completely controlled white clover and common dandelion and improved zoysiagrass cover 20% from the nontreated by December.

Overall, EH1580 (pyrimisulfan + penoxsulam) at 105 g ai/ha was an effective substitute for synthetic auxin herbicides applied in spring and summer for weed control programs in centipedegrass and zoysiagrass lawns.

HERBICIDE/INSECTICIDE CO-APPLICATION IMPACTS IN XTEND AND ENLIST COTTON. D. Miller*[1], D.O. Stephenson[2]; [1]LSU AgCenter, St Joseph, LA, [2]LSU Ag Center, Alexandria, LA (48)

ABSTRACT

Optimum timing for chemical control of insect pests in cotton often coincides with those needed to optimize effective management of weeds. Introduction of Xtend and Enlist cotton technologies may afford producers the opportunity to integrate pest management strategies through herbicide/insecticide co-application. Such co-applications could reduce the number of in-season applications and reduce production costs given negative impact is not observed on target pests or crop. Therefore field studies were conducted in 2018 at the Northeast Research Station near St. Joseph, La with the objective to evaluate potential negative impacts from co-application on growth and yield in Xtend and Enlist cotton. A four replication factorial arrangement of treatments was used and included herbicide (Factor A: glyphosate @ 1 lb ae/A + dicamba @ 0.5 lb ae/A (Roundup Powermax + Xtendimax) or glyphosate + 2, 4-D choline @ 1.94 lb ae/A (Enlist Duo) and no herbicide) and insecticide (Factor B: Advise @ 0.0313 lb ai/A, Besiege @ 0.059 lb ai/A, Bidrin @ 0.5 lb ai/A, Livid @ 0.9 lb ai/A, Prevathon @ 0.0605 lb ai/A, or Transform @ 0.047 lb ai/A and no insecticide). Treatments were applied at first bloom growth stage to DP1646B2XF or PHY490W3FE cotton planted on 5/8. Parameter measurements included visual crop injury 3, 7, and 17 d after application (DAT), crop height 7, 17, 27, DAT and prior to harvest, and yield.

In the Xtend cotton trial, injury at 3 and 7 DAT, when averaged across insecticides, was 5 and 3% following application of glyphosate plus dicamba, respectively, and greater than when no herbicide was applied (no injury). By 17 DAT, however, injury was not observed for any treatment. When averaged across herbicide treatment, cotton height at 7, 17, and 37 DAT was not reduced by insecticide co-application. When averaged across insecticides, height 17 and 37 DAT was reduced 3 and 5%, respectively when no herbicide was applied. Cotton height late season and yield were unaffected by herbicide/insecticide co-applications evaluated.

In the Enlist cotton trial, injury at 3 and 7 DAT, when averaged across insecticides, was 10 and 3% following application of glyphosate + 2,4-D Choline, respectively, and greater than when no herbicide was applied (1 and 0%). Cotton height 7, 17, and 37 DAT as well as late season and yield were not affected by any herbicide/insecticide co-application.

IMPACT OF REDUCED RATES OF ISOXAFLUTOLE ON SOYBEAN GROWTH AND YIELD. D. Miller*[1], D.O. Stephenson[2]; [1]LSU AgCenter, St Joseph, LA, [2]LSU Ag Center, Alexandria, LA (49)

ABSTRACT

Crops grown in close proximity along with similar equipment utilized in multi-crop farming operations come with many potential challenges involving off-target movement of herbicides or sprayer contamination. These added concerns justify research identifying possible deleterious effects on crops such as soybean. Therefore field studies were conducted in 2018 at the Northeast Research Station near St. Joseph, La with the objective to evaluate potential negative impacts of reduced rates of isoxaflutole on soybean growth and yield. A four replication factorial arrangement of treatments was used and included herbicide application timing (Factor A: unifoliate; 2 trifoliate; or 4 trifoliate) and herbicide treatment (Factor B: no herbicide or isoxaflutole @ 1x (0.094 lb ai/A), 1/8x, or 1/16x). Treatments were applied at designated timings following planting of P54A54X soybean on 5/8. Parameter measurements included visual crop injury 7 and 14 d after application (DAT) (chlorosis and necrosis), crop height 14 and 28 DAT as well as prior to harvest, and yield.

At 7 DAT, at both the unifoliate and 2 trifoliate application timings, the 1x herbicide rate resulted in greatest injury of 75 and 65%, respectively. The 1/8 and 1/16x herbicide rates resulted in equivalent injury of 4 and 1% and 34 and 30% at these respective timings. At the 4 trifoliate application timing, all herbicide rates resulted in equivalent injury ranging from 19 to 28%. At 14 DAT, no visual injury was observed at the unifoliate and 4 trifoliate application timings. At the 2 trifoliate application timing, slight differences were noted among herbicide rates however injury did not exceed 5%.

Averaged across application timing, height at 14 and 28 DAT and late season was reduced 22, 26, and 22%, respectively, only at the 1x herbicide rate.

At the unifoliate application timing, yield was only reduced at the 1x herbicide rate (26%). At the 2 trifoliate application timing, yield was reduced 22 and 11% at the 1x and 1/16x herbicide rates, respectively. At the 4 trifoliate application timing, yield reduction was greatest at the 1x herbicide rate (54%) and significant at the 1/8x herbicide rate (14%).

CUTLEAF EVENING PRIMROSE (OENOTHERA LACINIATA) AND WINTER ANNUAL BROADLEAF CONTROL IN WHEAT IN MISSISSIPPI AND OKLAHOMA.

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ABSTRACT

Cutleaf evening primrose (*Oenothera laciniata*) is a major weed problem of wheat in Mississippi and Oklahoma. Given the significance of broadleaf weed pressure on wheat yield, a two-year field study in Mississippi and Oklahoma was conducted to understand what treatment options provide the best control of winter annual broadleaf weeds in wheat. Two field sites in Mississippi (Newton and Brooksville) and one field site in Oklahoma (Perkins) were drilled with wheat using appropriate planting populations and varieties for each state in mid-October in 2018. Treatments selected for comparison included dicamba, 2,4-D, fluroxypyr + thifensulfuron methyl, chlorsulfuron + metsulfuron-methyl, halauxifen-methyl + florasulam, and multiple combinations of the above herbicides. Yields will be taken at the end of the season to better separate treatments from the study. Weed control was assessed at 7, 14, 28, and 56 days after application (DAA) for all three locations. Results showed that for the 28 DAA control ratings across all three locations, primrose and winter annual broadleaf control ranged from 91.25% to 12.5% of the treated plots. The best three performing treatments across location were chlorsulfuron + metsulfuron-methyl plus 2,4-D, halauxifen-methyl + florasulam plus chlorsulfuron + metsulfuron-methyl and chlorsulfuron + metsulfuron-methyl alone with across location ratings of 84.6%, 83.3% and 83% respectively. The three lowest performing treatments were dicamba, MCPA ester, and 2,4-D alone with ratings of 42%, 47.5%, and 55% respectively. Yields will be taken in the spring, which will give a more complete picture of the effect of winter annual broadleaf competition on wheat in Mississippi and Oklahoma. Initial results though show that when chlorsulfuron + metsulfuron-methyl is tank mixed with 2,4-D or halauxifen-methyl + florasulam, cutleaf evening primrose and other hard to control winter annual broadleaves can be achieved.

WSSA ADVOCATES FOR WEED CONTROLS THAT PROTECT SOYBEAN EXPORT VALUE. C. Moseley[1], L. Van Wychen*[2], H. Curlett[3], J. Schroeder[4], P. Laird[1], S.P. Conley[5]; [1]Syngenta, Greensboro, NC, [2]WSSA, Alexandria, VA, [3]USDA-APHIS, Washington, DC, [4]USDA Office of Pest Management Policy, Arlington, VA, [5]University of Wisconsin-Madison, Madison, WI (51)

ABSTRACT

Weeds and weed seeds are a serious phytosanitary concern. Most countries, including the United States, take action when weed seeds are detected in arriving shipments. The importing country may reject, re-export, or destroy the shipment. In the worst case, the country may suspend imports or close the market altogether. Soybeans are one of the United States' top exports. Increases in herbicide-resistant weeds may be contributing to more weed seeds in harvested beans. There are a number of best practices, many of which are already in use here in the United States, that can be applied on farm and by grain handlers to help reduce weed seeds in U.S. soybeans.

RESPONSE OF GRAIN SORGHUM TO LOW RATE OF ROUNDUP, LIBERTY, AND GRAMOXONE AT DIFFERENT GROWTH STAGES. J.W. Seale*[1], T. Bararpour[1], R.R. Hale[2], B. Lawrence[1], N.G. Corban[1]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS (52)

ABSTRACT

Herbicide drift from applications made on adjacent fields can pose issues for grain sorghum (*Sorghum bicolor*) growers in Mississippi. Field studies were conducted in 2017 and 2018 at the Delta Research and Extension Center, in Stoneville, Mississippi to evaluate grain sorghum response to low rates of glyphosate, glufosinate, and paraquat at different growth stages. Experiments were set up as a 2 (growth stage) by 4 (treatment) factorial arrangement in a randomized complete design. Applications were made at V6 and flag leaf of grain sorghum stage. Three herbicides used were paraquat, glyphosate, and glufosinate. A nontreated control was included as the fourth treatment. Each herbicide was applied at 1/10 of the recommended 1X labeled use rate. Paraquat was applied at 0.021 kg ai ha^{-1}, glyphosate at 0.060 kg ai ha^{-1}, and glufosinate at 0.060 kg ai ha^{-1}. The 1/10X rate was used to demonstrate a high concentrated drift rate. Visual injury percentage was assessed at 14, and 28 days after treatment (DAT).

In 2017, grain sorghum response to paraquat 14 days after treatment (DAT) was statistically significant at 28% injury across all application timings. At 14 and 28 DAT, paraquat applications were statistically significant at flag leaf with 17 and 9% injury, respectively. At 28 DAT, injury response for glyphosate and glufosinate were similar when averaged across application timings. Paraquat was the most damaging to grain sorghum 28 DAT at 20% injury, regardless of application timing. Grain sorghum following paraquat applications yielded 2,227 kg ha^{-1} as compared to nontreated control (3,254 kg ha^{-1}) averaged over application timing (a 32% yield reduction). Simulated drift from glyphosate and glufosinate were not significantly different from the nontreated control in terms of yield.

In 2018, an interaction of growth stage by application timing was significant at 14 and 28 DAT. Paraquat applied at flag leaf stage resulted in 43 and 23% injury to grain sorghum at 14 and 28 DAT, respectively. Glufosinate applications at flag leaf caused 25% injury as compared to glufosinate treatments at six leaf stage. By 28 DAT, six leaf and flag leaf applications were not significantly different following glufosinate applications. Glyphosate applied at six leaf injured grain sorghum 25% as compared to flag leaf application. Yield was not evaluated due to weather conditions.

WEED CONTROL PROGRAMS IN MISSISSIPPI PEANUT. J.W. Seale*[1], T. Bararpour[1], J.A. Bond[2], J. Gore[1], B.R. Golden[2], R.R. Hale[2]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS (53)

ABSTRACT

A field study was conducted in 2018 at the Delta Research and Extension Center, in Stoneville, Mississippi to evaluate weed control programs in peanut (*Arachis hypogeae*). Peanut (Georgia-D6G) was planted on beds with 40-inch row spacing at a seeding rate of 8 seeds/foot. This study was designed as a randomized complete block with fourteen treatments and four replications. Applications were made at three timings: preemergence (PRE), two- to three- (EPOST) and four- to five-weeks after emergence (MPOST). Herbicide treatments were: 1) flumioxazin (Valor SX 51 WDG) PRE at 1.5 oz/A followed by (fb) paraquat (Gramoxone) at 12 fl oz/A + non-ionic surfactant (NIS) at 0.25% v/v at EPOST: 2) *S*-metolachlor (Dual Magnum 7.62 EC) PRE at 1 pt/A fb Gramoxone + NIS at EPOST; 3) Valor PRE fb Dual Magnum + Gramoxone + NIS at EPOST; 4) Valor PRE fb lactofen (Cobra 2 EC) at 12 fl oz/A + clethodim (Select Max 0.97 EC) at 7 fl oz/A + crop oil concentrate (COC) at 1% v/v at EPOST; 5) Valor PRE fb Cobra + Select Max + COC at MPOST; 6) Dual Magnum PRE fb Cobra + Select Max + COC at EPOST; 7) Dual Magnum PRE fb Cobra + Select Max + COC at MPOST; 8) acetochlor (Warrant 3 EC) PRE at 3 pt/A fb Cobra + COC at EPOST; 9) Valor PRE fb Gramoxone + NIS at EPOST fb Cobra + Select Max + COC at MPOST; 10) Warrant PRE fb Dual Magnum + Gramoxone + NIS at EPOST fb Cobra + COC at MPOST; 11) Valor PRE fb Gramoxone + NIS at EPOST fb Warrant at MPOST; 12) Valor PRE fb Cobra + Select Max + COC at EPOST fb Warrant at MPOST; and 13) Valor PRE fb Warrant at EPOST fb Cobra + Select Max + COC at MPOST. A nontreated check was included as the fourteenth treatment.

There was no injury to peanut from any herbicide application 7 WAE. Treatment 9 provided 92, 97, 96, and 100% control of barnyardgrass (*Echinochloa crus-galli*), broadleaf signalgrass (*Urochloa platyphylla*), Palmer amaranth (*Amaranthus palmeri*), and pitted morningglory (*Ipomoea lacunosa*) 10 WAE, respectively. All treatments provided > 95% control of prickly sida (*Sida spinosa*) 10 WAE. Treatments 2, 6, and 11 provided < 90% control of Hemp sesbania (*Sesbania herbacea*) 10 WAE. Treatment 1, 9, 10, 11, and 12 provided > 90% control of Palmer amaranth 10 WAE. Overall, Valor (PRE) fb Gramoxone + NIS (EPOST) fb Cobra + Select + COC (MPOST) (trt. 9) provided the best control (> 92%) of barnyardgrass, broadleaf signalgrass, Palmer amaranth, and pitted morningglory. However, Valor (PRE) fb Cobra + Select + COC (EPOST) fb Warrant (MPOST) (trt. 12) numerically provided better control of Palmer amaranth (95%). Sequential herbicide applications of PRE, EPOST, and MPOST provided the best weed control programs. Timing of herbicide application is critical for most effective weed control.

FIELD SCALE HARVEST WEED SEED CONTROL IN VIRGINIA WHEAT AND SOYBEAN. S.C. Beam*[1], M.L. Flessner[2], K.W. Bamber[1], L.S. Rector[1]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech PPWS Dept., Blacksburg, VA (54)

ABSTRACT

As herbicide resistance has increasingly become a problem in the US, growers are starting to look for other methods of weed control to diversify their weed management plans. One of these methods is harvest weed seed control (HWSC). The efficacy of HWSC has been demonstrated in Australia where many of these techniques were first developed. Studies were conducted across Virginia in 2017 and continued through 2018 targeting Italian ryegrass [*Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot] in continuous winter wheat and common ragweed (*Ambrosia artemisiifolia* L.), and Palmer amaranth (*Amaranthus palmeri* L.) in continuous soybean to assess the efficacy of a one-time HWSC treatment. The studies were arranged as a randomized complete block design with 4 replications per location and 3 locations for Italian ryegrass and 4 locations each for common ragweed and Palmer amaranth. Plots measured 9 by 30 m at all locations except one Italian ryegrass location which had plots measuring 4.5 by 30 m. All studies were conducted on farm and all crop production management decisions were made by the farmer. Treatments consisted of HWSC (field residue and weed seed removal at crop harvest) and conventional crop harvest (where field residues and weed seed were returned to each plot). The plots were assessed for initial weed density at crop harvest in 2017 by counting seed heads or plants from multiple quadrats depending on weed density. Italian ryegrass density was assessed twice in early spring 2018 (March and April) and again at wheat harvest. Common ragweed density was assessed prior to soybean burndown, and both common ragweed and Palmer amaranth density were assessed prior to POST herbicide applications, and prior to soybean harvest. Weed density counts and crop yield data were subjected to ANOVA and means separated using Fisher's Protected LSD (α=0.05). Initial Italian ryegrass seed head counts ranged from 85.6 to 133.6 heads m^{-2} across all locations. HWSC reduced Italian ryegrass tiller counts in March by 71% compared to the conventional harvest at one location. In April HWSC reduced tillers by 29.6 and 69.6% compared to the conventional harvest at two locations, respectively. There were no differences between treatments at the other locations at these timings. At wheat harvest one location had a significant reduction in Italian ryegrass head counts in the HWSC plots, 40.8 vs 124.4 heads m^{-2}. At wheat harvest 2018, there were no differences in wheat yield between the HWSC and conventional harvest plots 3364 vs 3208 kg ha^{-1}, respectively. Initial common ragweed densities ranged from 4.9 to 5.4 plants m^{-2}. Prior to preplant burndown applications and postemergence applications the HWSC plots reduced densities of common ragweed by 20.6 and 27.9%, respectively, compared to the conventional harvest plots. By soybean harvest no differences were observed between the HWSC plots and the conventional harvest plots, due to effective POST herbicides. There were no differences in soybean yield between treatments, ranging from 2452 to 2648 kg ha^{-1}. There were no treatment differences at any evaluation timing for Palmer amaranth, which is attributed to grower weed management decisions (i.e. effective herbicides) and low weed densities that masked treatment effects. Soybean yield was also unaffected by treatment with yields ranging from 3269 to 3349 kg ha^{-1}. HWSC appears to be a viable method to help reduce weed populations in a field with weeds like Italian ryegrass and common ragweed. Future research is need to further evaluate the

effectiveness of various HWSC techniques on a variety of weed species under many different environmental conditions and weed densities.

DOSE RESPONSE STUDY TO EVALUATE DICAMBA TOLERANCE OF WILD TOMATO GERMPLASM. R. Zangoueinejad[1], M. Alebrahim[2], S. Shrestha[3], T. Tseng*[4]; [1]Mississippi State University, mississippi state, MS, [2]University of Mohaghegh Ardabili, Ardabili, Iran, [3]Mississippi State University, Starkville, MS, [4]Mississippi State University, Mississippi State, MS (55)

ABSTRACT

A dose response greenhouse study was conducted to identify tolerance potential of three wild tomato accessions to dicamba. Five dicamba treatments (0, 70, 140, 210 and 280 g ai ha^{-1}) and four tomato accessions (three wild, TOM 199, TOM 198, TOM 300; and one cultivar, Better Boy) were arranged in a factorial experiment in a completely randomized design with three replications. After application of dicamba at 140, 210 and 280 g ai ha^{-1}, response of wild tomato accessions and cultivar were evaluated based on reduction in plant height and dry weight. Dicamba at 70 g ai ha^{-1} decreased the height of all tomato accessions compared to their controls (untreated plots). Height reduction was 57, 60, 58, and 75 % for accessions TOM 199, TOM 198, TOM 300, and Better Boy (cultivar), respectively. The highest dry weight reduction (78%) at the lowest dicamba rate of 70 g ai ha^{-1} was observed in cultivar. The LD50 value for plant height was lower in Better Boy (LD50 = 4 g ai ha^{-1}) than the three wild accessions. Based on the LD10, LD50 and LD90 values for plant height reduction, dicamba sensitivity of all wild accessions was lower than Better Boy; thus, all three wild accessions were tolerant to dicamba at 70 g ai ha^{-1} rate. Herbicide tolerant traits from these dicamba tolerant tomato accessions can therefore be used in breeding programs. Availability of dicamba tolerant tomato will protect the crop from unintentional injury from dicamba drift.

SCREENING AND DEVELOPMENT OF MARKERS FOR WEED SUPPRESSIVE TRAIT IN SWEET POTATO. B.C. Schumaker*[1], M. Ferreira[2], G.A. Caputo[1], S. Shrestha[1], S.L. Meyers[3], N.R. Burgos[4], T. Tseng[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State University, mississippi state, MS, [4]University of Arkansas, Fayetteville, AR (56)

ABSTRACT

Sweet potato ((*Ipomoea batatas* (L.) Lam.) is grown on over 27,000 acres across 160 farms in Mississippi, with an estimated value of $80 million. Unfortunately, majority of the sweet potato farms are exposed to problematic weeds that can cause yield reduction of up to 90 %. Despite the negative weed interference in sweet potato, herbicide options in sweet potato are limited, and only a few are highly effective on problematic weeds. To overcome these herbicide limitations and preserve or improve sweet potato quality and yield for Mississippi growers, there is a distinct need to find an alternative weed control strategy that can effectively reduce the weed pressure around the crop, and at the same time protect the yield and quality of the storage roots. One of the promising weed control option is to use the weed suppressive ability already present in crop varieties, also known as allelopathy. The main goal of this study was to evaluate the allelopathic capacity of eighteen sweet potato cultivars against Palmer amaranth, and to identify genetic markers associated with allelopathy trait in sweet potato. From our greenhouse and field screening to identify allelopathic sweet potato varieties against Palmer amaranth, we found two out of 31 varieties that inhibited Palmer amaranth growth by up to 80%. The genetic diversity analysis shows higher gene diversity within the allelopathic (Nei's gene diversity value of 0.238) than non-allelopathic (Nei's gene diversity value of 0.173) population. All genetic markers were found to be polymorphic. None of the SSR markers were identified to be unique to allelopathic phenotypes, but instead they were more strongly correlated to the variety origin. Allelopathy promotes sustainable agriculture by increasing agricultural productivity and at the same time have minimal adverse effects on the environment. It increases crop productivity with minimal dependency on herbicides for weed control. Moreover, allelopathic crops can control weeds season long, thus reducing repetitive application of herbicides. The use of allelopathic crops will reduce the usage of herbicides for weed management, and therefore prevent further evolution of herbicide resistant weeds. Allelopathic sweet potato varieties will also be an effective option for managing weeds in organic production as herbicides are not permitted to be used.

BENOXACOR AND FENCLORIM SAFENERS FOR PROTECTING TOMATO FROM HERBICIDE INJURY: SCREENING AND MECHANISMS OF ACTION. S. Duarte[1], E. Castro[1], B.M. Silva[1], C.P. Moraes*[1], B.C. Schumaker[1], T. Tseng[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (57)

ABSTRACT

Safeners are agrochemicals known as herbicide antidotes capable of metabolizing various xenobiotics, including herbicides. The mechanism of action of the safener currently accepted is that these chemicals increase the tolerance of crops to herbicide application, inducing the expression of proteins involved in herbicide metabolism, thereby accelerating their detoxification. This study aimed to evaluate the effect of benoxacor safener for use in tomato culture, to determine if their mechanism of action is through the activation of the detoxifying enzyme, glutathione S-transferase (GST). The experimental design was completely randomized with four replications, in a factorial scheme 4 x 2, with Factor A consisting of four herbicide treatments (Flumioxazin, Femosafen, Linuron, and Control), and Factor B representing two safener treatments (benoxacor and control). The herbicide was applied to the aerial part of the tomato seedlings. The visual injury was collected at 3, 7, 14, and 21 days after application (DAA), and biomass recorded at 21 DAA. Leaf tissues for each treatment were collected at 24 and 48 hours after application of the herbicide and used for the determination of GST activity. Benoxacor pre-treatment resulted in lower injury in fomesafen, and linuron treated plants (only at 7 DAA). Biomass was higher in benoxacor pre-treated plants in fomesafen and linuron treatments. In general, pre-treatment of tomato seeds with benoxacor enhanced GST activity in the plant, especially in the absence of herbicide treatment. At 1 DAA, benoxacor safener increase GST enzyme activity by 1.4 times in plants exposed to fomesafen. Benoxacor safener has the potential to reduce injury and increase biomass in tomato plants treated with femosafen and linuron. The safener has the potential to enhance GST enzymatic activity, helping plants in the herbicide detoxification process. Knowing the defense mechanisms of plants and studying ways to maximize this survival strategy is essential for them to achieve their maximum development. The potential use of benoxacor safener presented positive responses by protecting tomato plants from the herbicide, and this may have been due to the increase in GST enzyme activity.

ALLELOPATHIC TOMATO: FROM COMPOUNDS TO MOLECULAR MARKERS.

B.M. Silva[1], E. Castro[1], S. Duarte[1], C.P. Moraes*[1], B.C. Schumaker[1], T. Tseng[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (58)

ABSTRACT

Tomato represents a large annual production with the United States ranked second in the world. Unfortunately, weed competition is a major yield limiting factor in tomato production. Weeds compete with the crop for light, water and nutrients, and serves as a host for numerous diseases. Different methods for control are used, with herbicides being most common; however, herbicides labeled in tomato are limited, as tomato is highly sensitive to most herbicides. Allelopathy can therefore serve as an alternative or supplemental weed control tactic. Allelopathy offers the potential to reduce weeds sustainably, through the release of natural chemical compounds and do not cause environmental problems such as with herbicides. The objective of this research was to identify chemical compounds associated with allelopathy in seven allelopathic tomato accessions selected from our preliminary allelopathy screening study, using HPLC chromatography technique. Seeds were selected and germinated in petri dishes in a growth chamber at 29°C and 55%. After germination, 4 plants were selected and transferred to test tubes with 30 mL of distilled water. All tubes containing the plant were propagated at the same conditions for 4 weeks. Water collections were performed once a week, in which 1 mL samples were collected. The samples were centrifuged for 10 min at 16.1×10^3 rcf, and 0.5 mL were collected and analyzed using HPLC. Three potential allelochemical compounds were used as standards. The varieties, AVRDC 1219 and 1463 presented the highest values of Chlorogenic Acid, while 1463 presented the lowest values of Caffeic Acid and Coumarin. At four weeks after planting, AVRDC 1219 had the highest concentration of total compounds (0.051 ppm). The allelopathic varieties presented high values of Chlorogenic Acid, and low values of Caffeic Acid. In addition, all varieties presented an increase in the concentration of all potential allelochemical compounds over time.

OUR COMPREHENSIVE HERBICIDE STEWARDSHIP PROGRAM AT THE UNIVERSITY OF TENNESSEE. N. Rhodes*[1], L.E. Steckel[2], T. Mueller[3], D. McIntosh[3]; [1]U of TN 252 Ellington Bldg, Knoxville, TN, [2]University of Tennessee, Jackson, TN, [3]University of Tennessee, Knoxville, TN (59)

ABSTRACT

Because of frequent off-target movement of auxinic herbicides to tobacco and other sensitive high value crops, we began a comprehensive educational program in 2011 that stresses the importance of proper stewardship with the use of pasture herbicides. Our goals were to reduce the occurrence and impact of off-target damage to tobacco and other sensitive, high value crops; and to create educational materials and other tools to help with the diagnosis of suspected cases of off-target damage. The initial funding was obtained via a grant and continued funding from Philip Morris International. Later, additional funding was obtained from Altria Client Services, Dow AgroSciences, DuPont Crop Protection, and Monsanto. We focused on four crops (tobacco, cotton, tomato and grape) and five herbicides (2,4-D, dicamba, aminopyralid, aminocyclopyrachlor and picloram) for the creation of educational materials and diagnostic tools. These include still images, time lapse videos and fact sheets; and we made them available through our initial website, herbicidestewardship.utk.edu; it became accessible in 2014. Later it was simplified to herbicidestewardship.com. In 2016, 2017, and again in 2018, widespread problems with dicamba drift occurred in the Midsouth on numerous sensitive crops as a result of in-crop applications of the herbicide in dicamba-tolerant cotton and soybean varieties. In 2017 we broadened our website to include additional information directly addressing stewardship of dicamba and 2,4-D tolerant crop technology. Because producers, even with their best efforts, were having difficulty keeping dicamba within target fields, we began active laboratory and field research programs looking for answers. We have actively provided herbicide stewardship training for growers and other applicators, dealers, and Extension Agents for the past 3 years. And, because proper herbicide stewardship will continue to be even more critical going forward we have incorporated herbicide stewardship training into our undergraduate and graduate curricula.

ALLELOPATHIC POTENTIAL AND ALLELOCHEMICALS IN TOMATO: AN ALTERNATIVE FOR SUSTAINABLE WEED MANAGEMENT. C.P. Moraes*[1], E. Castro[1], S. Duarte[1], B.M. Silva[1], B.C. Schumaker[1], R. Snyder[2], T. Tseng[3]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Crystal Springs, MS, [3]Mississippi State University, Mississippi State, MS (60)

ABSTRACT

Weed control is a major limiting factor in tomato production, primarily due to the presence of problematic weed species and limited chemical control options. There is a critical need for alternative weed control methods that is sustainable. One of the promising weed control option is to use the weed-suppressive ability already present in crop varieties, also known as allelopathy. Crops with allelopathic traits do not cause damage to the environment, can control weeds season long, and reduce herbicide usage. The aim of this study was to identify allelopathic tomato cultivars with the ability to suppress Palmer amaranth. The experiment was conducted in a greenhouse in a completely randomized design with 25 treatments (tomato accessions) replicated four times. Four seeds of tomato were sown on the edge of the pot, and four seeds of Palmer amaranth were sown in the center of the pot. Pots sown only with the weed were used as control. Palmer amaranth height reduction was recorded at 7, 14, 21 and 28 days after sowing (DAS), chlorophyll reduction measured at 21 and 28 DAS, and biomass reduction calculated at 28 DAS. Data were subjected to analysis of variance (ANOVA) and the means were compared by the test *t* (p= 0.05). The results indicated that 6 out of 25 tomato accessions could potentially be used for Palmer amaranth suppression, showing a reduction in height of 54 to 58%, chlorophyll of 22 to 26% and 83% in biomass.

DROPLET SIZE EFFECTS ON ITALIAN RYEGRASS (LOLIUM MULTIFLORUM) CONTROL IN MISSISSIPPI CORN (ZEA MAYS). M.T. Wesley Jr.[1], Z.R. Treadway*[2], J.A. Bond[3], E.J. Larson[4], D.B. Reynolds[2], J. Ferguson[2]; [1]MIssissippi State University, Mississippi State, MS, [2]Mississippi State University, Mississippi State, MS, [3]Delta Research and Extension Center, Stoneville, MS, [4]Mississippi State University, Starkville, MS (61)

ABSTRACT

Glyphosate resistant Italian ryegrass (*Lolium perenne* ssp. *multiflorum*), which was first documented in 2005, has proven to be very problematic in corn (*Zea mays*) production. Italian ryegrass can cause issues with corn planting and also with stand development of a corn crop. The competition that arises between the corn crop and the weed can lead to spotty stands, which lead to lowered yields. Droplet size of spray applications have also shown to have an effect on the efficacy of spray applications.

Experiments were conducted at the Black Belt Branch Experiment Station near Brooksville, MS to compare the efficacy of different herbicides sprayed through different nozzles with regards to ryegrass control in a corn production environment. Italian ryegrass was over-seeded in the entire experiment area prior to corn planting. Treatments were divided with three application timings, four herbicides, and three nozzle types. An untreated treatment was also included, in which ryegrass was over-seeded, corn was planted, and no other activity took place until harvest.

Plots were rated for ryegrass control at 7, 14, 28, and 56 days after herbicide application, and the weed control ratings were converted to percent suppression. Plots were harvested and yield results showed that, across herbicide treatments, the TT 110015 resulted in the highest yield which was 166 bu/A. Of the herbicides tested in this experiment, the combination of pyroxasulfone applied preemergence followed by a January application of clethodim and a February application of paraquat resulted in the highest yields which was 176 bu/a.

Results concluded that droplet size does have an effect on the efficacy of herbicide applications in a corn production environment. An application of pyroxasulfone PRE followed by clethodim followed by paraquat applied using TT 110015 nozzles results in the highest corn yields.

GLYPHOSATE-RESISTANT ITALIAN RYEGRASS CONTROL WITH RESIDUAL HERBICIDES AND COVER CROPS. J.D. Peeples, B.H. Lawrence, H.M. Edwards, T.L. Sanders, N.G. Corban, and J.A. Bond; Delta Research and Extension Center, Stoneville,, MS (62)

ABSTRACT

Seventy-two counties in Mississippi now contain populations of glyphosate-resistant (GR) Italian ryegrass. Glyphosate-resistant Italian ryegrass in row crop production areas poses a challenge to producers utilizing conservation or no tillage systems. Heavy infestations of GR Italian ryegrass could compromise preplant burndown practices and weed control options. Ineffective control of Italian ryegrass prior to planting can result in significant Italian ryegrass residue which impedes the planting process. Research was conducted to (1) evaluate control of GR Italian ryegrass with a combination of cover crop and fall-applied residual herbicides and (2) determine tolerance of wheat or cereal rye cover crops to residual herbicides targeting GR Italian ryegrass.

Research was established during 2017-18 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, at a site known to be infested with GR Italian ryegrass. The experimental design was a split-plot with four replications. Whole plots were cover crop and consisted of no cover crop, cereal rye, or winter wheat. Sub-plots were fall-applied residual herbicide treatments and included no herbicide, pyroxasulfone at 0.133 lb ai/A, *s*-metolachlor at 1.27 lb ai/A, metribuzin at 0.188 lb ai/A, *s*-metolachlor plus metribuzin at 1.63 lb ai/A, and pendimethalin at 0.95 lb ai/A. Cereal rye and winter wheat cover crops were seeded at 90 lb/A on October 17, 2017. Residual herbicide treatments were applied with a compressed-air sprayer set to deliver 15 gallons per acre when cereal rye and winter wheat cover crops reached the two-leaf growth stage. Visual estimates of Italian ryegrass control and injury of cover crop species were estimated at 30 and 130 d after herbicide application (DAT). Data were subjected to ANOVA with means separated by Duncan's multiple range test at $p \leq 0.05$.

Greatest cover crop injury 30 DAT was 16% on winter wheat following pyroxasulfone. Pyroxasulfone injured winter wheat more than cereal rye; however, metribuzin and *s*-metolachlor plus metribuzin were more injurious to cereal rye. By 130 DAT, cereal rye and winter wheat were injured 14 and 11%, respectfully, with no fall-applied residual herbicide. This was due to wet and cold conditions that persisted at the site. Injury to winter wheat 130 DAT was similar following all fall-applied residual herbicide treatments and in plots receiving no herbicide. In contrast, injury to cereal rye was at least 19% greater from all herbicide treatments compared with the no herbicide treatment. Cereal rye injury was 19 to 25% greater than winter wheat injury for all fall-applied residual herbicides.

Italian ryegrass control was 40 and 41% 30 DAT with cereal rye or winter wheat, respectively, and no fall-applied residual herbicide. Control with cover crop only was less than that in any plot receiving a fall-applied residual herbicide. Italian ryegrass control with pyroxasulfone and *s*-metolachlor plus metribuzin was similar for all cover crop treatments. By 130 DAT, Italian ryegrass control from cover crops only was ≤33%. Only *s*-metolachlor plus metribuzin controlled Italian ryegrass >78% 130 DAT when applied to bare ground. Both cover crops improved control with pyroxasulfone, metribuzin, and pendimethalin. The combination of *s*-

metolachlor and winter wheat provided greater control than when s-metolachlor was applied in cereal rye or to bare ground.

Although Italian ryegrass control 130 DAT was improved when fall-applied residual herbicides were combined with cereal rye cover crop, injury was ≥33% following all herbicides applied to cereal rye. This level of injury would prohibit cereal rye from use as a cover crop to suppress Italian ryegrass. Winter wheat injury 130 DAT was mainly due to poor growing conditions because visual injury was similar across all fall-applied residual herbicide treatments. Furthermore, with the exception of *s*-metolachlor plus metribuzin, Italian ryegrass control was greater following fall-applied residual herbicides applied in winter wheat compared with bare ground. Italian ryegrass should be targeted with *s*-metolachlor plus metribuzin if no cover crop is utilized. Where a cover crop is desirable and Italian ryegrass is problematic, *s*-metolachlor plus metribuzin, pyroxsulfone, or *s*-metolachlor should be combined with a winter wheat cover crop.

IMPACT OF REDUCED RATES OF ISOXAFLUTOLE ON GROWTH AND YIELD OF COTTON. D. Miller*[1], D.O. Stephenson[2]; [1]LSU AgCenter, St Joseph, LA, [2]LSU Ag Center, Alexandria, LA (63)

ABSTRACT

Crops grown in close proximity along with similar equipment utilized in multi-crop farming operations come with many potential challenges involving off-target movement of herbicides or sprayer contamination. These added concerns justify research identifying possible deleterious effects on high value crops such as cotton. Therefore field studies were conducted in 2018 at the Northeast Research Station near St. Joseph, La with the objective to evaluate potential negative impacts of reduced rates of isoxaflutole on cotton growth and yield. A four replication factorial arrangement of treatments was used and included herbicide application timing (Factor A: cotyledon; 2 lf; or 4 lf) and herbicide treatment (Factor B: no herbicide or isoxaflutole @ 1x (0.094 lb ai/A), 1/8x, or 1/16x). Treatments were applied at designated timings following planting of ST5517GLTP cotton on 5/8. Parameter measurements included visual crop injury 7 and 14 d after application (DAT), crop height 14 and 28 DAT as well as prior to harvest, and yield.

At 7 DAT, at both the cotyledon and 2 lf application timings, greatest injury was observed with the 1x herbicide rate (65 and 45%, respectively) in comparison to lower herbicide rates (8 to 14 and 30 to 31%, respectively). All herbicide rates resulted in equivalent injury ranging from 30 to 31% when applied at the 4 lf timing. At 14 DAT, at the cotyledon application timing, the 1x herbicide rate resulted in 70% injury in comparison to the 1%injury observed at both lower herbicide rates. At the 2 lf application timing, injury was equivalent among herbicide rates and ranged from 16 to 28%. At the 4 lf application timing, injury was 50% for the 1x herbicide rate which was equivalent to the 41% at the 1/16x herbicide rate and greater than the 28% at the 1/8x herbicide rate.

At 14 DAT, cotton height at the cotyledon application timing was reduced only at the 1x herbicide rate (34%). At the 2 and 4 lf application timings, height was reduced 26 to 32 and 11 to 23%, respectively, and equally among all herbicide rates. At 28 DAT, at the cotyledon application timing height was reduced at all herbicide rates (13 to 40%0 and greatest for the 1x rate (40%). At the 2 lf application timing, height was reduced at all herbicide rates with the 1x rate resulting in a reduction of 30% which was equivalent to the 24% at the 1/8x rate but greater than the 20% at the 1/16x rate. Prior to harvest, when averaged across application timing, height reduction was significant and equivalent for all herbicide rates ranging from 7 to 11%.

Averaged across application timing, a significant yield reduction was noted only at the 1x (20%) and 1/8x (11%) herbicide rates.

SESAME TOLERANCE TO BICYCLOPYRONE. J. Rose*[1], P.A. Dotray[2] , and W. Grichar[3]; [1]Sesaco Corp, Austin, TX, [2]Texas Tech University, Lubbock, TX, [3]Texas A&M AgriLife Research, Yoakum, TX (64)

ABSTRACT

Field studies were conducted during the 2017 and 2018 growing season under weed-free conditions in south Texas near Knippa and in the Texas High Plains near New Deal to determine sesame (*Sesamum indicum* L.) response to bicyclopyrone applied the day after planting (preemergence) or 14, 21, or 28 days after planting (postemergence). During the 2017 growing season at Knippa, bicyclopyrone was applied premergence (PRE) and postemergence (POST) at 50 and 100 g ai ha^{-1} (1X and 2X, respectively) and at New Deal bicyclopyrone was applied PRE and POST at 50 g ai ha^{-1}. During the 2018 growing season at Knippa, bicyclopyrone applications were made PRE and POST at 25, 50, and 100 g ai ha^{-1} while at New Deal applications were made PRE and POST at 25 and 50 g ai ha^{-1}. An untreated check was included at each location for comparison. Sesame response was evaluated at 2 wk intervals for the first six weeks and a final rating prior to harvest. Sesame yields were taken in 2017 at both locations; however, in 2018, yields were only taken at New Deal due to excessive rains received in September and October at the Knippa location.

Preemergence applications of bicyclopyrone in 2017 caused little injury to the sesame at both locations. No differences in sesame yield were noted at either location. In 2018, the 1/2x rate also showed no injury at Knippa; however, the 1X and 2X rates caused significant levels of injury to the sesame. This injury level was not seen at New Deal and no yield differences were seen. All POST applications of bicyclopyrone at Knippa in 2017 caused injury to the sesame. Sesame recovery occurred for plots receiving applications made 21 and 28 DAP. While the injury was still visible (stunted height), the yields from these plots was not lower than the untreated. Only the applications made 14 DAP caused a yield loss. At New Deal, all POST applications caused significant injury compared to the untreated. In regards to injury, all treated plots did recover through the season; however, a yield loss occurred from plots treated 28 DAP. In 2018, at Knippa, the only applications to not cause injury compared to the untreated were the 1/2x and 1x rates applied 21 DAP. By 4 weeks after application (WAA) recovery had occurred for all applications made 14 and 21 DAP. At New Deal, the 1/2x rate applied 14 and 28 DAP and the 1x rate applied 14 DAP did not cause significant injury, while all other applications did cause injury compared to the untreated.

In summary, the PRE applications at Knippa for 2017 and 2018 show great differences. One reason for the large amount of injury seen in 2018 could be rainfall. There was a rainfall event of approximately 4 cm, 4 days after application. This could have moved the herbicide into direct contact with the seedlings as they germinated.

For the POST applications, there is a general decrease in injury from 2017 to 2018 at both locations. A contributing factor for this could be varietal. In 2017, the studies were conducted on S40 and in 2018 studies were conducted on S39.

CRITICAL PERIOD OF WEED CONTROL FOR ITALIAN RYEGRASS IN WHEAT.

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ABSTRACT

Winter wheat (*Triticum aestivum*) is often used in double cropping systems, as it can aid reducing soil erosion, weed suppression, and provides growers with an additional source of income. Italian ryegrass (*Lolium multiflorum*) is one of the most troublesome weeds for wheat production throughout Southern US. The inability to control this weed can result in reduced yields, reduced quality, or both. Cultural practices, such as the Critical Period of Weed Control (CPWC) can help reduce yield losses. The CPWC is a period in a crop´s growth cycle during which weeds must be controlled to prevent yield losses. The objective of this study was to determine winter wheat's critical period of weed control for Italian ryegrass that results on or less than 5% total yield loss. Plots were kept weedy or weed free through 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 weeks after crop emergence. Two controls consisting of weedy and weed free all season plots were used for a treatment comparison based on a regression analysis where time of weed removal was related to crop yield. The CPWC to reduce yield losses to 5% or less was found to start around the 7th WAE (6.89, $p \leq 0.05$) and end at the 19th WAE (19.36, $p \leq 0.05$). Wheat most be maintained weed free during this period to prevent significant yield losses

CONTROL OF LANCELEAF RAGWEED (AMBROSIA BIDENTATA) IN SUMMER PASTURES. J.D. Byrd[1], D.P. Russell[2], N.H. Thorne[3], H.B. Quick*[2]; [1]Mississippi State University, Miss State, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State University, Mississippi State University, MS (66)

ABSTRACT

Field studies were established in 2017 and 2018 to evaluate the performance of eight herbicides at various rates on lanceleaf ragweed (*Ambrosia bidentata*) control. Sixteen total treatments were arranged in a randomized complete block design with four reps. Treatments were broadcast applied in August 2017 during late-bloom and in June 2018 during the late-vegetative growth stage using a CO_2 pressurized sprayer that delivered 140 L/ha. Weed coverage was measured on the day of application and again on the day of harvest at 356 days after treatment (DAT) to determine percent change. Visual response to herbicides were evaluated at 23 and 50 DAT for both studies. Cattle were excluded for 90 days following application and again for 30 days prior to harvest. Hexazinone applied at both 68.8 and 137.6 g ai/ha resulted in the greatest amount of visual control at 50 DAT in both studies. This treatment, however, did not provide the residual activity needed to consistently reduce lanceleaf ragweed yield or coverage the following season. Herbicide treatments that resulted in both the lowest lanceleaf ragweed yield and greatest reduction in coverage included picloram + 2,4-D at 49.5 + 183.4 and 99 + 366.8 g ae/ha, dicamba + 2,4-D at 45.9 + 13.6 and 91.7 + 263.2 g ae/ha, and aminopyralid + 2,4-D at 20 + 162.2. Dicamba alone at 91.7 and 183.4, aminopyralid + 2,4-D at 11.2 + 90.7, and quinclorac at 137.6 g ae/ha was inconsistent at providing significant reduction in lanceleaf ragweed yield and coverage. The 2018-initiated study will conclude with final yield and coverage data in the summer of 2019 to be compared to previous findings.

DIFFERENCES IN SEED SET AMONG DIVERSE CYTOPLASMIC MALE STERILE SORGHUM BICOLOR GENOTYPES, FOLLOWING POLLINATION WITH SORGHUM HALEPENSE. C. Sias*, B.L. Young, D. Hathcoat, T. Mundt, G. Hodnett, W. Rooney, M. Bagavathiannan; Texas A&M University, College Station, TX (67)

ABSTRACT

The potential for gene flow between cultivated species and their weedy relatives poses agronomic and environmental concerns, particularly when there are opportunities for the transfer of specific adaptive traits, or agronomic traits such as herbicide resistance, into the weedy forms. Knowledge of the frequency of these genetic exchanges in agricultural production systems is of utmost importance for understanding their environmental and/or agronomic implications. One of the most widely cultivated crops in Texas, *Sorghum bicolor* (sorghum, 2n=2X=20), is a prime example of a crop that has a sympatric weedy relative, *S. halepense* (johnsongrass, 2n=4X=40), capable of exchanging genetic information. Previous findings have shown that such crosses (sorghum as the female parent) typically produce triploid embryos that often collapse due to chromosomal imbalance, and that a low frequency of tetraploid embryos are produced which turn into fully developed seed. We hypothesized that tetraploid progenies are produced in these crosses as a result of 2n female gamete production in *S. bicolor*, and the frequency of this occurring varies among different sorghum genetic backgrounds and the type of cytoplasmic male sterility (CMS) present in them. The objective of this experiment was to determine the frequency of 2n gamete production across 12 different sorghum genetic backgrounds and three different cytoplasm types (A1, A2 and A3). Preliminary results based on mature seed production in *S. bicolor* (male sterile, female parent) when pollinated with naturally occurring *S. halepense* (male parent) showed wide variation among the different sorghum lines and cytoplasm types. The results suggest both genetics and cytoplasm influence outcrossing potential. Further characterization is underway to determine ploidy of the progenies and the frequency of 2n gamete production for each of these crosses. Results suggest that hybridization potential between *S. bicolor* and *S. halepense* can be reduced by selection of appropriate sorghum genetic backgrounds.

FEASIBILITY OF HARVEST WEED SEED CONTROL FOR JOHNSONGRASS IN GRAIN SORGHUM. B.L. Young*[1], D. Sarangi[1], N. Korres[2], L.M. Lazaro[3], M.J. Walsh[4], J.K. Norsworthy[2], M. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]University of Arkansas, Fayetteville, AR, [3]Louisiana State University, Baton Rouge, LA, [4]University of Sydney, Sydney, Australia (68)

ABSTRACT

Concurrent maturity of crops and weeds often result in the redistribution of weed seeds to the soil surface following mechanical harvest. Harvest weed seed control (HWSC) was proposed as a useful strategy to take advantage of this weakness of weeds (i.e. seed retention at harvest) for minimizing seedbank inputs. However, the effectiveness of HWSC is dependent on a) the degree of seed retention (lack of shattering) by the target weed species and 2) the amount of weed seed captured by the harvest equipment at the typical harvest height. First, field experiments were conducted in 2016 and 2017 at College Station, TX to estimate seed shattering potential of johnsongrass (*Sorghum halepense*), a major weed species in sorghum production fields in South Texas. In each year, johnsongrass seed shattering was observed on sixeight randomly selected plants naturally occurring in a sorghum field, at weekly intervals from the beginning of weed seed maturity till crop harvest. Four plastic trays (25.4 cm × 25.4 cm) were placed underneath each johnsongrass plant to capture shattered seeds. Results showed that seed retention potential was high in johnsongrass, but highly varied (70 to 95%) across the two drastic environments experienced between the two study years. Second, sorghum production fields naturally infested with johnsongrass were surveyed in South Texas during 2017 and 2018, to document the proportion of johnsongrass seed available for capture by a commercial harvester at the standard harvest height. Results showed that about 80% of the seed retained by johnsongrass (after any shattering) at the time of harvest can be targeted by HWSC methods. High seed retention coupled with high proportion of seed production above commercial sorghum harvest heights, as revealed from this study, indicates the suitability of HWSC tactics for johnsongrass management. More research and extension efforts are vital for promoting practical adoption of HWSC in sorghum.

DOES SENSITIVITY AMONG SOYBEAN CULTIVARS VARY TO A LOW DOSE OF DICAMBA? O.W. France*[1], J.K. Norsworthy[1], J. Ross[2], M.C. Castner[1], T. Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (69)

ABSTRACT

The resurgence of dicamba in recent years, while providing an effective option for weed control, has also posed several new threats to non-dicamba soybean farmers in the form of physical drift and volatility. Soybean is extremely sensitive to dicamba, even at very low rates, such as when volatility or physical drift occur. The objective of this study was to determine if commercial soybean cultivars exhibit differential tolerance to low rates of dicamba. A field trial was established at the Arkansas Agricultural Research and Extension Center in Fayetteville, Arkansas in 2018. This trial was set up as a factorial containing four replications with a 1/250X rate of dicamba applied to 21 soybean cultivars at the V3 or R1 growth stages. Averaged across cultivars, injury was higher for applications made at R1 than V3, with 35% and 53% injury at 14 days after the V3 and R1 applications, respectively. Several cultivars exhibited less visible injury following the dicamba applications, with those having greatest tolerance being Eagle Drewsoy, UA5014C, 4930 LL, and Leland. Relative yield data did not reveal any significant yield loss for any variety. These findings would indicate that breeders could possibly select for enhanced tolerance to low rates of dicamba, which would be beneficial to growers in areas where the herbicide is widely used.

LONGEVITY OF CONTROL ACHIEVED BY PREPLANT AND PREEMERGENCE SOIL RESIDUAL HERBICIDES IN SOYBEAN. G.L. Priess*[1], J.K. Norsworthy[1], Z.D. Lancaster[1], M.C. Castner[1], T. Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (70)

ABSTRACT

Residual herbicides are an essential component of sustainable weed management programs, with length of control or activation likely impacted by application timing (preplant vs. preemergence). Preplant applications increase herbicide activation at planting; however, longevity of weed control may suffer. Field studies were conducted near Marianna (2017, 2018), Crawfordville (2018), and in Fayetteville (2017, 2018), AR to assess the longevity of five preplant (12-16 days prior to planting) and preemergence herbicide applications on Palmer amaranth control. Palmer amaranth control was visibly rated weekly for ten weeks after planting and days to 80% control after planting estimated using regression analysis. At planting, paraquat was applied at 700 g ai ha^{-1} to desiccate emerged vegetation. Herbicides applied preplant were activated in all site years, and herbicides applied at planting were activated timely in three of five site years. Because Palmer amaranth emergence occurred prior to activation at two site years, control was poorer for most preemergence herbicides compared to preplant applications. Longevity of Palmer amaranth control was lower for *S*-metolachlor + metribuzin and flumioxazin + chlorimuron-ethyl when applied preplant versus at planting in two of five site years. Sulfentrazone, sulfentrazone + chloransulam-methyl, and saflufenacil + dimethenamid-P + pyroxasulfone displayed no reduction in longevity of Palmer amaranth control when applied preplant versus at planting in all site years. Herbicide treatments applied preplant were always activated prior to soybean planting, and the treatments that were most persistent did not differ in length of in-crop Palmer amaranth control. Applying herbicides preplant increase the likelihood for activation at planting whereas applications at planting may allow Palmer amaranth emergence prior to the herbicide becoming activated.

EFFECT OF CARRIER VOLUME AND NOZZLE SELECTION ON GLUFOSINATE AND 2,4-D EFFICACY. S. Davis*[1], D. Dodds[1], L.X. Franca[1], J.P. McNeal[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Mississippi State, Mississippi, MS (71)

ABSTRACT

An experiment was conducted at Hood Farms in Dundee, MS in 2018 to determine the effect of carrier volume and spray nozzle selection on Palmer amaranth control with glufosinate and 2,4-D, alone and in combination. The location was naturally infested with a high population of glyphosate-resistant Palmer amaranth. Herbicide applications were made when Palmer amaranth plants averaged 10 cm in height. Glufosinate (Liberty 280 SL; 0.6 kg ai ha^{-1}) and 2,4-D (Enlist One; 1.06 kg ae ha^{-1}) were applied using a Bowman MudMaster™ at a speed of 13 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 11004 (TTI 11004) and Air Inducted Turbo TwinJet 11004 (AITTJ60 11004) Application spray volumes tested included 93 L ha^{-1} and 140 L ha^{-1}. Visual weed control (0-100) and overall phytotoxicity (0-100) ratings were taken at 7, 14, 21, and 28 days after application (DAA). Palmer amaranth biomass was also collected at 28 DAA. Data were analyzed in SAS 9.4 using the PROC Glimmix procedure. All data were subjected to analysis of variance and means were separated using Fischer's Protected LSD at α=0.05.

At all application timings, glufosinate tank-mixed with 2,4-D (78-95%) provided greater AMAPA control than glufosinate alone (59-87%). At 7 DAA, an interaction between nozzle selection and application spray volume affected AMAPA control. At 93 L ha^{-1}, AMAPA control was not different between nozzle types (92-95%). However, when applications were made at 140 L ha^{-1}, AITTJ60 11004 (91%) nozzles provided greater AMAPA control than TTI 11004 (86%) nozzles. At later rating timings, no differences in AMAPA control were observed due to nozzle selection or application volume. At 14 DAA, differences were observed in phytotoxicity ratings due to nozzle selection. Cotton showed greater injury levels when TTI 11004 (2.3%) nozzles were used compared to when AITTJ60 11004 (0.3%) nozzles were used. No differences in AMAPA biomass were observed due to application volume, spray nozzle selection, or herbicide selection. Overall, combining herbicide mode of action provided greater AMAPA control and nozzle selection plays a role in herbicide efficacy especially when active ingredients are less concentrated in the spray solution.

SPRAY EFFICACY AND DRIFT POTENTIAL OF AN UNMANNED AERIAL SPRAYER INFLUENCED BY CROSS-WIND, FLIGHT SPEED, AND NOZZLE SELECTION. J.E. Hunter*, R.E. Austin, R.J. Richardson, T. Gannon, J.C. Neal, R.G. Leon; North Carolina State University, Raleigh, NC (72)

ABSTRACT

The use of unmanned aerial vehicle (UAV) technology has increased over the last few years and has been recently adapted to conduct commercial applications of liquid pesticides. UAV sprayers can greatly leverage site-specific weed management. However, there is a lack of information associated with the accuracy and uniformity of UAV-based pesticide applications. The present study was conducted to characterize the spray pattern of UAV-sprayers and determine their susceptibility to off-target movement created by crosswind. The spray patterns of different nozzle types with different droplet sizes were evaluated at four different flying speeds, and under varying crosswind conditions. The results indicated that the AIXR nozzle provided the most adequate and consistent coverage as application speeds increased. The HC and XR nozzles were highly susceptible to off-target movement, while the TTI nozzle did not provide acceptable coverage. Application coverage and consistency and drift risk were highly influenced not just by crosswind speed but also the level of turbulence generated. The results of the present study indicate that nozzle selection and flight speed are critical parameters for UAV pesticide applications, while off-target movement may depend on the particular characteristic of the crosswind.

EFFECT OF SOYBEAN VARIETY AND MATURITY GROUP ON DICAMBA INJURY.

M.A. Granadino*, W. Everman, J. Sanders, D.J. Contreras, E.A. Jones; North Carolina State University, Raleigh, NC (73)

ABSTRACT

In the last two decades, the use of dicamba has increased to control glyphosate-resistant weeds (Alves et al 2018). Dicamba-resistant crop varieties have the potential to become widely utilized as a tool to manage glyphosate-resistant weeds in North Carolina. Dicamba sprayed as low as 0.04 g ae h^{-1} has been reported to reduce yield by up to 10% (Weidenhamer et al 1989). Soybean has been found to be more susceptible to dicamba applications when exposed at flowering (R1 and R2) compared to vegetative stages (V1 to V7) (Kniss 2018). This research was conducted to evaluate injury of sub-lethal rates of dicamba in maturity group V and VI soybean cultivars at V4 and R2, and evaluate if visual injury is an accurate method of estimating yield loss. Two separate studies were conducted in 2018 in Kinston and Rocky Mount, NC. Study group was organized by soybean maturity group and planting timing (May and June). Plots consisted of two borders rows to minimize potential drift. Dicamba applications were made with a pressurized CO_2 backpack sprayer. Dicamba was sprayed at 0.44, 1.76 and 7.04 g ae a^{-1} at V4 and R2 at each respective planting date. Weekly visual injury ratings and height measurements as well as final yield were collected. Applications between June V4 and May R2 had no significant difference in injury. Dicamba rates had no significant effect on maturity groups and varieties' effect on yield, regardless of the planting date and application timing. There was no significant difference in yields or injury between maturity groups and varieties. Visual injury is not an accurate method of estimating yield loss.

WEED EFFICACY AND ECONOMICS OF BOLLGARD II XTENDFLEX COTTON SYSTEMS. B.M. DeLong*[1], W. Keeling[2], P.A. Dotray[3], J. Everitt[4]; [1]Texas A&M AgriLife, Lubbock, TX, [2]Texas A&M AgriLife Research, Lubbock, TX, [3]Texas Tech University, Lubbock, TX, [4]Bayer Crop Sciecne, Lubbock, TX (74)

ABSTRACT

Managing glyphosate-resistant Palmer amaranth *(Amaranthus palmeri)* has increased weed management costs for Texas High Plains cotton producers. The introduction of Bollgard II XtendFlex (dicamba-tolerant) varieties and registration of dicamba formulations for postemergence use in cotton, combined with residual herbicides, can effectively control Palmer amaranth. It is estimated that 60-70% of the region's cotton acreage was planted in Bollgard II XtendFlex varieties in 2018. To maintain this technology, proper use of residual herbicides is essential. A field study was conducted in 2018 at Lubbock to evaluate Palmer amaranth control and weed management cost for XtendFlex, LibertyLink, Roundup Ready, and conventional cotton systems for irrigated and dryland production. Trifluralin was used as a preplant incorporated (PPI) treatment in all cotton production systems. Caparol was applied preemergence (PRE) in all systems except for the XtendFlex with XtendiMax applied PRE only. The XtendFlex system included a tank mix of XtendiMax + Roundup PowerMax applied early postemergence (EPOST) and XtendiMax + Roundup PowerMax + Warrant applied mid postemergence (MPOST). LibertyLink systems included Liberty EPOST and Liberty + Warrant MPOST. Roundup Ready systems included Roundup PowerMax EPOST and Roundup PowerMax + Warrant MPOST, and used hand hoeing and tillage to control glyphosate-resistant Palmer amaranth. The conventional system utilized tillage and hand hoeing for in-season weed control and Warrant MPOST. The XtendFlex (XtendiMax PRE only) system included Roundup PowerMax EPOST and Roundup PowerMax + Warrant MPOST, and utilized tillage and hand hoeing to control glyphosate-resistant Palmer amaranth. Applications were made using a CO_2-pressurized backpack sprayer at a volume of 15 gallons per acre. Dicamba treatments were sprayed with Turbo TeeJet Induction 11002 nozzles and non-dicamba treatments were applied with Turbo TeeJet 11002 nozzles. Consistent season-long Palmer amaranth control was achieved with the XtendFlex system in both irrigated and dryland production with 99-100% control. In irrigated production, greatest lint yields were achieved with XtendFlex and Roundup Ready systems. All systems produced similar yields in dryland cotton production. Total weed management costs were similar across all systems, with greater seed/technology and herbicide costs in XtendFlex systems, compared to higher tillage and hand hoeing costs in Roundup Ready, conventional, and XtendFlex PRE systems. Greatest gross revenues above weed management costs were achieved with the XtendFlex system in irrigated production. Gross revenue above weed management costs were similar across dryland production systems.

EFFECT OF SPRAY VOLUME ON THE EFFICACY OF ASULAM ON FALL PANICUM CONTROL. R. Mereb Negrisoli*, D. Odero; University of Florida, Belle Glade, FL (75)

ABSTRACT

Fall panicum is the most troublesome annual grass in Florida sugarcane. Changes in spray volume can play an important role on herbicide efficacy, especially with late rescue applications on much bigger or taller weeds. Furthermore, increase in the spray volume can result in greater penetration and thereby increase efficacy. Greenhouse experiments were performed at the Everglades Research and Education Center in Belle Glade, FL to determine the effect of spray volume on the efficacy of asulam on fall panicum control. The experiment was a randomized complete block design with a five by two factorial arrangement and four replications. Asulam (3,740 g a.i/ha) was applied at spray volumes of 0, 94, 140, 187, and 281 L/ha on fall panicum 15 and 30 cm in height. There was an effect of fall panicum size on the efficacy of asulam applied at different spray volumes on fall panicum visual control. Asulam provided better control of small sized fall panicum (96 to 98%) compared to the larger plants. (76 to 86%). There was no significant difference between spray volumes on the efficacy of asulam on 15 cm tall fall panicum control. However, fall panicum control was significantly lower at the highest spray volume compared to the other spray volumes for 30 cm tall plants, indicating that increasing spay volume to 281 L/ha for larger sized fall panicum does not improve control. These results show that spray volume did not influence the efficacy of asulam on small sized fall panicum but was a factor on larger more mature plants.

WEED MANAGEMENT SYSTEMS IN AUXIN TOLERANT COTTON. K.R. Russell*[1], P.A. Dotray[1], W. Keeling[2]; [1]Texas Tech University, Lubbock, TX, [2]Texas A&M AgriLife Research, Lubbock, TX (76)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S. Wats) is a native species to the southern United States. Glyphosate-resistant Palmer amaranth was first found in Georgia in 2005 and has rapidly spread across the entire cotton (*Gossypium hirsutum*) growing region. Two recently released herbicide resistant traits in cotton (XtendFlex™ and Enlist™) provide producers additional options to control troublesome weeds including glyphosate-resistant Palmer amaranth. Prior to the release of these traits, group O herbicides could not be applied during the cotton growing season and several counties in Texas have calendar application restrictions. To minimize the development of herbicide resistance, it will be critical to utilize weed management strategies that include multiple herbicide modes of action as well as mechanical weed control where feasible. The objective of this research was to evaluate season-long weed control in XtendFlex™ and Enlist™ cotton using several different weed management systems that include the use of dicamba in XtendFlex™ cotton and 2,4-D choline in Enlist™ cotton. A field study was established in a randomized complete block design in Lubbock, Texas using a number of weed management inputs at different application timings. All treatments included bed listing followed by rod weeding to ensure a clean start prior to the initiation of the trial. Weed management treatments included one or more of the following; trifluralin at 1.0 lb ai/a applied preplant; prometryn at 1.2 lb ai/a applied preemergence; S-metolachlor at 1.2 lb ai/a, dicamba at 0.5 lb ae/a or 2,4-D choline at 0.95 lb ae/a tank mixed glyphosate at 1.0 lb ae/a applied early and mid-postemergence; and interrow cultivation. In the XtendFlex™ cotton systems, differences in Palmer amaranth control ranged from 79% following the base treatment of two POST applications of dicamba and glyphosate to 100% when four additional weed management inputs were used during the growing season. Palmer amaranth was controlled ≥86% following two weed management inputs plus the base treatment of two POST applications of dicamba and glyphosate. In the Enlist™ system, Palmer amaranth control ranged from 69% in the base two POST applications of 2,4-D and glyphosate program to 98% following four additional weed management inputs. Palmer amaranth was controlled ≥76% following two weed management inputs plus the base treatment of two POST applications of 2,4-D choline plus glyphosate.

EFFICACY OF ENLIST, XTEND AND LIBERTY BASED WEED CONTROL SYSTEMS IN COTTON. R. Vulchi*[1], S.A. Nolte[1], M. Matocha[2], G. Morgan[1], J. McGinty[1]; [1]Texas A&M AgriLife Extension, College Station, TX, [2]Texas AgriLife Extension Service, College Station, TX (77)

ABSTRACT

Crop losses due to weeds in cotton were in millions of dollars during the 1990's and early part of the 21st century. Different weed control systems were developed using herbicide tolerant traits in cotton resulting in an increase in spectrum of weed control and yields. With heavy reliance of glyphosate in Roundup-Ready cotton, weeds evolved resistance and their management became increasingly difficult. Reports that major weed species evolving resistance to multiple modes of action is making them expensive and ineffective. Therefore, alternative herbicide technologies with different modes of action are needed to control glyphosate resistant weeds. By employing residual products at planting and in-season, growers will increase their chances of having a successful weed control program. Comparative studies were conducted between the weed control systems looking at weed control, yield and economics. Weed control and economic returns within transgenic and non-transgenic weed control systems has been studied, but there is no data comparing XtendFlex, Enlist and Liberty Link systems. For these reasons, cotton systems comparison studies were conducted near College Station and Corpus Christi, TX in XtendFlex, Enlist, and Liberty-Link weed control systems. Sequential applications for each technology were employed and evaluated for their effectiveness for weed control and subsequent yield.

EVALUATION OF CURRENT CHEMICAL CONTROL OPTIONS FOR SMUTGRASS (SPOROBOLUS INDICUS VAR. INDICUS) IN TEXAS. Z. Howard*[1], S.A. Nolte[1], M. Matocha[2]; [1]Texas A&M AgriLife Extension, College Station, TX, [2]Texas AgriLife Extension Service, College Station, TX (78)

ABSTRACT

Smutgrass *(Sporobolus indicus* var. *indicus*) is a tuft forming perennial grass that displaces desirable grasses in many native and improved pastures in Texas. Smutgrass is problematic due to its poor palatability to cattle and its difficulty to control once established. Currently the only labeled selective chemistry for control of smutgrass in pastures is hexazinone and imazapic. Research evaluating smutgrass control with alternative pasture herbicides has been limited due to undesirable crop response or lack of labeling. Therefore, the objective of this research was to compare current hexazinone recommendations with alternative pasture herbicides for smutgrass control. Research was initiated in the spring of 2018 in Grimes County, Texas, to evaluate the efficacy of hexazinone at two application timings, nicosulfuron + metsulfuron methyl as single and sequential applications, glyphosate + imazapic as a single application, and quinclorac as a single application. Smutgrass control and crop response was evaluated at 6, 12, and 24 weeks after (WA) B application. At 6 WAB, regardless of application timing, hexazinone provided only 10-25% control while glyphosate + imazapic as well as the split applications of nicosulfuron + metsulfuron methyl provided 85 and 45% control, respectively. By 24 WAB, control with hexazinone dropped to less than 10% control, while glyphosate + imazapic and the split application of nicosulfuron + metsulfuron methyl had dropped to 50 and 15% control, respectively. In established stands, sequential applications of glyphosate + imazapic may be necessary over multiple seasons to achieve acceptable control of smutgrass.

EVALUATION OF RICE VARIETAL TOLERANCES TO BENZOBICYCLON APPLIED AT DIFFERENT GROWTH STAGES. J.A. Patterson*, J.K. Norsworthy, C.B. Brabham, Z.D. Lancaster, G.L. Priess; University of Arkansas, Fayetteville, AR (79)

ABSTRACT

Benzobicyclon is a new herbicide that is currently being evaluated for use in Midsouth rice. Benzobicyclon must be applied post-flood for its phytotoxic form, benzobicyclon hydrolysate, to be formed. Little to no herbicidal activity has been observed from benzobicyclon when there is no continuous flood present. Benzobicyclon will be the first Group 27 (HPPD) herbicide available for Midsouth rice production. In 2018, a field research trial was conducted at the Rice Research and Extension Center near Stuttgart, Arkansas. The objectives of the trial were to assess levels of injury across five rice cultivars when receiving an application of benzobicyclon, and to evaluate the impact of crop stage at the time of application on injury caused by benzobicyclon. The trial was implemented as a split plot with four replications. The herbicides used in the trial were Rogue (benzobicyclon) and Rogue Plus (benzobicyclon + halosulfuron) with the benzobicyclon and halosulfuron rates being 741 and 106 g ai ha^{-1}, respectively, which are twice the anticipated labeled rate. The rice varieties used were CL153, Provisia, Rondo, Diamond, and XL745. Herbicide treatments were applied post-flood at three crop stages: 1- to 2-leaf, 2- to 3-leaf, and tillering. At three weeks after the post-flood application, Rondo was severely injured (>95% injury) at all growth stages likely because of its indica background. For the four other japonica-type rice varieties, tolerance to both benzobicyclon treatments generally increased with rice size at application. Generally, rice was more tolerant to benzobicyclon plus halosulfuron (Rogue Plus) than benzobicyclon alone (Rogue) possibly because of differences in formulation of these two herbicides (SC vs DF). For tillering rice, no more than 18% injury was observed, and this injury was transient, indicating rice has adequate tolerance to this herbicide.

OVER-EXPRESSION OF PPO2 (ΔG210) GENE MUTATION IN RICE. P.C. Lima*, G. Rangani, S. Zhao, A.C. Langaro, V. Srivastava, N.R. Burgos; University of Arkansas, Fayetteville, AR (81)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) is one of the most challenging agronomic weeds to control across the southeastern United States. Palmer amaranth has evolved resistance to several herbicides with different modes of action, including protoporphyrinogen IX oxidase (PPO)-inhibiting herbicides. The majority of PPO-resistant Palmer amaranth populations in Arkansas harbor a Gly210 deletion mutation (ΔG210), which is the same primary mechanism of resistance to PPO inhibitors in tall waterhemp (*Amaranthus tuberculatus)*. Thus far, three mutations have been reported in the *PPO2* gene of Palmer amaranth: ΔG210, Arg128Gly, and Arg128Met. Primary objectives of this research are to overexpress the Palmer amaranth *ppo2* ΔG210 mutant gene in japonica rice 'Nipponbare' and quantify the level of resistance. Explants from rice seedlings were transformed by particle bombardment with pRP7 plasmid carrying the coding region of Palmer *ppo2* ΔG210 under the control of maize ubiquitin (UBI) promotor. Transgenic events were generated after co-bombardment with a selectable marker gene (hpt) so that successful events can be selected in a medium containing hygromycin. Few transgenic events survived the selection procedure. After continuous selection of the proliferating tissues in the regeneration medium, only one transformed embryogenic callus regenerated into a transgenic plant (T0). Molecular characterization of T0 and first generation (T1) plants revealed the presence of Palmer *ppo2* ΔG210 transgene. The phenotypic response to fomesafen was evaluated among T1 plants. Around 50% of the T1 plants had higher tolerance to the 2X dose of fomesafen (X= 0.392 kg/ha) than the wild type plants. Some T1 plants (50%) were susceptible to fomesafen. The molecular mechanisms causing different tolerance levels among T1 plants are being investigated. The stability of transgene inheritance and phenotypic expression of resistance across multiple generations will be evaluated. This trait could be a tool for weed management in some crops.

PALMER AMARANTH CONTROL FOLLOWING SEQUENTIAL APPLICATIONS OF XTENDIMAX AND LIBERTY WITH AND WITHOUT WARRANT. G.K. Flusche Ogden*[1], P.A. Dotray[1], J. Everitt[2]; [1]Texas Tech University, Lubbock, TX, [2]Monsanto Company, Shallowater, TX (82)

ABSTRACT

Dicamba tolerant cotton weed management systems were introduced in 2017, which will allow new inputs to manage glyphosate resistant populations of Palmer amaranth. The use of glufosinate (Liberty® 280 SL) plus a residual herbicide applied postemergence may not only improve the management of glyphosate-resistant Palmer amaranth, but also be effective against rapid development of herbicide resistance to group 4 modes of action. A field study was conducted in Lubbock, Texas in 2018 in a non-crop environment that contained a dense population of Palmer amaranth to determine the influence of sequential order when applying XtendiMax® with VaporGrip Technology® and Liberty® 280 SL on Palmer amaranth when initiated at three different weed sizes (<4-inch, 4- to 8-inch, and 12+ inch weeds). Additionally, this study examined the benefit of adding Warrant® (acetochlor) in tank mixture in one of the sequential postemergence applications. When averaged across all weed sizes, treatments containing Liberty controlled Palmer amaranth greater than treatments containing XtendiMax when evaluated 7 days after initial application. However, when evaluated 21 days after the sequential application, XtendiMax followed by (fb) XtendiMax and XtendiMax fb Liberty controlled less than 4-inch Palmer amaranth 92-93%, which was greater than the control provided by Liberty fb XtendiMax and Liberty fb Liberty (86-88%). Palmer amaranth 4- to 8-inches in size were controlled 74% when treated with Liberty fb XtendiMax when evaluated 21 days after the sequential application, which was greater than the control following XtendiMax fb Liberty (69%). No treatment controlled 12+ inch Palmer amaranth more than 55%. Warrant improved control of <4-inch Palmer amaranth when added to several tank mixes, such as Liberty + Warrant fb Liberty (91%) when compared to Liberty fb Liberty (86%) when evaluated 21 days after the sequential application. This study will be repeated in 2019 in another dense population of Palmer amaranth in a non-crop environment as well as in-crop using an overhead irrigation system.

SENSITIVITY OF NNON-TOLERANT WWHEAT TO QUIZALOFOP-P-ETHYL IN CENTRAL OKLAHOMA. J.T. Childers*[1], M.R. Manuchehri[1], V. Kumar[2], J. Crose[1], R. Liu[3]; [1]Oklahoma State University, Stillwater, OK, [2]Kansas State University, Hays, KS, [3]Texas A&M, College Station, TX (83)

ABSTRACT

CoAXium™ Wheat Production Systems is a new herbicide tolerant wheat that allows for the use of Aggressor™ herbicide (active ingredient: quizalofop-p-ethyl) over-the-top of wheat. An increase in the use of broadcast applications of quizalofop-p-ethyl may increase the likelihood of physical drift and/or tank contamination to nearby sensitive plants, including wheat that is not tolerant to Aggressor™. To evaluate non-tolerant winter wheat response to quizalofop-p-ethyl at various rates, studies were conducted during the 2018-19 winter wheat growing season in central Oklahoma. Fall treatments consisted of 1X, 1/10X, 1/50X, 1/100X, and 1/200X where 1X rates equaled 62 and 92 g ai ha^{-1}. These 1X rates represent recommended rates from the Aggressor™ herbicide label. Visual crop response was recorded every two weeks throughout the growing season. At Lahoma five weeks after treatment, the 1X rate of 62 and 92 g ai ha^{-1} resulted in 72 and 80% crop injury, respectively; however, little wheat response was observed for all other rates. At Perkins and Stillwater, greater than 87% injury was observed for 1X rates of 62 and 92 g ai ha^{-1} while wheat injury for the three lowest rates, regardless of 1X rate, was similar and below 5%. Overall, significant visual wheat response five weeks after treatment was observed for both 1X rates of quizalofop-p-ethyl at Lahoma, Perkins, and Stillwater and for 1/10X rates at Perkins and Stillwater. Little to no visual injury was observed for the three lowest rates at any site, regardless of whether 62 or 92 g ai ha^{-1} was used as the 1X rate. Additional application timings (spring alone and fall followed by spring) will be assessed in the near future, yield will be recorded this summer, and trials will be replicated during the 2019-20 wheat growing season.

WEED MANAGEMENT EFFECTS ON PEANUT YIELD AND WEED POPULATIONS THE FOLLOWING YEAR. A.T. Hare*, D. Jordan, R.G. Leon, M. Inman; North Carolina State University, Raleigh, NC (84)

ABSTRACT

Field Studies were conducted in 2016 and 2017 in North Carolina near Lewiston-Woodville and Rocky Mount to evaluate weed control and yield of peanut when herbicides were applied postemergence within the first six weeks after planting. Dominant weeds included common ragweed (129 plants m^{-2} in 2016 and 61 plants m^{-2} in 2017) at Lewiston-Woodville and Palmer amaranth (54 plants m^{-2} in 2016 and 65 plants m^{-2}) at Rocky Mount. Commercially-available herbicides were applied at 2 or 6 weeks after planting (WAP) only; 2 and 4 WAP; 4 and 6 WAP; and 2, 4, and 6 WAP. A non-treated control was also included. No preemergence herbicides were applied. Visual estimates of percent weed control were recorded 7, 10, and 20 WAP and peanut yield was determined. During the following growing season, cotton was planted directly back into the same plots. Emerged weeds were counted 3, 7, and 20 WAP with herbicides applied across the entire test area immediately after weed densities were recorded 3 and 7 WAP. Cotton was harvested and lint yield recorded.

In absence of herbicides, peanut yield was 880 and 1110 kg ha^{-1} when data were pooled over years at Lewiston-Woodville and Rocky Mount, respectively. At Lewiston-Woodville, yield ranged from 1760 to 2660 kg ha^{-1} with only one herbicide application while at Rocky Mount peanut yield ranged from 2080 to 2480 kg ha^{-1} with this level of weed management. When herbicides were applied twice, peanut yield ranged from 2690 to 3280 kg ha^{-1} at Lewiston-Woodville and 3420 to 3840 kg ha^{-1} at Rocky Mount. The greatest yields were recorded when herbicides were applied three times (3680 kg ha^{-1} at Lewiston-Woodville and 5030 kg ha^{-1} at Rocky Mount). Common ragweed populations at Lewiston-Woodville the following year in cotton were influenced by weed management the previous year in peanut at the 3 and 7 WAP measurements with a range of 66 to 107 and 6 to 13 plants m^{-2} at these respective evaluation periods. By 20 WAP, previous years herbicide application timing did not have an influence on common ragweed populations in cotton. At Rocky Mount, Palmer amaranth populations in cotton were not affected by weed management in peanut and ranged from 66 to 107, 6 to 13, and 0 to 1 plant m^{-2} at these respective evaluation periods. Cotton lint yield ranged from 1540 to 1,690 kg ha^{-1} at Lewiston-Woodville and from 920 to 1090 kg ha^{-1} at Rocky Mount with no differences due to weed management during the previous year in peanut. At both locations imazapic was applied in three of the weed management programs in peanut but did not impact cotton planted the following year. Although these experiments do not constitute a true time of weed removal or duration of weed interference study, results inform practitioners of the relative importance of timing and duration of weed management for peanut in North Carolina.

SETARIA PARVIFLORA MANAGEMENT IN TALL FESCUE AND BERMUDAGRASS PASTURES. B. Greer*; Auburn University, Auburn University, AL (85)

ABSTRACT

Setaria parviflora, more commonly known as marsh bristlegrass or knotroot foxtail is a problematic perennial weed in forage crops grown for hay. The objective of these studies was to evaluate different herbicides for their control or suppression of *Setaria parviflora* in tall fescue. This trial was established in 2017 and then repeated in 2018. To evaluate the benefits of a two year program, the 2017 trial was repeated in the same area in 2018. A similar trial was initiated in 2018 with additional herbicides. Dormant applications of pendimethalin, and indaziflam were applied alone and in sequential programs (after first cutting) with quinclorac, and quinclorac + pendimethalin. Stand-alone applications of topramezone were applied, at two different rates, after first cutting as well. While pendimethalin and indaziflam provided early season suppression of knotroot foxtail, there was not enough residual to last throughout the entire growing season. At 224 days after dormant application there was only a 30% or less seed head suppression rating observed from the dormant applications alone. However, when another application was made to these dormant applications after first cutting the seed head suppression was evaluated at 90% or above after 224 days or 65 days after first cutting. The standalone applications of topramezone also showed good to excellent control at this timing (85-95%). However, there was significant injury observed early with both of these treatments. No bleaching injury was observed by 65 days after first cutting. To obtain more than just a visual injury rating, 3 one foot squared quadrants were taken from each plot and separated into tall fescue, knotroot foxtail, and other. These were then compiled and put into a table to show the percent of each species present in the samples. The separations were pretty consistent with the visual suppression that was observed. The residual applications showed higher amounts of *Setaria parviflora,* and the sequential applications showed more control of the problematic weed. There was also more tall fescue collected from the plots with lower foxtail amounts. If a pendimethalin/indaziflam + quinclorac program can be developed to suppress seed heads or completely control knotroot foxtail it would be extremely beneficial for forage producers in the South.

EFFECT OF FLOODING PERIOD AND SEED BURIAL DEPTH ON PALMER AMARANTH (AMARANTHUS PALMERI) SEED GERMINATION. L.X. Franca*, D. Dodds, M. Plumblee, S. Davis; Mississippi State University, Mississippi State, MS (86)

ABSTRACT

Palmer amaranth (*Amaranhus palmeri* S. Wats.) is an extremely prolific seed producer with a single female plant capable of producing up to 600,000 seeds under favorable conditions. Palmer amaranth seed production of 312,000 and 500,000 seeds per plant has been reported when plants were competing with soybeans and cotton, respectively. Seed germination and viability is dependent on factors such as soil moisture, oxygen availability and quality, temperature, light exposure, microbial activity, and burial depth. Flooding conditions create an unfavorable environment for most weed species, which typically results in reduced seed germination and emergence. Flooding is a common practice in most rice (*Oryza sativa* L.) fields in the Lower Mississippi Alluvial Valley. Fall-winter flooding is an effective practice for rice straw decomposition and waterfowl habitat. Nevertheless, limited research is available regarding the effects of fall-winter flooding and seed burial depth on Palmer amaranth seed germination in Mississippi.

Experiments were conducted in 2016 and 2017 at the R. R. Foil Plant Research Center in Starkville, MS to evaluate the effect of flooding period and Palmer amaranth seed burial depth on seed germination. Flood simulation was conducted using 27 L buckets containing 30 cm of soil plus 15 cm of water. 500 micron pore opening mesh bags measuring 64 cm^2 containing 20 grams of soil were used to store 100 viable Palmer amaranth seeds for the duration of the experiment. Three soil textures were used, a Leeper silty clay loam, a Dundee silty loam, and a Brooksville silty clay. Mesh bags were placed at soil surface as well as buried at 15 cm depth and subjected to six flooding periods which included, no-flooding, 1 month (October), 2 months (October-November), 3 months (October-December), 4 months (October-January), and 5 months (October-February). Following each flooding period, seeds were removed from the experimental area, enumerated under a microscope, and characterized as normal or damaged. Following characterization, seeds were germinated in a growth chamber under 35-30°C day-night temperatures with 14-10 hours day-night period. Seeds were considered germinated when radicle length was equal or longer than 1 mm. Data were subjected to analysis of variance using PROC MIXED procedure in SAS® v. 9.4 and means were separated using Fisher's Protected LSD at α=0.05.

Flooding periods of 4 and 5 months resulted in the greatest amount of damaged Palmer amaranth seeds. Additionally, Palmer amaranth seed germination was reduced by 25% when data was pooled over all flooded treatments. No differences on Palmer amaranth seed germination were observed due to soil texture ($p = 0.1470$). Moreover, germination of damaged seeds only accounted for 2.4 and 0.8% of total germination in no-flooding and flooding treatments, respectively. Palmer amaranth seed viability was significantly greater when buried at 15 cm compared to 0 cm in no-flooding condition ($p \leq 0.0001$). However, seed burial did not affect Palmer amaranth germination in flooded treatments.

FLOODING DEPTH AND BURIAL EFFECT ON EMERGENCE OF FIVE

CALIFORNIA WEEDY RICE BIOTYPES. L.B. Galvin*[1], M.B. Mesgaran[1], K. Al-khatib[2]; [1]University of California, Davis, Davis, CA, [2]UC Davis, davis, CA (87)

ABSTRACT

Weedy rice (*Oryza sativa* f. *spontanea*), a common pest in other rice growing regions of the world, has recently become a concern in California rice production systems. There are five phenotypically distinct weedy rice accessions that are unique to California and difficult to detect due to their conspecific features with cultivated rice. There are currently no registered herbicides available in California that will reduce weedy rice, so alternative methods are needed to determine best management practices for reducing in-field abundance. To address this problem, an emergence experiment was conducted under controlled conditions to analyze the effects from flooding and tillage. Treatment combinations of four flooding depths at 0, 5, 10, and 15 cm as well as four burial depths, 1.25, 2.5, 5, and 10 cm, were applied in combination to the five weedy rice accessions, simply referred to as Types 1, 2 ,3 ,4, 5, as well as 'M-206' rice (medium grain, median maturity) for comparison. Burial depth played the most significant role in reducing emergence; all rice accessions were greatly inhibited by depths at or below 5 cm. Flooding depths greater than 10 cm significantly decreased emergence, but not to the extent of deep burial depths. M-206 had similar emergence compared with types 1 and 2, types 3 and 5 had more emergence compared to the control, and type 4 had significantly less emergence compared with all other rice accessions. Despite these similarities, dry weight analysis indicated that all weedy rice types, with the exception of one biotype, had significantly more biomass compared with M-206. This research indicates that California weedy rice types have a competitive advantage once emerged, however, prevalence of all weedy rice accessions can be greatly reduced by tilling seeds to depths deeper than 5 cm.

OPTIMIZING SELECTIVE GOOSEGRASS CONTROL IN BERMUDAGRASS TURF. J. Brewer*, S. Askew; Virginia Tech, Blacksburg, VA (88)

ABSTRACT

Topramezone has recently been registered in bermudagrass (*Cynodon dactylon*) turf as a rescue treatment to control goosegrass (*Eleusine indica*). Even at low rates needed for goosegrass control, bermudagrass is severely discolored by HPPD inhibitors like topramezone. Using metribuzin as an admixture with topramezone and post-treatment irrigation have both shown promise for reducing bermudagrass injury. We hypothesized that mixtures of reduced topramezone rates with metribuzin will be less injurious than higher rates of topramezone alone and post-treatment irrigation will further reduce bermudagrass injury but would also reduce goosegrass control. Our first objective was to compare topramezone plus metribuzin to topramezone alone for bermudagrass response and goosegrass control. The second objective was to determine how different timings of post-treatment irrigation will influence bermudagrass injury and goosegrass control from these two treatment programs.

For weed control and turf response evaluations, 12 field and 3 greenhouse studies were conducted between 2016 and 2018 to assess 1.3-cm bermudagrass and 12- to 40-tiller goosegrass response to low-rate topramezone plus metribuzin and high-rate topramezone alone. All studies were established in Blacksburg, VA between June and September, and were arranged in a randomized complete block design (RCBD) with 3 or 4 replications. Topramezone was applied alone at 6.13 g ha^{-1} or mixed at 3.68 g ha^{-1} with metribuzin at 210 g ha^{-1}. Treatments were applied twice at a two week interval and included methylated seed oil (MSO) at 0.5% V/V. Treatments were applied with a CO_2-powered sprayer calibrated to deliver 280 L ha^{-1}. For the post-treatment irrigation evaluation, one 'Latitude 36' bermudagrass response study and one fallow goosegrass control study were initiated on August 16, 2018 in Blacksburg, VA. Both studies were arranged in a RCBD with 4 replications and a two-herbicides-by-four-irrigation-timings factorial treatment design. Topramezone was applied alone at 12.3 g ha^{-1} or mixed at 6.13 g ha^{-1} with metribuzin at 210 g ha^{-1}. Treatments included the same adjuvant and propellant as discussed above. The four levels of post-treatment irrigation were no irrigation, and 2.5 mm of irrigation at 1, 15, and 30 minutes after herbicide application. In all cases, data included weekly and biweekly assessments of visually-estimated control and injury and normalized difference vegetation index (NDVI). Data were subjected to ANOVA and means separated with Fisher's Protected LSD at $P \leq 0.05$.

Topramezone at 3.68 g ha^{-1} plus metribuzin injured bermudagrass less than topramezone applied alone at 6.13 g ha^{-1}, and both treatments consistently controlled goosegrass 95% or greater at 8 weeks after treatment (WAT). Post-treatment irrigation reduced bermudagrass injury significantly for both treatments across the three irrigation timings. Both visual and NDVI data indicated that topramezone at 6.13 g ha^{-1}plus metribuzin injured bermudagrass less than topramezone applied alone at 12.3 g ha^{-1} across all levels of irrigation and was more influenced by irrigation timing. Both herbicide treatments during the irrigation evaluation controlled goosegrass similarly when no irrigation was applied (~95%) and during the 15-minute interval (~77%), while topramezone at 12.3 g ha^{-1} controlled goosegrass greater than topramezone at 6.13 g ha^{-1} plus metribuzin during the 1- and 30-minute irrigation intervals.

In conclusion, topramezone at 3.68 g ha^{-1} plus metribuzin improves selectivity of goosegrass control in bermudagrass compared to a higher rate of topramezone applied alone. Also, rapid post-treatment irrigation reduces bermudagrass phytotoxicity from topramezone applied alone and topramezone plus metribuzin but may decrease goosegrass control.

PALMER AMARANTH RESIDUAL CONTROL AS EFFECTED BY COVER CROP AND HERBICIDE. C.M. Perkins*[1], K.W. Bradley[2], J.K. Norsworthy[3], D.B. Reynolds[4], K.L. Gage[5], S. Steckel[6], B.G. Young[7], L.E. Steckel[6]; [1]The University of Tennessee, Jackson, TN, [2]University of Missouri, Columbia, MO, [3]University of Arkansas, Fayetteville, AR, [4]Mississippi State University, Mississippi State, MS, [5]Southern Illinois Univeristy, Carbondale, IL, [6]University of Tennessee, Jackson, TN, [7]Purdue University, West Lafayette, IN (89)

ABSTRACT

Palmer amaranth *(Amaranthus palmeri)* and waterhemp *(Amaranthus tuberculatus)* have consistently been the most problematic weed in soybean across the Mid-South and Midwest. Multiple herbicide applications are normally needed due to the ability of these weeds to germinate throughout the growing season, their prolific seed production, and their competitive nature. Using cover crops has helped minimize the number of herbicide applications required by aiding in the prevention of weed emergence. This has led to the question of the potential benefits of using soil residual preemergence (PRE) herbicides in combination with cover crops for early-season control of *Amaranthus spp.* weeds in soybean.

A regional study was conducted across the Mid-South (TN and AR) and Midwest (IN) to evaluate the benefit of the residual activity from the labelled PRE herbicides in a cover crop prior to soybean. Trials were conducted in Fayetteville, AR, Jackson, TN, and Farmland, IN in 2018. The cover crop consisted of cereal rye *(Secale cereal)* 67 kg ha^{-1} + hairy vetch *(Vicia villosa)* 8 kg ha^{-1} planted the preceding fall. Treatments included non-treated (no residual), *S*-metolachlor (1070 g ai ha^{-1}), pyroxasulfone + flumioxazin (160 g ai ha^{-1}), dimethenamid-P (840 g ai ha^{-1}), pendimethalin (1060 g ai ha^{-1}), metribuzin (630 g ai ha^{-1}), flumioxazin (71.5 g ai ha^{-1}), acetochlor (1260 g ai ha^{-1}), and pyroxasulfone (119 g ai ha^{-1}). Plots were 3 m wide and 9.1 m long. Treatments were replicated four times and arranged in a randomized complete block design. Visual control was assessed when Amaranthus spp. reached 10 cm tall and 7 days after Amaranthus spp. reached 10 cm tall, when average heights were then assessed. Data were analyzed using a general linear mixed model analysis of variance PROC Glimmix of SAS (Version 9.4) ($\alpha \leq 0.05$).

In Tennessee, the use of herbicides suppressed Palmer amaranth emergence, on average, by just over two weeks. However, seven days after Palmer reached 10 cm tall, there was no difference between treated and the non-treated plots for weed counts in Tennessee and Arkansas. The PRE applied herbicide treatments flumioxazin, pyroxasulfone + flumioxazin premix, and acetochlor supplemented the weed control provided by the cover crop by reducing the establishment of Palmer and waterhemp compared with the other herbicides tested. Height differences were only evident in Indiana for waterhemp. Despite the improved weed control, no yield differences were detected amongst the two weed species or the three locations. The authors suggest that the reason for the lack of yield response was due to the cover crop reducing the number of Amaranth spp. that emerged and delaying that emergence by 14 days. Several published studies have shown that reducing and delaying Amaranth spp. emergence can mitigate soybean yield loss from competition.

Although all residual herbicides evaluated delayed Palmer amaranth emergence and growth to 10 cm tall, some provided more consistent control than others. These data suggest that adding a soil residual herbicide for control of Palmer amaranth greatly improves the consistency of control in a cover crop system preceding soybean by both delayed and reduced emergence. This can play an important role in herbicide resistance management since fewer weeds are exposed to POST herbicide applications resulting in less selection pressure.

DISTINGUISHING WEED SPECIES IN A FIELD ENVIRONMENT WITH THE UTILIZATION OF UAVS AND SPECTRAL IMAGING. E.A. Jones*, J. Sanders, W. Everman, D.J. Contreras, M.A. Granadino; North Carolina State University, Raleigh, NC (90)

ABSTRACT

For unmanned aerial vehicle (UAV) remote sensing to be employed as a viable and widespread tool for weed management, the accurate detection of distinct weed species must be possible through the use of analytical procedures on the resultant imagery. The objective of the research was to create a foundation to accurately differentiate weeds species with supervised classification and determine if weed species possessed innate reflectance characteristics that facilitated accurate determination. In 2017, two field studies were performed to identify any weed height thresholds on the accurate species detection and species by height classification of three common broadleaf weed species in Rocky Mount, North Carolina: Palmer amaranth (*Amaranthus palmeri*), common ragweed (*Ambrosia artemisiifolia*) and sicklepod (*Senna obtusifolia*). Pots of the three species at heights of 5, 10, 15, and 30 cm were randomly arranged in a grid and 5-band multispectral imagery was collected at 15 m above the ground. Image analysis was used to identify the spectral reflectance behavior of the weed species and height combinations and to evaluate the accuracy of species based supervised classifications. Supervised classification was able to discriminate between the three weed species with between 20-100% accuracy depending on height and species. Palmer amaranth classification accuracy was improved at larger weed heights and detection accuracy for the species was at least 68%. Increased height of sicklepod and common ragweed plants did not reliably confer improved accuracy but the species were correctly identified with at least 68% and 40% accuracy, respectively. Spectral separation was found to be dependent on the species, band, and height being observed. Thus, the results of the experiment provide evidence that accurately differentiating weeds species in a field environment are not dependent on heights or spectral reflectance differences observed between the species.

OPTIMIZING CHLOROACETAMIDE PLACEMENT IN DICAMBA-RESISTANT COTTON AND SOYBEAN PRODUCTION SYSTEMS. J.T. Buol*[1], L.X. Franca[1], D.B. Reynolds[1], D. Dodds[1], A. Mills[2]; [1]Mississippi State University, Mississippi State, MS, [2]Monsanto Company, Collierville, TN (91)

ABSTRACT

In order to best steward the Xtend™ Weed Control System, best management practices such as mode of action diversification are necessary. Chloroacetamides effectively control small-seeded broadleaf and grass weeds and can be applied flexibly within soybean and cotton production systems. A chloroacetamide type (2) x application timing (7) factorial experiment was conducted in 2017 and 2018 to optimize application timing of s-metolachlor or acetochlor in Xtend soybean and cotton production systems. The seven application timings included were PRE, EP, LP, PRE + EP, PRE + LP, and EP + LP. Soybean research was conducted at two locations in Mississippi and one in Nebraska, and cotton research was conducted at two locations in Mississippi. GR Palmer amaranth and tall waterhemp were studied in Mississippi and GR kochia in Nebraska. Late-season visible weed control was reduced by 20-50% if a single chloroacetamide application was used in cotton as opposed to a split application, and a similar 10-35% reduction in control was observed in soybeans. Late-season weed densities were increased by 30-60% if initial chloroacetamide application was delayed until POST in soybeans and cotton, respectively. Late season crop height was generally reduced as initial chloroacetamide application timing was delayed or if a single PRE application was used. Chloroacetamide applications at any timing except PRE alone minimized weed biomass at crop harvest. Soybean yield was maximized by any split application timing or the EP application timing alone, and cotton yield was maximized by any split application timing.

PALMER AMARANTH (AMARANTHUS PALMERI) AND THRIPS (THRIPS SP.) CONTROL WITH VARIOUS DICAMBA + INSECTICIDE TANK-MIXES IN COTTON (GOSSYPIUM HIRSUTUM). J.P. McNeal*[1], D. Dodds[2], A. Catchot[3], L.X. Franca[2], S. Davis[2]; [1]Mississippi State University, Mississippi State, Mississippi, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State University, Starkville, MS (92)

ABSTRACT

A field experiment was conducted to evaluate the effect of carrier volume and spray droplet size on the efficacy of dicamba + insecticide tank mixtures to control Palmer amaranth (*Amaranthus palmeri*) and thrips (*Thrips sp.*) in cotton (*Gossypium hirsutum*). This experiment consisted of two field locations: the Delta Research and Extension Center in Stoneville, Mississippi, and Hood Farms in Dundee, Mississippi. Four row plots were planted with a single cotton variety: DP 1646 B2XF, and plot dimensions were 3.9m x 14.2m (Stoneville, MS) and 3.8m x 9.1m (Dundee, MS). Applications were made on 04 and 07 June 2018 in Stoneville and Dundee, respectively. Applications were initiated when cotton reached the 4-leaf growth stage.

Applications were made with a Capstan Pinpoint Pulse-Width Modulation (PWM) sprayer on a high-clearance Bowman Mudmaster at a ground speed of 14.5 km hour^{-1}. A single formulation of dicamba: (XtendiMAX® with VaporGrip) applied at 1.5 kg ha^{-1}, and two insecticides: acephate (Acephate 97UP) applied at 0.2 kg ha^{-1}, and dimethoate (Dimethoate 4EC) applied at 0.4 kg ha^{-1} were chosen. This experiment utilized two carrier volumes: 140 and 280 L ha^{-1} and two droplet sizes: 200µm and 800µm.

Pesticide - Carrier Volume - Droplet Size treatment combinations included [1] dicamba-141 L ha^{-1}-800 µm, [2] dicamba + acephate-141 L ha^{-1}-800 µm, [3] dicamba + dimethoate-141 L ha^{-1}-800 µm, [4] dicamba + acephate-280 L ha^{-1}-800 µm, [5] dicamba + acephate-280 L ha^{-1}-800 µm, [6] acephate-141 L ha^{-1}-200 µm, [7] acephate-141 L ha^{-1}-800 µm, [8] dimethoate-141 L ha^{-1}-200 µm, [9] dimethoate-141 L ha^{-1}-800 µm. Each replication contained both a weed/pest free check in addition to an untreated control.

Visual thrips damage ratings (1-5) and thrips counts (adults and nymphs) were taken at 1, 3, and 7 days after treatment (DAT). Visual Palmer amaranth control (0-100) was evaluated at 7, 14, 21, and 28 DAT, and visual cotton injury (0-100) was evaluated at 7, 14, and 21 DAT. Seed cotton yield was collected using a spindle picker modified for plot research. Additionally, 25 boll -samples were collected prior to mechanical harvest and ginned on a laboratory micro-gin to determine lint turnout. The experimental design was a randomized complete block and data were analyzed using PROC MIXED in SAS v. 9.4. Means were separated using Fisher's Protected LSD at an alpha level of 0.05.

At 1, 3, and 7 DAT, thrips counts varied by location but not due to carrier volume, or droplet size. At 1 DAT, adult counts were 44% less in Stoneville ($p = 0.0068$) relative to Dundee, but nymphs were 63% less in Dundee ($p = 0.001$) relative to Stoneville. At 3 DAT, adult and nymph counts were 62% ($p = 0.0126$) and 56% ($p \leq 0.0001$) less in Stoneville relative to Dundee. Finally, at 7 DAT, only nymphs counts varied across location, and were 67% fewer Stoneville ($p = 0.0146$) relative to Dundee.

At 7 DAT, visual Palmer amaranth control varied due to treatment ($p = <0.0001$). All treatments resulted in greater control of Palmer amaranth relative to the untreated control. However, the weed free check resulted in the highest level of control relative to all other treatments.

At 14 DAT visual Palmer amaranth control varied due to treatment ($p = < 0.0001$). All treatments resulted in greater control of Palmer amaranth relative to the untreated control. However, the weed free check resulted in the highest level of control relative to all other treatments.

Seed cotton yield varied by location ($p = \leq 0.0001$) but not due to pesticide, carrier volume, or droplet size. Seed cotton yield was 74% (3240 kg ha^{-1}) and 76% (3293 kg ha^{-1}) higher in Stoneville relative to Dundee in Experiment 1 and 2, respectively.

Our data indicate that thrips counts varied across location, but did not vary due to carrier volume or droplet size and Palmer amaranth control did not vary due to carrier volume or pesticide tank-mix 14 DAT. No treatment resulted in the same level of Palmer amaranth control as the weed free check. Finally, seed cotton yield varied due to location and not due to pesticide, carrier volume, or droplet size. Future research should focus on various dicamba + insecticide tank-mixes for their potential utility in cotton production systems. Furthermore, the potential volatility of dicamba formulations when tank-mixed with an insecticide should be thoroughly investigated.

FALLOW PERIOD NUTSEDGE MANAGEMENT SYSTEM USING MECHANICAL TUBER REMOVAL AND GLYPHOSATE FOLLOWED BY COVER CROP IN VEGETABLE PRODUCTION. R.S. Randhawa*, P.J. Dittmar; University of Florida, Gainesville, FL (93)

ABSTRACT

Perennial nutsedge (*Cyperus* spp.) has been ranked as the most troublesome weed in Florida vegetable production. Past research has exhibited that the mechanical nutsedge tuber removal from the field using peanut digger has the potential to provide nutsedge control. At the same time, multiple other researchers have demonstrated that the potential of cover crops for nutsedge control. Therefore, we conducted a study to evaluate the effect of mechanical tuber removal and establish appropriate cover crop planting timing for effective nutsedge control. The study utilized a split plot design with 3 main treatments and 3 sub treatments. Main treatments included glyphosate at 1155 g ae ha^{-1}, mechanical digging, and non-treated. The sub-treatments were cover crop (Cowpea; *Vigna unguiculata*) planted 2 wks after main treatment, 4 wks after main treatment and no cover crop. The cover crop was terminated at the end of fallow period and summer squash (*Cucurbita pepo*) crop was planted. For data collection, nutsedge counts were taken at two wk interval and nutsedge tuber counts at study initiation, cover crop termination, and squash termination. The yield data were collected for squash over multiple harvesting timings. The results indicated that the mechanical tuber removal and glyphosate plots had significantly lower nutsedge counts throughout the cover crop growing season however cover crop planting time did not affect in nutsedge counts. In the squash, main treatments had a significant effect until the 4 weeks after planting; glyphosate and mechanical digging reduced nutsedge populations 50% and 33% at 2 and 4 weeks after planting, respectively, relative to the non-treated check while the cover crop planting time did not affect nutsedge counts. Main treatments resulted in 50% tuber reduction relative to non-treated, at the time of cover crop termination and though the tuber counts increased during the cash crop, but the main treatments still had 50% lesser tubers at the termination of cash crop. Squash yield was not different among treatments. Mechanical digger provided similar nutsedge control as a glyphosate application during the fallow period

EVALUATION OF COVER CROPS FOR WEED SUPPRESSION IN WATERMELON GROWN WITH PLASTICULTURE. F.B. Browne*, S. Li, K.J. Price; Auburn University, Auburn, AL (94)

ABSTRACT

Weed management in watermelon production is challenging due to wide row spacing, highly disturbed soil, and few selective herbicides registered for use. Cover crops and plastic mulch may provide additional weed management tools. To evaluate watermelon performance in cover crop residues grown with plastic mulch, field trials were conducted in 2017/2018 in Henry and Lee Counties in Alabama. Cover crops tested were daikon radish, crimson clover, cereal rye, and oats at 16, 28, 112, and 112 kg ha^{-1}. Additionally, mixtures of crimson clover with cereal rye or oats were also planted. Row middles either remained untreated or received an application of halosulfuron-methyl (52.53 g ai ha^{-1}) + clethodim (136.03 g ai ha^{-1}) 5 weeks after planting (WAP) before vines started to run. Vine length and weed counts were recorded at 4 and 8 WAP as well as yield at harvest. Cover crop mixtures of clover + rye and clover + oats resulted in the highest biomass at termination of 4581 and 4929 kg ha^{-1}, respectively. Weed densities were significantly reduced by all cover crops 4 WAP compared to bare ground. Clover + oat mixtures consistently suppressed weeds 4 WAP with less than 2 plants m^{-2} compared to 20.02 and 11.31 plant m^{-2} in bare ground in Henry and Lee counties, respectively. Rye, clover + rye, and clover + oat cover crops significantly reduced weed densities at least 50% compared to bare ground 8 WAP in Lee County. After receiving herbicide applications, all cover crops with the exception of daikon radish had significantly lower weed densities than bare ground 8 WAP in Henry County. Herbicide applications reduced weed densities to 1.5 plant m^{-2} or lower 8 WAP regardless of cover crop residue in Lee County. Watermelons grown in oat, clover + rye, and clover + oat residues had longer vine lengths 4 WAP compared to bare ground with increases of 24, 23, and 45% in Henry County, respectively. No significant differences were observed for watermelon vine lengths 4 WAP in Lee County or either county 8 WAP. Yield response did not differ across locations and was not affected by herbicide application in row middles. Yield increases of 58 and 63% were observed for watermelons grown with oat and clover + oat residues. Data indicate high residue cover crops are likely to decrease early-season weed competition in watermelon production and may lead to increased yields. Combination of plastic mulch, cover crops, and herbicide applications before watermelons vine into row middles can extend weed control and provide additional tools for weed management programs.

IMPACT OF NOZZLE TYPE AND CARRIER VOLUME ON COTTON HARVEST AID EFFICACY. S.A. Byrd[1], B.R. Wilson*[2]; [1]Texas A&M University AgriLife Extension, Lubbock, TX, [2]Oklahoma State University, Stillwater, OK (95)

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. Carrier volume and droplet size can have a crucial impact on penetration and coverage within the crop canopy. Increased carrier volumes are beneficial due to greater penetration into the canopy. 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 carrier volume and nozzle selection on cotton harvest aid performance.

An experiment was conducted in 2016 and 2017 in Lubbock, TX, to evaluate the performance of cotton harvest aids with differing carrier volumes and 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, terminal regrowth, and basal regrowth at 7, 14, 21 days after application. Data were subjected to analysis of variance using PROC Mixed procedure in SAS 9.4 and means were separated using Fishers protected LSD at $p = 0.05$.

In 2016, increased carrier volumes of 141 and 187 L/ha resulted in the greatest leaf defoliation 7 and 14 DAA compared to the non-treated control. No differences were observed 21 DAA between carrier volumes of 94, 141, and 187 L/ha. In 2017, defoliation ratings were considerably lower compared to 2016, this is possibly due to cool and cloudy conditions during and after the harvest aid application. No differences were observed in defoliation at 7 DAA between carrier volumes. At 14 and 21 DAA, increased carrier volumes of 141 and 187 L/ha resulted in the greatest defoliation in 2017. Terminal regrowth ratings at 14 DAA indicated that the use of TXR and turbo teejet tips resulted in significantly lower regrowth ratings than those following harvest aid applications with turbo teejet induction tips. Harvest aid application at 94 L/ha or greater with tips producing medium to fine droplets are still recommended.

HERBICIDE EFFICACY AS INFLUENCED BY DENSITY AND DURATION OF SHADE. D.J. Mahoney*[1], D. Jordan[2], A.T. Hare[2], R.G. Leon[2]; [1]North Carolina State Univ., Raleigh, NC, [2]North Carolina State University, Raleigh, NC (96)

ABSTRACT

Herbicide efficacy may be impacted by many factors including, but not limited to temperature, relative humidity, plant growth stage, rainfall, soil conditions, and time of day. The effect of shade or limited light on herbicide phytotoxicity has largely been conducted in growth chambers with limited studies conducted outdoors, either in a pot or field study. Previous studies have been limited with respect to shade density, shade duration, and mechanisms of actions (MOAs) represented. In order to address these knowledge gaps, research was conducted to determine the response of Palmer amaranth (*Amaranthus palmeri*) and common ragweed (*Ambrosia artemisiifolia*) to various MOAs under different shade densities and durations. Palmer amaranth and common ragweed were sown into pots and allowed to emerge in the greenhouse. Following emergence, plants were moved outdoor 8 d prior to experiment implementation. Palmer amaranth and common ragweed were thinned to 4 and 3 plants pot^{-1}, respectively, in order to ensure adequate spray coverage. Additionally, prior to herbicide application pots, were arranged in a checkerboard manner to mitigate pot-to-pot plant interference of herbicide coverage. Shade densities of 30, 60, and 90% were provided using black shade cloth supported by polyvinyl chloride structures. A no shade treatment was also included. Shading intervals included application day as well as two d before (2DB), two d after (2DA), or two d before and after (5DS). Atrazine, fomesafen, glufosinate, mesotrione, and paraquat represented differing light-dependent MOAs and were sprayed at three rates to accommodate differing weed sensitivities. Weed control was visually estimated on a scale of 0 to 100 (0 = no plant control and 100 = complete plant death) 14 d after treatment.

With respect to paraquat, no significant differences were observed across any density, duration, or weed species as only a few plants survived across all treatments. Generally, trends in control across shade treatments were similar for atrazine, glufosinate, fomesafen, and mesotrione. Shading plants 2DB and 5DS had increased control compared to no shading or shading 2DA. Control was similar when comparing 2DA to no shade. Increased shading densities also generally increased control compared to lower densities. Increased control ranged from 11 – 28% higher when shade was provided 2DB or 5DS compared to 2DA or no shade across shade densities. The tested MOAs either directly or indirectly affect photosynthesis, leading to radical oxide formation and lipid peroxidation. It may be hypothesized that shading prior to treatment reduced in plant antioxidant defenses (i.e. enzymes or pigments) allowing for increased control from herbicides caused by radical oxide formation. Plants shaded after treatment had defenses in place when needed. These data suggest caution is needed when applying light-dependent herbicides when a few cloudy days precede full sun. While increased weed control may be realized, increased crop injury may occur. Future research will include radical oxide scavenger enzyme assays to test this hypothesis as well as plant photosynthetic capacities.

MANAGEMENT OF PERENNIAL GRASS SSP. IN LOUISIANA RICE PRODUCTION.

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ABSTRACT

In Louisiana, the climate is sub-tropical which provides suitable conditions for a wide variety of perennial grass species. Brook crowngrass (*Paspalum acuminatum* Raddi.), creeping rivergrass (*Echinochloa polystachya* Kunth Hitchc.) and southern watergrass (*Luziola fluitans* Michx.) are C_4 perennial aquatic grasses that thrive in a sub-tropical climate and have proven to be problematic for rice growers in Louisiana. The control of these grasses is essential and if left unchecked, can pose a significant threat to rice production. With the release of new herbicides for postemergence weed control in rice, it is important to evaluate the activity of these new herbicides on these perennial grasses.

The objective of this research was to evaluate early season control of brook crowngrass, creeping rivergrass and southern watergrass with four different herbicides in a drill-seeded rice production system. A separate trial was conducted for each of the three aforementioned grass species. Trials were conducted in 2018 at the Louisiana State University AgCenter's H. Rouse Caffey Rice Research Station near Crowley, LA. Provisia rice cultivar "PVL01" was drill-seeded in 1.5 x 5.2 m plots. For each trial, the respective weed species was transplanted at a density of 2 plants per m^{-2}. Treatments consisted of a single application of quizalofop at 77, 100, 119, or 139 g ai ha^{-1}; florpyrauxifen-benzyl at 29 g ai ha^{-1}; penoxsulam at 40 g ai ha^{-1} or bispyribac at 28 g ai ha^{-1}.

Results indicated none of the evaluated herbicides provided adequate control of brook crowngrass at 42 DAT with 45% control from 139 g ai ha^{-1} of quizalofop and 23% control with florpyrauxifen-benzyl applied at 29 g ai $ha^{-1}$and penoxsulam applied at 40 g ai ha^{-1}. Therefore, cultural control methods such as increased tillage, combined with a preemergence herbicide application may be required to adequately control brook crowngrass. However, creeping rivergrass and southern watergrass was consistently controlled at 42 DAT when treated with all rates of quizalofop resulting in 83 to 96% control.

INFLUENCE OF ADJUVANTS AND GLYPHOSATE FORMULATIONS ON DROPLET SPREADING ON CONTRASTING LEAF SURFACES. M. Machado Noguera*[1], F.C. Caratti[2], N.R. Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Fayeteville, AR (98)

ABSTRACT

Glyphosate can be considered one of the most important herbicides used in agriculture, due to its broad activity and efficacy. It is available in many formulations, in which acid equivalent, type of salt and inert substance load differs. It is well known that these formulations and the addition of adjuvants can affect glyphosate activity by altering herbicide solubility and surface tension of the spray droplet, among other factors. The surface characteristics of the target plant also plays an important role on glyphosate efficacy, altering leaf wettability. Taking this into consideration, the purpose of this work was to evaluate the effect of glyphosate formulation (RoundUp Powermax II and Rodeo), adjuvant (Induce, ORO 079, AMS and ORO 079 + AMS), and leaf surface characteristic (waxy and hairy, represented by common lambsquarters and velvetleaf, respectively) on droplet size, droplet spreading, and glyphosate absorption. To evaluate effect on droplet size and spreading, treatments were spotted (2uL droplets) on the leaves and droplet diameter was measured with a digital microscope. To evaluate glyphosate absorption, plants were sprayed at 0.63 kg ae/ha and then spotted with radiolabeled glyphosate at 150 000 dpm per plant. At 72 hours after treatment (HAT), plants were sectioned into fours parts: treated leaf, tissues under and above the treated leaves, and roots; treated leaves were rinsed with 10% ethanol. Harvested tissues were air-dried and oxidized. Radioactivity in plant tissues and in the treated-leaf rinsate was quantified by Liquid scintillation spectroscopy. The results indicates that Rodeo benefitted more from added adjuvants, as Rodeo has less adjuvant load than the RoundUp Powermax formulation; AMS does not have visible effect on physical properties of the spray mixture; leaves of common lambsquarters are highly hydrophobic. Glyphosate absorption cannot be explained only by droplet spreading, as Induce lowered droplet surface tension and increased spreading, but did not increase absorption.

PEANUT INJURY EVALUATION OF PPO INHIBITOR HERBICIDES AS AFFECTED BY APPLICATION TIMINGS AND SURFACTANTS. K.J. Price*, S. Li; Auburn University, Auburn, AL (99)

ABSTRACT

Due to the prevalence of ALS-inhibitor resistant weeds such as Palmer amaranth, more PPO-inhibitors are being utilized to control weeds in peanuts. Some PPO-inhibitors, such as carfentrazone and lactofen, are often used as late-season clean up options since they have short pre-harvest interval. However, PPO-inhibitors often cause crop injury or foliar burns. This issue can be further compounded by different surfactants, application timings, and interactions with environmental stresses, especially at the peanut reproductive stages. Therefore, two studies conducted in Henry and Escambia counties in Alabama in 2018, were designed to evaluate three objectives: 1) the effect of PPO-inhibitor based treatments on dryland peanut growth and yield when applied during sensitive reproduction stages 60 (R4-R5), 75 (R6), and 90 days (R6-R7) after planting (DAP) 2) study the role of surfactants and chloroacetamide herbicides on peanut injury and 3) assess the level of correlation of NDVI data to traditional visual injury ratings. At 60 DAP, tank mixes of lactofen and 2,4-DB with pyroxasulfone, *S*-metolachlor, dimethenamid-P with high surfactant oil concentrate (HSOC), a crop oil, were applied at recommended labeled rates. At 75 DAP tank mixes of lactofen, carfentrazone-ethyl, acifluorfen plus 2,4-DB and either non-ionic surfactant (NIS) or HSOC, were applied at 1) the recommended labeled rates and 2) 1.5 times over the label rate. At 90 DAP tank mixes of 2,4-DB, carfentrazone-ethyl, lactofen were applied at the highest labeled rates with either HSOC or NIS. Visual injury ratings and normalized difference vegetation index (NDVI) readings using a hand held Trimble GreenSeeker were conducted at approximately 7, 14, 21, and 28 days after treatment. Yield was collected at the end of the growing season. Results showed peanuts are more sensitive 75 days after planting to PPO inhibitors in combination with HSOC than any other application timing. Yields losses ranged from 13-31 % with carfentrazone-ethyl 52 g ai ha^{-1} + 2,4-DB 420 g ai ha^{-1} + HSOC 0.9 % v/v causing the most significant yield loss among all treatments evaluated. For treatments applied 60 DAP, lactofen 219 g ai ha^{-1} + 2,4-DB 420 g ai ha^{-1} + *S*-metolachlor 1,700 g ai ha^{-1} + HSOC 0.75% v/v was the only chloroacetamide tank mix evaluated to cause a significant yield loss of 13% relative to NTC. Carfentrazone-ethyl at 35 g ai ha^{-1} + 2,4-DB at 420 g ai ha^{-1} + HSOC 0.75% v/v applied at 90 DAP caused a 21% yield reduction compared to the NTC. A Pearson correlation of injury ratings and NDVI readings, for all applications dates, showed a significant negative correlation ($R= -0.69$, $p<0.0001$), suggesting NDVI readings can provide additional support to subjective visual injury ratings. Overall, treatments with HSOC and/or carfentrazone-ethyl were more likely to cause significant injury, NDVI reductions as well as yield loss than treatments with NIS. Peanuts are most sensitive to injury from PPO-inhibitor herbicides at 75 days after planting (around R6 growth stage).

ALS CROSS-RESISTANCE AND MULTIPLE-RESISTANCE IN CALIFORNIA ACCESSIONS OF CYPERUS DIFFORMIS. A. Ceseski*, A. Godar, K. Al-Khatib; UC Davis, davis, CA (100)

ABSTRACT

Control of smallflower umbrella sedge (*Cyperus difformis* L.) in California rice has relied heavily on acetolactase synthase (ALS) inhibiting herbicides for more than two decades. As a result, smallflower populations resistant to ALS inhibitors are found throughout California's rice growing region. In addition, grower complaints indicate that multiple-resistant smallflower may be a budding concern.

The present research seeks to evaluate the level of resistance of ALS-resistant California smallflower populations, and to determine if multiple-resistance exists within select smallflower populations. Sample populations from previously-determined ALS cross-resistance patterns were self-pollinated and the progeny were subjected to dose-response studies with the ALS-inhibitors Londax (bensulfuron), Halomax (halosulfuron), Regiment (bispyribac), and Granite (penoxsulam), at rates ranging from 0.1875x to 12x label rate for resistant populations, and from 0.05x to 1.5x for a known susceptible population. In addition, these populations were screened at 0.5x, 1x, and 3x field rates for multiple resistance to Stam (propanil), Shark (carfentrazone), and Abolish (thionbencarb).

Dose response study confirms that one population is strongly resistant to all of the ALS inhibitors used in the study, regardless of application rate. This resistance is possibly due to a mutation causing insensitivity to the target enzyme. Another population is strongly resistant to each ALS inhibitor *except* Halomax, to which it is susceptible at 0.375x field rate. All other populations' tolerance/ resistance appears to be dose-dependent, and likely due to nontarget-site mechanism(s).

Multiple-resistance study indicates that none of the tested populations were tolerant/ resistant to Shark or Abolish, however many appear to have a dose-dependent tolerance to Stam. When treated with Stam, all populations except one had <50% mortality at the 0.5x rate, three populations had <50% mortality at the 1x rate, and all populations had >80% mortality when treated with Stam at 3x field rate.

Future research will seek to uncover the precise mechanisms of ALS resistance in these populations.

SPECIES IDENTIFICATION OF RYEGRASS ACCESSIONS FROM TEXAS BLACKLANDS BASED ON GRIN REFERENCE SAMPLES. A. Maity*[1], S.E. Abugho[2], V. Singh[2], N. Subramanian[2], G.R. Smith[2], M. Bagavathiannan[2]; [1]Texas A&M university, College Station Texas, College Station, TX, [2]Texas A&M University, College Station, TX (101)

ABSTRACT

Ryegrass is one of the most problematic weeds in wheat production fields worldwide, besides its importance as a forage, turf, and cover crop species. Commonly occurring ryegrass species in the United States are capable of naturally outcrossing with each other, giving rise to a wide range of phenotypes. Therefore, field identification of ryegrass species can be challenging, especially between Italian ryegrass (*Lolium multiflorum*) and perennial ryegrass (*L. perenne*). In this study, we used various taxonomic features to identify 55 different ryegrass accessions collected randomly from wheat production fields and field edge/roadside habitats across the Texas Blacklands region, by comparing with the characteristics of known seeds of Italian, perennial and rigid ryegrass, obtained from the Western Regional Plant Introduction Centre, Pullman, WA through the Germplasm Resources Information Network (GRIN) of the United States Department of Agriculture. Various seed and plant morphological traits such as the presence of awn, awn length, number of tillers, leaf color and width, vernation pattern, spike and spikelet size, number of spikelets per spike and number of seeds per spikelet were observed. Though a wide range of morphological variability was present across the accessions, a close comparison with the GRIN samples revealed the occurrence of one major ryegrass species in the Texas Blacklands region: *L. multiflorum*(Italian ryegrass) with few plants of *L. perenne* (perennial ryegrass) mixed in few accessions. Source of these mixtures are unknown and needs further investigation. Some accessions showed overlaps between the two species for several of these traits; thus, clear identification was extremely difficult. We didn't find any *L. rigidum* (rigid ryegrass) among the accessions evaluated nor any *L. temulentum* (poison ryegrass). To our knowledge, this is the first systematic identification of ryegrass species occurring in wheat production in Texas and information generated in this study will assist with the selection of appropriate management options.

THE EFFECT OF NON-CHEMICAL MANAGEMENT PRACTICES ON WEED POPULATION DYNAMICS IN ORGANIC GRAIN PRODUCTION. S.L. Samuelson*, N. Rajan, R.W. Schnell, M. Bagavathiannan; Texas A&M University, College Station, TX (102)

ABSTRACT

There has been an increased global interest in organic food production. In an effort to lessen our dependence on herbicides, the adoption of cover crops as a means of weed management has been encouraged. A field study was established in September 2016 at the Texas A&M University research farm near College Station, TX on a site that was fallowed for 10 years. The experimental design was a randomized strip-split plot with three replications. The main plot treatments consisted of soybean-corn- sorghum rotation, with each crop planted in the first year, followed by the other two crops in sequence. The sub-plot treatments include: 1) Standard practice, which uses primary and secondary tillage operations for pre-plant weed control, incorporation of manure, and seedbed preparation; 2) summer cover crop and no-till planting; 3) summer cover crop followed by a fall cover mulch and no-till planting; and 4) summer cover crop with the same fall cover mulch, but conventional tillage for seedbed preparation. Soil seedbank samples were collected after crop harvest each fall to determine the changes in weed seedbank size over time with different management practices. At 21 days after planting (DAP), weed seedling emergence and density were recorded by randomly placing four 1 m2 quadrats in each plot. Similar observations were carried out in fall in sub-plots planted with cowpeas at 21 DAP. Conventional tillage provided considerable weed control in the spring after planting of the cash crop. Fallowing the field for 10 years built weed pressure, especially johnsongrass, which posed a challenge for non-chemical weed control. However, this experiment presented a worst-case scenario for transitioning into organic systems with high background weed densities. Results provide valuable information for non-chemical weed control in organic grain production.

USE OF LOW TUNNEL FIELD TRIALS TO UNDERSTAND DICAMBA VOLATILITY.

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ABSTRACT

Dicamba volatility can be affected by several factors not restricted to dicamba formulations or weather conditions at time of application. Previous research demonstrated that the addition of glufosinate to dicamba increased volatility of dicamba. However, the mixture of dicamba and glufosinate is not allowed. A field experiment was conducted in 2018 at the Arkansas Agricultural Research & Extension Center (AAREC) in Fayetteville, Arkansas. The objective was to determine dicamba volatility as a function of application timing of glufosinate and type of target surface. The experiment was set as a factorial arrangement of treatments in a randomized complete block design with 3 replications, with the first factor being glufosinate application timing (4 days prior to dicamba application or in mixture) and the second factor was the type of target surface (bareground soil or XtendFlex™ cotton canopy). Open tunnels measuring 6.4 m long were assembled to cover 2 soybean rows. The area under each low tunnel established was a plot. At a remote location, herbicide treatments were applied to soil or dicamba-resistant cotton seedlings contained in 52 x 40 x 6 cm-trays. Following application, trays were placed at the center of each tunnel along with a high-volume air sampler. At 48 hours after initial application, the tunnels were taken down and tray treatments discarded. Plots delimited by the area inside the tunnels, were divided into 1.6-m sections of soybean row. Injury was evaluated in each section at 21 and 28 days after treatment (DAT). Additional ratings were measured from the center of each tunnel in the direction of dicamba symptomology until dicamba injury was 5%. Data analysis was performed in JMP Pro 14, and means were reported using Fisher's protected least significant difference test with α=0.05. Dicamba volatilized and moved further when applied over-the-top of XtendFlex cotton than when applied to soil. Averaged over treated surface, dicamba was less volatile when applied 4 days after glufosinate than when applied as a mixture of both herbicides. The current XtendiMax label would permit an application of glufosinate prior to dicamba, but it is unknown if volatility of dicamba would be greater than dicamba applied to a surface not previously treated with glufosinate. Future efforts will focus on quantifying dicamba collected by the air samplers and evaluating the impact of other herbicides labelled as tank-mix partners.

PREPLANT AND PREEMERGENCE PALMER AMARANTH CONTROL IN GRAIN SORGHUM FOR THE TEXAS HIGH PLAINS. C.D. Ray White*[1], B.M. DeLong[1], J.L. Spradley[1], W. Keeling[2], B. Bean[3]; [1]Texas A&M AgriLife, Lubbock, TX, [2]Texas A&M AgriLife Research, Lubbock, TX, [3]United Sorghum Checkoff Program, Lubbock, TX (104)

ABSTRACT

Herbicide options in grain sorghum are more limited than in other agronomic crops. MiloPro (propazine) is an effective sorghum herbicide but will not be available in coming years. Palmer amaranth, the most common weed in grain sorghum grown in Texas, is especially problematic due to limited postemergence options that will not affect rotational crops such as cotton. Effective season-long Palmer amaranth control with soil-applied residual herbicides is critical to profitable grain sorghum production. Evaluate registered and non-registered herbicides applied early preplant or preemergence for crop response and Palmer amaranth control in grain sorghum. In 2017, early preplant (EPP) applications were done on May 19th and in 2018 EPP was applied on May 22nd. In 2017, Preplant (PRE) applications were done on May 30th and in 2018 PRE applications were done on June 6th. Applications were made using a CO_2-pressurized backpack sprayer at a volume of 15 gallons per acre. Effective season-long Palmer amaranth control (>90%) was achieved in both years with Lumax EZ, Bicep Lite II Magnum, and Degree Xtra applied EPP. Effective season-long Palmer amaranth control was achieved in both years with Degree Xtra, Bicep Lite II Magnum, and MiloPro + Dual Magnum applied PRE. Injury was observed with SureStart II (15%) applied EPP which is not registered for use in sorghum. No other EPP or PRE herbicides injured sorghum (data not shown). Tank-mixes or premixes with two active ingredients more effectively controlled Palmer amaranth compared to Atrazine, Dual, Warrant, and Callisto alone.

RELATIVE DURATION OF RESIDUAL CONTROL AMONG PREEMERGENT HERBICIDES. B. Sperry*[1], D.B. Reynolds[1], J. Ferguson[1], J.A. Bond[2], G. Kruger[3], A. Brown[4]; [1]Mississippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]University of Nebraska-Lincoln, North Platte, NE, [4]Mississippi State Chemical Laboratory, Mississippi State, MS (105)

ABSTRACT

Weed resistance to POST herbicides has expanded in recent years resulting in increased reliance on PRE herbicides in many cropping systems. However, PRE herbicides do not all provide the same duration of control and require sequential applications at different times. Traditionally, sequential applications of PRE herbicides are initiated based on weed emergence requiring a POST herbicide in sequential applications to control emerged weeds. Ideally, sequential residual applications should be applied prior to weed emergence to maintain constant control; however, this time point is generally unknown due to a plethora of environmental factors. Consequently, time series experiments were conducted across four site-years in Mississippi and Nebraska in effort to quantify the duration of residual Amaranthus control of commonly used PRE herbicides in the US. Acetochlor, S-metolachlor, pyroxasulfone, flumioxazin, clomazone, pendimethalin, dicamba, 2,4-D, isoxaflutole, metribuzin, fomesafen, mesotrione, and fluometuron were applied at standard use rates under fallow conditions and Amaranthus control, was evaluated weekly for 70 days. Data were fit to a nonlinear regression model to estimate time to 90% Amaranthus control. Time to 90% Amaranthus control was shortest for dicamba and 2,4-D resulting in durations of 7 and 5 DAT, respectively. Pyroxasulfone and fluometuron provided the longest duration of Amaranthus control which did not drop below 90% for the duration of the experiment. Time to 90% Amaranthus control for all other herbicides ranged from 29 to 48 DAT. Weed biomass 70 DAT was greatly reduced from acetochlor, S-metolachlor, pyroxasulfone, mesotrione, fluometuron, and fomesafen treatments which ranged from 0 to 50 g 0.33 m^{-2}. While 2,4-D, dicamba, and pendimethalin treatments reduced weed biomass 70 DAT compared to the nontreated, weed biomass was still 220 to 275 g 0.33 m^{-2}. These data indicate that for most residual herbicides, sequential residual applications should be made approximately 28 days apart; however, some herbicides persist longer allowing for increased time between applications.

ACTIVE INGREDIENT EFFECTS ON ITALIAN RYEGRASS (LOLIUM MULTIFLORUM) CONTROL IN MISSISSIPPI CORN (ZEA MAYS L.). M.T. Wesley Jr.*[1], J.A. Bond[2], E.J. Larson[3], D.B. Reynolds[4], J. Ferguson[4]; [1]MIssissippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University, Starkville, MS, [4]Mississippi State University, Mississippi State, MS (119)

ABSTRACT

A field study to determine the effects of active ingredient selection on the efficacy of preemergence herbicides for Italian ryegrass (*Lolium perenne ssp. multiflorum*) in corn (*Zea mays* L.) was conducted from November 2017 to August 2018 at Mississippi State University. The study was conducted at the Black Belt Research Station in Brooksville, Mississippi and was a Randomized Complete Block design. This study consisted of 17 preplant herbicide programs. Applications of seven different fall applied residual herbicides were followed by either a January clethodim (Select Max) plus a February paraquat (Gramoxone SL 2.0) application or a February paraquat application only. Three of the programs did not include a fall applied residual herbicide. Italian ryegrass emergence ratings were taken seven, 14, 28, and 56 days after each herbicide application to assess herbicide efficacy. This study was conducted using a four-nozzle boom sprayer at 4.3 km h^{-1}, a carrier volume of 140 L ha^{-1}, and a pressure of 276 kPa. Plots measured three by nine meters, and corn was planted on raised beds with 97 cm spaced rows on April 6th, 2018. Corn development was assessed throughout the growing season by obtaining plant height measurements and leaf chlorophyll readings. Corn was harvested on August 6th, 2018, and yield was recorded and analyzed. The highest yielding treatment was sprayed with *S*-metolachlor plus atrazine (Cinch ATZ) in the fall and paraquat in February, and averaged 12,479 kg ha^{-1}. The lowest yielding treatment, the untreated check, averaged 5,042 kg ha^{-1}. Four of the five lowest yielding treatments did not receive a fall residual herbicide application. This data shows the importance of residual herbicide use in regards to Italian ryegrass control in Mississippi corn production. This study is currently being replicated and will conclude with the 2019 corn harvest.

ASSESSING THE POTENTIAL FOR ENLIST ONE TO VOLATILIZE AND INJURE NON-ENLIST COTTON.

G.L. Priess*[1], J.K. Norsworthy[1], Z.D. Lancaster[1], T. Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (120)

ABSTRACT

In 2018, off-target movement of 2,4-D choline injured adjacent susceptible cotton. Understanding how 2,4-D choline moved off-target may lead to actions that mitigate risk for off-target movement. An experiment to evaluate the mechanisms of movement of a commercial Enlist One (2,4-D choline) application was conducted on August 8, 2018, at the Lon Mann Cotton Research Station, near Marianna, AR. A 0.4-ha area was treated with 2,4-D choline at 1065 g ae/ha + glufosinate at 656 g ae/ha in the center of a 4-ha field of XtendFlex® (2,4-D susceptible) cotton when air temperature was 31.6 C and wind speed was 12.8 kph. Before application, 19-L buckets were placed over marked susceptible plants in 7.62 m increments in the downwind direction to edge of the field. The buckets were removed 30 minutes after application. XtendFlex® potted cotton plants were placed in the treated area at 0.5, 24, and 48 hours after application and later removed at 72 hours after application. Aerial photos including red-green-blue (RGB) and normalized difference vegetation indice (NDVI) were taken to observe drift patterns. High volume air samplers were placed in the center of the treated area and directly outside of the treated area on all four sides of the field 30 minutes after application. Sampling media (filter paper and PUFs) were replaced in the high volume air samplers every 24 hours after application up to 72 hours. The potted cotton plants were evaluated for auxin-like injury symptoms at 14 and 21 days after application. Volatilization of 2,4-D choline did occur at a rate of 3.766 ng/m^3 from inside the treated area, but no auxin symptoms were observed on potted plants. Likewise, cotton plants in the field in the downwind direction covered by buckets up to 30 minutes after application showed no auxin symptoms whereas uncovered plants were injured 55 to 75%. The NDVI and RGB photos showed that Enlist One did move out of the treated area injuring susceptible cotton only on the downwind side of the field at time of application. Based on these findings, it is concluded that injury to nearby non-Enlist cotton from an Enlist One (2,4-D choline) + Liberty (glufosinate) application is most likely the result of physical drift and there is little risk for injury caused by volatilization.

INTEGRATING THE TINE WEEDER WITH HERBICIDES IN CONVENTIONAL PEANUT PRODUCTION. W.C. Johnson III*; USDA-ARS, Tifton, GA (121)

ABSTRACT

There are several reports from the 1980's of cultivation being a cost-effective component in an integrated system to manage weeds in peanut. Those studies included benefin, dinoseb, alachlor, naptalam, and chloramben used in conjunction with cultivation. Those herbicides are no longer used on peanut and have been replaced by herbicides that are more versatile and have enhanced residual weed control properties. Previous weed management research conducted on organic peanut indicated that repeated cultivation with a tine weeder is an effective component in that production system. Studies were conducted in Tifton, GA from 2014 through 2017 to determine if tine weeding can be integrated with herbicides in conventional peanut production. Experiments evaluated a factorial arrangement of two levels of cultivation with a tine weeder and eight herbicide combinations. Cultivation regimes were cultivation with a tine weeder six times at weekly intervals and a non-cultivated control. Herbicides were labelled rates of ethalfluralin PRE, *s*-metolachlor PRE, imazapic POST, ethalfluralin/*s*-metolachlor, ethalfluralin/imazapic, *s*-metolachlor/imazapic, ethalfluralin/*s*-metolachlor/imazapic, and a nontreated control. The herbicides chosen were based on knowledge of the weed species composition at the research sites. Smallflower morningglory was present each year of the study. Treatments that included imazapic effectively controlled smallflower morningglory and did not require cultivation to supplement control from the herbicide. However, cultivation with the tine weeder supplemented ethalfluralin and/or *s*-metolachlor and the integrated combination effectively controlled smallflower morningglory. In contrast, ethalfluralin and/or *s*-metolachlor did not effectively control smallflower morningglory unless cultivated with the tine weeder. Annual grasses were effectively controlled by treatments that included ethalfluralin and/or *s*-metolachlor and did not need cultivation to supplement control provided by the herbicides. However, imazapic alone did not effectively control annual grasses and needed supplemental control from tine weeding. Interestingly, peanut yields did not respond to improved weed control from the integration of tine weeding with herbicides in two years of four. Peanut were cultivated with the tine weeder in May and June, with 2014 and 2017 having more total rainfall and days of rainfall events during that time period compared to the other years. Rainfall and wet soils affected the scheduling of cultivation and performance of the implement, lessening the benefits of cultivation. While weed control was improved by cultivation in 2014 and 2017, the benefit was not enough to affect peanut yield. This highlights the risk of depending on cultivation for weed control. In years without excessive rainfall during the cultivation period, peanut yields were increased by cultivation used to supplement herbicides. These results indicate that cultivation with the tine weeder can supplement herbicides and perhaps reduce herbicide use. This is contingent on knowing the weed species composition and carefully matching herbicides with weed species.

INFLUENCE OF TOPRAMEZONE PLUS TRICLOPYR MIXTURES AND APPLICATION TIMING ON BERMUDAGRASS CONTROL IN SUGARCANE. D.J. Spaunhorst*; USDA-ARS, Houma, LA (122)

ABSTRACT

Bermudagrass remains one of the most troublesome perennial weeds to control in sugarcane. Previous research has shown increased herbicidal activity with mixtures of topramezone plus triclopyr on bermudagrass in tall fescue turf. Limited data is available on sugarcane yield response and bermudagrass control with topramezone plus triclopyr mixtures. The first objective of this study was to evaluate the single herbicide treatments: topramezone (24.5 g ai ha^{-1}) plus triclopyr (1,130 g ae ha^{-1}), topramezone (24.5 g ai ha^{-1}) plus triclopyr (1,130 g ae ha^{-1}) plus asulam (1,850 g ae ha^{-1}), and topramezone (24.5 g ai ha^{-1}) plus triclopyr (1,130 g ae ha^{-1}) plus trifloxysulfuron (15.8 g ai ha^{-1}). A sequential treatment of topramezone (24.5 g ai ha^{-1}) plus triclopyr (1,130 g ae ha^{-1}) was applied 3 weeks after treatment to plots that were treated to the previously listed herbicide mixtures, and bermudagrass control was evaluated. The second objective was to determine if bermudagrass infestation level at the time of herbicide treatment influences herbicide efficacy for control of bermudagrass and sugarcane yield components and the third objective was to evaluate if additional bermudagrass control can be achieved with the addition of asulam or tryfloxysulfuron to topramezone plus tryclopyr to create a three-way herbicide mixture. Sequential herbicide treatments reduced green bermudagrass biomass and bermudagrass cover 4 and 43% more than single herbicide treatments, respectively, and had no negative impact on sugarcane yield and sucrose yield. Delaying the herbicide treatment timing until bermudagrass infestation reached 100% resulted in 21% less green bermudagrass biomass compared to herbicide treatments applied at 25% bermudagrass infestation. Increased control is likely attributed to having less time for bermudagrass to recover from the herbicide treatment before the row middles were shaded out by the crop canopy. Sucrose yield is a function of theoretical recoverable sucrose and sugarcane biomass yield. Herbicide treatments did not reduce sugarcane yield, but some treatments reduced sucrose yield. The three-way mixture of topramezone plus triclopyr plus asulam resulted in 11% greater sucrose yield than the two-way topramazone plus triclopyr mixture, but was similar to the topramezone plus triclopyr plus trifloxysulfuron mixture. Results from this study show plant cane (cultivar L 01-299) is highly tolerant to bermudagrass competition, as sucrose yield recorded from the nontreated check was equal to or greater than sucrose yields from herbicide treated plots. Additional research is needed to determine the effect of bermudagrass competition on subsequent ratoon yield and to evaluate other commonly planted sugarcane cultivars yield response to topramezone plus triclopyr mixtures.

EVALUATION OF CORN INJURY TO PREAPPLIED PSII HERBICIDES. J.T. Richburg*, J. Norsworthy, C. Meyer, J. Green; University of Arkansas, Fayetteville, AR (123)

ABSTRACT

Atrazine is the most effective and commonly used herbicide in corn weed control programs. Atrazine, a photosystem II (PSII) inhibitor, has the flexibility to be applied preemergence or postemergence. The current federal label restricts in-season atrazine applications to no more than 2,800 g/ha/year. Recently, the EPA released a statement regarding consideration for banning or limiting atrazine use to only 560 g/ha/year. Hence, research was initiated in 2017 at the Arkansas Agricultural Research and Extension Center in Fayetteville, Arkansas, to find other possible PSII-inhibiting herbicides that offer similar weed control without injuring corn. Combinations of various PSII-inhibiting herbicides were applied, alone or in combination with *S*-metolachlor or mesotrione, to LibertyLink corn and rated for percent injury (0-100%). The trial was maintained weed-free with applications of glufosinate and *S*-metolachlor. Fourteen days after application (DAA) less than 20% injury was observed for all treatments. Subsequently, by 28 DAA no treatment was injured greater than 10%, except fluometuron plus mesotrione (19% injury) and metribuzin plus *S*-metolachlor (12% injury). There was no height or stand differences among treatments at any point during the study. Yield was not impacted by treatments compared to atrazine-containing programs. This study indicates that corn has adequate tolerance to many of the preemergence-applied, PSII-inhibiting herbicides evaluated at the rates tested, even when tank-mixed with *S*-metolachlor or mesotrione. Some of these PSII-inhibiting herbicides include prometryn, linuron, and ametryn. This study will be repeated across multiple site years to ensure the safety over a wide assortment of environments.

SPECTRUM OF BURNDOWN WEED CONTROL BY HALAUXIFEN-METHYL. C. Cahoon*1, C. Askew2, A.C. York3, M. Flessner4, T. Hines2; 1Eastern Shore ARC Virginia Tech, Painter, VA, 2Virginia Tech, Painter, VA, 3North Carolina State University, Cary, NC, 4Virginia Tech, Blacksburg, VA (124)

ABSTRACT

Halauxifen-methyl is a member of the new arylpicolinate family of auxin herbicides developed by Dow AgroSciences. A pre-mix of halauxifen-methyl plus florasulam is currently labeled for use in wheat, barley, and triticale. Halauxifen-methyl alone is being marketed for horseweed control preplant burndown prior to planting corn, cotton, soybean, and other crops. Previous research has shown halauxifen-methyl effectively controls horseweed and henbit. However, little is known about its efficacy against many other common winter weeds. The objective of this study was to evaluate control of small and large horseweed and other common weeds encountered preplant burndown. Experiments were conducted near Jackson, NC, Ramseur, NC, three separate fields near Painter, VA (PL1A,PL1B, and PJ1), and two separate fields near Rocky Mount, NC (RM1 and RM2). Treatments were arranged in a randomized complete block design with treatments replicated 3 or 4 times. Treatments included halauxifen-methyl (0.004 lb ai A^{-1}), dicamba (0.25 lb ae A^{-1}), 2,4-D low rate (LR) (0.475 lb ae A^{-1}), 2,4-D high rate (HR) (0.95 lb ae A^{-1}), glyphosate (1.125 lb ae A^{-1}), halauxifen-methyl + glyphosate, dicamba + glyphosate, 2,4-D LR + glyphosate, and 2,4-D HR + glyphosate. Methylated seed oil at 1% V/V was included with halauxifen-methyl and halauxifen-methyl + glyphosate whereas nonionic surfactant was included with dicamba and 2,4-D when applied alone. Horseweed and cutleaf eveningprimrose were observed at 4 of 6 locations. Halauxifen-methyl controlled small (9 cm) and large (15 cm) horseweed 98 and 69%, respectively. Dicamba controlled small and large horseweed similar to halauxifen-methyl whereas 2,4-D was less effective. Horseweed density followed a similar trend. Halauxifen-methyl, dicamba, 2,4-D LR, 2,4-D HR, and glyphosate controlled cutleaf eveningprimrose 8, 49, 82, 93, and 27%, respectively. Halauxifen-methyl effectively controlled henbit (90%), common vetch (85%) and yellow woodsorrel (98%). However, the herbicide was less effective against common chickweed (10%), mouse-ear chickweed (0%), cudweed (3%), curly dock (10%), field violet (0%), and wild garlic (0%).

EVALUATION OF POSTEMERGENCE HERBICIDES IN SESAME. P.A. Dotray1, J. Grichar2, J.A. Tredaway3, J. Jones*4, W. Greene4, B. Greer3; 1Texas Tech University, Texas A&M AgriLife Research and Extension Service, Lubbock, TX, 2Texas A&M AgriLife Research, Yoakum, TX, 3Auburn University, Auburn University, AL, 4Auburn University, Auburn, AL (125)

ABSTRACT

Research was conducted to evaluate the effects of herbicides and application timing in sesame (*Sesamum indicum* L). Studies were conducted at the Field Crops Unit of the Auburn University E.V. Smith Research Station in Shorter, AL. The study was a randomized complete block with a split-plot treatment arrangement with four replications. Treatments included Dual Magnum (S-Metolachlor) at 0.64, 1.27, and 2.54 lbs ai/A, Warrant (acetochlor) at 1.5 lbs ai/A, Outlook (dimethenamid-P) at 0.75 lbs ai/A, Zidua SC (pyroxsulfone) at 0.084 lbs ai/A, Pethoxamid (chloracetamide) at 1 lbs ai/A, bicyclopyrone at 0.045 and 0.089 lb ai/A, and ProGibb at 0.004 lbs ai/A. Each herbicide treatment was applied at 3 and 6 days after sesame emergence (DAE) equaling 20 treatments in total. Visual injury was evaluated at 1, 3, and 7 weeks after treatment (WAT).

At 1 WAT, sesame sprayed at 6 DAE showed the lowest tolerance to both rates of bicyclopyrone (0.045 and 0.089 lb ai/A, respectively) and similar levels of injury to the highest rate of Dual (2.54 lbs ai/A) and Pethoxamid (1 lb ai/A). Outlook, ProGibb, Warrant, and Zidua did not injure the sesame as much as the other treatments at 3 DAE timing. At 3 WAT, sesame sprayed at 6 DAE continued to show the highest injury with both rates of bicyclopyrone and pethoxamid. Dual Magnum at the highest and middle rate (2.54 and 1.27 lbs ai/A) and Warrant caused similar levels of injury. Sesame sprayed at 3 DAE showed the most injury with treatments of bicyclopyrone, Dual Magnum, Pethoxamid, and Warrant. At 7 WAT, sesame treated at 3 DAE with all treatments did not rise above 50% injury with the exception of Warrant which was above 75%. Sesame treated at 6 DAE was most significantly injured by both rates of bicyclopyrone, the high rate of Dual Magnum (42.7 fl oz/A), and Pethoxamid. Outlook, ProGibb, and Zidua showed the lowest amount of injury at 7 WAT. The test had a total of 14.55 inches of rainfall throughout the injury rating time frame which could have affected the overall injury ratings.

POTENTIAL HERBICIDE OPTIONS FOR WEED CONTROL IN INDUSTRIAL HEMP.

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ABSTRACT

Industrial hemp is a new crop for North Carolina and for the United States as a whole. Industrial hemp production in North Carolina was approved under House Bill 992 in 2017. It is legal to produce in Kentucky, Colorado, Tennessee and California and several other states where markets are currently underdeveloped. Varieties of hemp considered industrial must contain less than 1% tetrahydrocannabinol and the crop can be utilized for multiple purposes. Hemp is a strong natural fiber with very long bast fibers. The seed can be harvested as a food crop for both hemp hearts and also for oil and meal. The oil is a healthy fat with high levels of two essential fatty acids linoleic acid (18:2 *omega*-6) and *alpha*-linolenic acid (18:3 *omega*-3). The meal is approximately 25% protein and can be used for high-value protein powders or high quality protein supplements in animal and human food sources (Callaway 2004). The hulls produced from the dehulling process are 30% protein. These also make an excellent nutritious additive for animal feeds. Hemp nuts are the product of dehulled industrial hemp seed. These are premium food grade products in high demand worldwide and the current market does not fulfill the anticipated demand. Hemp nuts without their hull are not viable seed and may be shipped globally. With several potential markets, industrial hemp offers producers a multi-purpose crop that may be delivered to several end-users.

There are currently no labeled herbicides for use in industrial hemp in the United States. The objective of this work was to evaluate pre and postemergence herbicides for safety in industrial hemp and begin developing data packages to request labeling for industrial hemp. Two postemergence herbicide tests and one preemergence herbicide test were planted in Oxford NC and Salisbury NC June 16th 2017. The experiments were randomized complete block designs with four replications each. Plots were 5 x 23 ft. Preemergence herbicides were applied on the day of planting and postemergence herbicides were applied 4 weeks later during the vegetative stage. Preemergence herbicides included Prowl 4.8 pt/a Dual Magnum 1.5 pt/a Zidua 1.5 oz/a Valor 3 oz/a 1 FlexStar 1.5 pt/a Atrazine 2.4 pt/a Tricor 5.3 oz/a, and Command 2 pt/a.

Postemergence herbicides included: FirstRate 0.75 oz/a, Classic 0.5 oz/a, UltraBlazer 1.5 pt/a, Huskie 15 oz/a, Clarity 16 oz/a, Callisto 3 oz/a, Basagran 1.5 pt/a, Harmony 0.75 oz/a, and Sharpen 2 oz/a. All products were applied using a CO2 backpack sprayer calibrated to deliver 287L/ha through a 11002 TTI nozzles.

In these tests all postemergence herbicides caused significant visible injury to industrial hemp plants. However, at this late application timing Clarity, UltraBlazer, Sharpen, Callisto, and Firstrate yielded statistically similar to the nontreated check. It is unlikely that these herbicides will be completely safe to use especially at earlier timings when weed control is most effective and industrial hemp plants are smaller. No preemergence herbicides tested were safe to use at the rates we applied. In many other tests unrelated to herbicide safety we were able to maintain a good stand with Dual Magnum applied as an early postemergence treatment. In 2018 we will be conducting an early postemergence test for several preemergence herbicides and continuing herbicide testing for both pre and postemergence products through the IR4 program.

HERBICIDE PHYSIOLOGY OF BENZOBICYCLON AND RICE TOLERANCE.

C. Brabham*, V. Varanasi, J. Norsworthy; University of Arkansas, Fayetteville, AR (127)

ABSTRACT

Benzobicyclon is a new 4-hydroxyphenylpyruvate dioxygenase inhibiting pro-herbicide from Gowan for use in rice. In the Mid-south, benzobicyclon (Rogue) is being evaluated as a post-flood herbicide treatment in a new soluble concentrate formulation. Our objective in this study was two-fold. First, investigate the potential uptake routes of benzobicyclon containing spray droplets after a post-flood treatment (direct foliage, indirectly through flood water, and the combination) and secondly, evaluate the effects of adjuvants (NIS, COC, MSO) on herbicide efficacy. Two separate greenhouse experiments were conducted and in all experiments benzobicyclon was applied at 371 g ai ha^{-1} to 2-4 leaf barnyardgrass (*Echinochloa crus-galli* (L.) Beauv) and 3-4 sprangletop (*Leptochloa panicoides* (J. Presl) Hitchc.). Prior to applications, a 2-inch flood was established and maintained for 28 days after treatment (DAT). At 28 DAT, averaged over species, the efficacy of benzobicyclon available only through direct foliage contact with or without adjuvants was negligible (6%), while control significantly improved to 74% on average when benzobicyclon was available in the flood water. This indicates a flood is essential for benzobicyclon activity. Interestingly, the addition of MSO to benzobicyclon when applied directly to the foliage improved control from 0% with no adjuvant to 11%. In a second experiment that simulated a post-flood herbicide application, the addition of any adjuvant, especially MSO, significantly improved control of barnyardgrass and sprangletop at 28 DAT. This indicates MSO may be the appropriate adjuvant to use with benzobicyclon, however crop safety and field experiments need to be conducted.

CHARACTERIZATION OF NON-TARGET SITE RESISTANCE TO FOMESAFEN IN PALMER AMARANTH. V. Varanasi*, C. Brabham, J. Green, J. Norsworthy; University of Arkansas, Fayetteville, AR (128)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S. Wats.) is one of the most prolific and troublesome weeds in North America, especially in the midsouthern U.S. The evolution of resistance to protoporphyrinogen oxidase (PPO) inhibitors in different biotypes is a major cause of concern to soybean and cotton growers in several states. A statewide survey conducted earlier revealed widespread PPO-inhibitor resistance in Palmer amaranth and the mechanism to be predominantly target-site based (Gly_{210}deletion and Arg_{128}Gly/Met substitutions). In this study, we reconfirmed our initial findings about a PPO-resistant accession having no target-site mutations. Seedlings of this accession at the 3- to 4-leaf stage were sprayed in the greenhouse with fomesafen (Flexstar at 395 g ai ha^{-1}) and 20% of the plants survived. Further, dose-response assay was conducted on the resistant and susceptible (1986) populations to assess the level of PPO-inhibitor resistance in this accession. The resistant index (R/S), based on the GR_{50} was found to be 17.9 for the accession. TaqMan quantitative PCR on the survivors indicated no target-site mutations. The results were further validated by sequencing the target-sites *PPX2* and *PPX1* genes. No novel mutations were detected, indicating a possible non-target site resistance mechanism in this accession. Currently, we are testing for cross-resistance to other PPO inhibitors and testing our hypothesis that resistance in this biotype is metabolic in nature.

MOLECULAR MARKERS AND COMPOUNDS ASSOCIATED WITH SWEETPOTATO ALLELOPATHY. D. Wilson*1, G.A. Caputo1, M. Ferreira1, Z. Yue2, C. Barickman1, T. Tseng1; 1Mississippi State University, Mississippi State, MS, 2Mississippi State University, Starkville, MS (129)

ABSTRACT

Sweet potato ((*Ipomoea batatas* (L.) Lam.) is grown on over 27,000 acres across 160 farms in Mississippi, with an estimated value of $80 million. Unfortunately, majority of the sweet potato farms are exposed to problematic weeds that can cause yield reduction of up to 90%. Despite the negative weed interference in sweet potato, herbicide options in sweet potato are limited, and only a few are highly effective on problematic weeds. To overcome these herbicide limitations and preserve or improve sweet potato quality and yield for Mississippi growers, there is a distinct need to find an alternative weed control strategy that can effectively reduce the weed pressure around the crop, and at the same time protect the yield and quality of the storage roots. One of the promising weed control option is to use the weed suppressive ability already present in crop varieties, also known as allelopathy. From our greenhouse and field screening to identify allelopathic sweet potato varieties against Palmer amaranth, we found two out of 31 varieties that inhibited Palmer amaranth growth by up to 80%. All markers were found to be polymorphic. Genetic diversity among allelopathic varieties (h=0.238, I=0.357) were higher than among non-allelopathic varieties (h=0.173, I=0.252). None of the SSR markers were identified to be unique to allelopathic phenotypes, but instead they were more strongly correlated to the varietal origin. HPLC analysis revealed coumarin, chlorogenic acid, caffeic acid, hydroxycinnamic acid, and transcinnamic acid present in higher levels in allelopathic than compared to non-allelopathic variety. Allelopathy promotes sustainable agriculture by increasing agricultural productivity and at the same time have minimal adverse effects on the environment. It increases crop productivity with minimal dependency on herbicides for weed control. Moreover, allelopathic crops can control weeds season long, thus reducing repetitive application of herbicides. The use of allelopathic crops will reduce the usage of herbicides for weed management, and therefore prevent further evolution of herbicide resistant weeds. Allelopathic sweet potato varieties will also be an effective option for managing weeds in organic production as herbicides are not permitted to be used.

A TRANSCRIPTOMIC APPROACH FOR UNDERSTANDING PROPANIL RESISTANCE IN ECHINOCHLOA COLONA. C. Rouse*1, N. Roma-Burgos1, C.A. Saski2, R. Noorai2, V. Shankar2; 1University of Arkansas, Fayetteville, AR, 2Clemson University, Clemson, SC (130)

ABSTRACT

The use of next-generation-sequencing technologies to understand weed genomics and their associated 'weedy traits' is a novel approach to understanding weed biology. These technologies can be used to assess the plant transcriptome to understand a variety of critical plant functions. We used transcriptomics to identify the resistance mechanisms to quinclorac in multiple-resistant (ECO-R) *Echinochloa colona*. Similarly, we used the same approach to investigate the resistance mechanism to propanil in ECO-R and describe the general physiological response of *E. colona* to propanil. Previous experiments showed that increased production of aryl acylamidase enzyme, the enzyme that degrades propanil in plants, was the cause of resistance. The assumption was that resistance to propanil in *Echinochloa* spp. populations is by the same mechanism. Using the transcriptome, we sought to verify this hypothesis. Without herbicide treatment, ECO-R had elevated biosynthesis of trehalose, which is known to be involved in stress response. Following propanil treatment, most biological functions were repressed (97% of transcripts) in ECO-R. These included components of photosynthesis and carbon metabolism. Two primary hydroxylating enzymes were induced - CYP709B2 (8.6-fold) and CYP72A15 (3.4-fold). Along with these, several secondary conjugating enzymes including GSTU17 and multiple glycosyltransferases were also induced. These secondary enzymes are capable of modifying the 3,4-dichloroanaline and propionic acid metabolites. The response of susceptible *E. colona* (ECO-S) to propanil treatment involved both biotic and abiotic stress- mitigating actions similar to a hypersensitive reaction. Trehalose biosynthesis was also induced in ECO-S following propanil treatment. Multiple peroxidase genes were induced in ECO-S, which is a standard response to alleviate the phytotoxic effect of herbicide. This response was not observed in ECO-R. Otherwise, ECO-R and ECO-S shared common responses to propanil action including increased glucosinolate production, avirulence protein transcription, and ABA-dependent processes. Given the gene expression pattern across both ecotypes, it appears that ECO-R is capable of detoxifying propanil via the CYP709B2 or CYP72A15 enzymes. The accompanying increased production of trehalose which may aid in the recovery and protection against propanil application.

PALMER AMARANTH RESISTANCE TO PPO INHIBITORS: IT'S COMPLICATED.

N. Roma-Burgos, G. Rangani, R.A. Salas-Perez, A.C. Langaro, M. Bastiani, R.C. Scott; Department of Crop Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR 72704 (131)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) is arguably the most formidable broadleaf weed of agronomic and annual horticultural crops in the southern USA today. It has evolved resistance to ALS (acetolactate synthase)-, EPSPS (5-enolpyruvyl-shikimate-3-phosphate synthase)-, microtubule assembly-, PS II (photosystem II)-, HPPD (4-hydroxyphenylpyruvate dioxygenase)-, and PPO (protoporphyrinogen oxidase)-inhibitors. Resistance to PPO inhibitors was discovered first in tall waterhemp (*A. tuberculatus*). Resistance was due to a unique target-site (TS) mechanism, deletion of the G_{210} codon. So far, this is the only resistance mechanism found in tall waterhemp. It was predicted, and later discovered, that the same mechanism will also be selected by PPO herbicides among Palmer amaranth populations. Recent studies on Palmer amaranth revealed that about 75% of 35 resistant populations tested carried the deletion mutation, but only about 50% of PPO-resistant plants carried the G_{210} deletion mutation. The rest either had a different TS mutation or had nontarget-site resistance (NTSR) mechanisms. Indeed, some PPO-R Palmer amaranth carried a different TS mutation located at R_{128}, which could be either $R_{128}G$ or $R_{128}M$. Besides these, we found yet other novel TS mutations in the *PPX2* gene of Palmer amaranth. Populations harboring the G_{210} deletion mutation were 8- to 15-fold more resistant than the susceptible standard; those without the G_{210} deletion were 3- to 10-fold more resistant. The range in resistance levels of field populations carrying the same TS mutation is due largely to the different levels of homogeneity and zygosity within populations. The resistance level is modified further by the type of TS mutation. The resistance factor values indicate that the G_{210} deletion may be the strongest mutation that can be fixed in a population. Other mutations that lend higher resistance level to PPO inhibitors may also cause high fitness penalty and, therefore, are eliminated from the population. Weaker mutations that are selected still contribute to the resistance evolution dynamics and, if accompanied even by a weak NTSR mechanism, may endow a field-level resistance that can cause economic problems. The TS mutations, by themselves, may not endow 100% protection from initial damage by PPO herbicides; but supplementary protection from other mechanisms could boost the plant's resistance level. This is true for both intra-plant and intra-population multiple-resistance situation. Around 15% of PPO-resistant Palmer amaranth have NTSR mechanisms. In a closer study of 23 PPO-resistant populations, the survivors within a population could have a range of injury from 0 – 10% to 0 - 89%. Two populations homogeneous for the same TS mutation may still have different levels of resistance because of the presence of other (protection or avoidance) mechanisms. Adding a layer of complication is the fact that different TS mutations confer different cross-resistance patterns to foliar- and soil-applied PPO herbicides. One TS mutation may not eliminate the utility of all PPO-inhibitor herbicides. For example, these TS mutations have minimal to no effect on the binding affinity of oxadiazon and saflufenacil. PPO-resistant Palmer amaranth are still generally susceptible to saflufenacil. Palmer amaranth has diverse resistance-conferring mutations in the *PPX2* gene. Effective site-specific management of PPO-resistant Palmer amaranth is possible once the profile of resistance mechanisms is known.

HOSTING THE 2017 SWSS WEED CONTEST - REFLECTIONS AND LESSONS LEARNED. R. Jain*1, C. Dunne1, J. Holloway, Jr2, R. Wuerffel3, E. Rawls1, K. Randolph1, E. Parker4, J. Long5, M. Smith1, B. Minton6; 1Syngenta Crop Protection, Vero Beach, FL, 2Syngenta Crop Protection, LLC, Jackson, TN, 3Syngenta, Sebastian, FL, 4University Tennessee- Knoxville, Knoxville, TN, 5Syngenta, Vero Beach, FL, 6Syngenta Crop Protection, Cypress, TX (133)

ABSTRACT

The 38th annual SWSS (Southern Weed Science Society) Weed Contest was held at Syngenta's Vero Beach Research Center in Vero Beach, Florida on August 1st and 2nd, 2017. A total of 64 students from 9 different Universities in the Southern Region participated in the contest. There were thirteen graduate and three undergraduate teams competing in five different events; Weed Identification, Herbicide Identification based on symptomology, written Calibration test, hands-on Sprayer Calibration, two different Farmer Problems, and a fun Mystery event.

It took several months of planning and preparation by a core team of Syngenta employees from Vero Beach and the company's southern region to put the contest together. Over 70 volunteers, a majority from Syngenta, but also several members of the Southern Weed Science Society from Universities and other companies, came to help with running the contest.

The winner of the undergraduate student team award was Texas A&M University. Winners of the graduate student team awards were Virginia Tech (1st place), University of Arkansas (2nd place), and Texas A&M University (3rd place). A total of 17 other awards were also presented to high scoring individuals.

A survey was conducted to receive feedback from the students and coaches participating in the contest. Results from the survey will be used to identify areas for improvement and help the organizers of future contests.

WSSA HERBICIDE RESISTANCE PORTAL: HELPING END-USERS FIND USEFUL INFORMATION TO MANAGE A SERIOUS PROBLEM. M. Horak*1, M. Bagavathiannan2, C. Rouse3, D. Shaw4, R. Leon5; 1Monsanto Company, St. Louis, MO, 2Texas A&M AgriLife Research, College Station, TX, 3University of Arkansas, Fayetteville, AR, 4Mississippi State University, Miss State, MS, 5North Carolina State University, Raleigh, NC (134)

ABSTRACT

Herbicide resistance (HR) has become one of the most important threats to agricultural production. Effective training and easy access to educational material about how to deal with this problem is of great importance to help farmers prevent, delay and manage HR. A large number of academic institutions, agribusiness companies and individuals have generated educational materials about HR. However, those materials are either useful but difficult to locate using regular search engines, or can be easily found but the information/recommendations presented are not supported by scientific data or meet the basic principles of HR management as endorsed by the Weed Science Society of America (WSSA). For this reason, the WSSA Herbicide Resistance Education Committee (E12b) initiated a project to develop an on-line portal that will provide the general public with a fast and easy tool to find information sources (e.g., websites, pdf, videos, podcasts, etc.) that properly address HR management and that are based on sound scientific data. The WSSA Herbicide Resistance Portal is a website-interface connected to a database that is populated by submission of documents and media. All documents will be reviewed by volunteered WSSA members to make sure that they meet established standards before inclusion. Users will be able to search the database with multiple filter options including crop, weed species, region/state, and herbicide. The impact of the WSSA Herbicide Resistance Portal will depend on the members of WSSA and affiliated regional societies actively submitting suitable documents and recommending this tool to end-users.

AN OVERVIEW OF THE NEW EPA MANDATED REQUIREMENTS FOR PARAQUAT CONTAINING PRODUCTS: WHAT DOES THAT MEAN FOR THE END-USER AND REGISTRANT. M.U. Dixon*; Syngenta Crop Protection, Greensboro, NC (135)

ABSTRACT

Paraquat products are valuable components in integrated weed management programs associated with conventional and genetically modified crops. Furthermore, paraquat is extremely important where glyphosate resistance in weeds has been identified and is also an essential component in delaying the development of resistance to glufosinate in crops that are designed to tolerate that herbicide. Additionally, but no less important, paraquat is a critical tool in reduced and no-till farming which leads to reduced soil erosion and a significantly reduced carbon footprint when compared to conventional cultivation. On December 14, 2016, the United States Environmental Protection Agency issued the Paraquat Dichloride Human Health Mitigation Decision that specified required changes for who and how paraquat containing products may be used. These changes include label changes, creation and distributions of supplemental warning materials, new training requirements for paraquat users, requirementd for closed system packaging and restrictions on who may use paraquat products. These changes will be implemented in a three phase process with the final requirements having to be in place by October 1, 2020.

ACTIVE INGREDIENT EFFECTS ON ITALIAN RYEGRASS (LOLIUM MULTIFLORUM) CONTROL IN MISSISSIPPI CORN (ZEA MAYS L.). M.T. Wesley Jr.*[1], J.A. Bond[2], E.J. Larson[3], D.B. Reynolds[4], J. Ferguson[4]; [1]MIssissippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University, Starkville, MS, [4]Mississippi State University, Mississippi State, MS (119)

ABSTRACT

A field study to determine the effects of active ingredient selection on the efficacy of preemergence herbicides for Italian ryegrass (*Lolium perenne ssp. multiflorum*) in corn (*Zea mays* L.) was conducted from November 2017 to August 2018 at Mississippi State University. The study was conducted at the Black Belt Research Station in Brooksville, Mississippi and was a Randomized Complete Block design. This study consisted of 17 preplant herbicide programs. Applications of seven different fall applied residual herbicides were followed by either a January clethodim (Select Max) plus a February paraquat (Gramoxone SL 2.0) application or a February paraquat application only. Three of the programs did not include a fall applied residual herbicide. Italian ryegrass emergence ratings were taken seven, 14, 28, and 56 days after each herbicide application to assess herbicide efficacy. This study was conducted using a four-nozzle boom sprayer at 4.3 km h^{-1}, a carrier volume of 140 L ha^{-1}, and a pressure of 276 kPa. Plots measured three by nine meters, and corn was planted on raised beds with 97 cm spaced rows on April 6th, 2018. Corn development was assessed throughout the growing season by obtaining plant height measurements and leaf chlorophyll readings. Corn was harvested on August 6th, 2018, and yield was recorded and analyzed. The highest yielding treatment was sprayed with *S*-metolachlor plus atrazine (Cinch ATZ) in the fall and paraquat in February, and averaged 12,479 kg ha^{-1}. The lowest yielding treatment, the untreated check, averaged 5,042 kg ha^{-1}. Four of the five lowest yielding treatments did not receive a fall residual herbicide application. This data shows the importance of residual herbicide use in regards to Italian ryegrass control in Mississippi corn production. This study is currently being replicated and will conclude with the 2019 corn harvest.

ASSESSING THE POTENTIAL FOR ENLIST ONE TO VOLATILIZE AND INJURE NON-ENLIST COTTON.

G.L. Priess*[1], J.K. Norsworthy[1], Z.D. Lancaster[1], T. Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (120)

ABSTRACT

In 2018, off-target movement of 2,4-D choline injured adjacent susceptible cotton. Understanding how 2,4-D choline moved off-target may lead to actions that mitigate risk for off-target movement. An experiment to evaluate the mechanisms of movement of a commercial Enlist One (2,4-D choline) application was conducted on August 8, 2018, at the Lon Mann Cotton Research Station, near Marianna, AR. A 0.4-ha area was treated with 2,4-D choline at 1065 g ae/ha + glufosinate at 656 g ae/ha in the center of a 4-ha field of XtendFlex® (2,4-D susceptible) cotton when air temperature was 31.6 C and wind speed was 12.8 kph. Before application, 19-L buckets were placed over marked susceptible plants in 7.62 m increments in the downwind direction to edge of the field. The buckets were removed 30 minutes after application. XtendFlex® potted cotton plants were placed in the treated area at 0.5, 24, and 48 hours after application and later removed at 72 hours after application. Aerial photos including red-green-blue (RGB) and normalized difference vegetation indice (NDVI) were taken to observe drift patterns. High volume air samplers were placed in the center of the treated area and directly outside of the treated area on all four sides of the field 30 minutes after application. Sampling media (filter paper and PUFs) were replaced in the high volume air samplers every 24 hours after application up to 72 hours. The potted cotton plants were evaluated for auxin-like injury symptoms at 14 and 21 days after application. Volatilization of 2,4-D choline did occur at a rate of 3.766 ng/m^3 from inside the treated area, but no auxin symptoms were observed on potted plants. Likewise, cotton plants in the field in the downwind direction covered by buckets up to 30 minutes after application showed no auxin symptoms whereas uncovered plants were injured 55 to 75%. The NDVI and RGB photos showed that Enlist One did move out of the treated area injuring susceptible cotton only on the downwind side of the field at time of application. Based on these findings, it is concluded that injury to nearby non-Enlist cotton from an Enlist One (2,4-D choline) + Liberty (glufosinate) application is most likely the result of physical drift and there is little risk for injury caused by volatilization.

EVALUATION OF CORN TOLERANCE TO POSTEMERGENCE-APPLIED PSII HERBICIDES . J.T. Richburg*[1], J.K. Norsworthy[1], T. Barber[2], M.C. Castner[1], M.M. Zaccaro[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (121)

ABSTRACT

Atrazine is the most effective and commonly used herbicide in corn weed control programs. As a photosystem II (PSII) inhibitor, atrazine has the flexibility to be applied preemergence or postemergence. The current federal label restricts in-season atrazine applications to no more than 2,800 g/ha/year. Recently, the EPA released a statement regarding its consideration for banning or limiting atrazine use to only 560 g/ha/year. Therefore, research was conducted in 2017 and 2018 at the Arkansas Agricultural Research and Extension Center in Fayetteville, Arkansas as well as on-farm locations near Rohwer and Tillar, Arkansas in 2017 and 2018, respectively, to determine if corn would tolerate other PSII-inhibiting herbicides that offer weed control similar to atrazine. Various PSII-inhibiting herbicides were applied, alone or in combination with *S*-metolachlor or mesotrione, to 30-cm-tall Roundup Ready/LibertyLink corn. Site years were considered a random effect to allow data analysis over the four unique environments. Trial sites were maintained weed-free with applications of glufosinate and *S*-metolachlor. Fourteen days after application (DAA) the addition of *S*-metolachlor to prometryn- and linuron-containing treatments caused43% and 40% injury to corn, respectively. Injury to corn for metribuzin-, propazine-, and simazine-containing treatments was comparable to atrazine-containing treatments (<8% injury). Subsequently, by 28 DAA corn was not injured more than 25% by any herbicide treatment and certain fluometuron- and ametryn-containing treatments did not differ from atrazine-containing treatments. There was no height or stand differences among treatments at any point during the study. Corn yield, averaged across additives with PSII herbicides, was greatest for atrazine-containing treatments, averaging 13,000 kg ha^{-1}. Based on this research, corn appears to have some visible tolerance to several postemergence-applied, PSII-inhibiting herbicides. Future efforts should focus on implementing the most promising PSII-inhibiting atrazine replacements into a full-season corn weed control program.

BROWNTOP MILLET (UROCHLOA RAMOSA) AND BROADLEAF SIGNALGRASS (UROCHLOA PLATYPHYLLA) COMPETITION EFFECTS ON GROWTH AND YIELD OF PEANUT (ARACHIS HYPOGAEA) MANAGED WITH PROHEXADIONE CALCIUM. Z.R. Treadway*, B. Zurweller, J. Ferguson; Mississippi State University, Mississippi State, MS (123)

ABSTRACT

The use of prohexadione calcium growth regulator on peanut (*Arachis hypogaea)* has become a common practice among producers. The chemical is known to reduce internode elongation, which leads to rows that are easily differentiated from one another for greater pod production which is often lost due to the excessive vegetative growth of runner peanuts in Mississippi. Studies have also concluded that peanut plants that have been subjected to the two labeled applications of prohexadione calcium show increased yields at time of harvest and also exhibit a decrease in the amount of pods shed from the plant during growth and digging.

With the increasing dependence on prohexadione calcium, a question was posed about the efficacy of the growth regulator when applied to peanut plants under stressful conditions. An experiment was conducted at Mississippi State University in which a field of Georgia-06G peanuts were subjected to various factors to produce a stressful environment. Treatment plots included an herbicide damaged crop and a crop suffering from leaf spot. Treatment plots were mirrored, in that each treatment was broken into sub-treatments. Each treatment plot had a sub-treatment plot that was constantly under weed pressure from browntop millet (*Urochloa ramosa)*, and broafleaf signalgrass *(Urochloa platyphylla)*, and a sub-treatment that was subject to weed control.

Plots were harvested, and the results proved that a weed free environment lends itself to a higher peanut yield across treatment compared to one with heavy *Urochloa* spp. pressure. The highest yield was 6,173 kg ha^{-1} without any environmental or weed pressure whereas the yields were only 1,522 kg ha^{-1} when plants were suffering from leaf spot with heavy *Urochloa* spp. weed pressure.

Results concluded that weed pressure and stress level both have an influence on the efficacy of prohexadione calcium and therefore have an effect on yield. The only way to insure an economical and effective application of prohexadione calcium is to apply on weed free and healthy peanuts.

CHANGES TO COTTON BOLL DISTRIBUTION FOLLOWING LOW RATES OF DICAMBA AT DIFFERENT GROWTH STAGES. K.R. Russell*, P.A. Dotray, G.L. Ritchie; Texas Tech University, Lubbock, TX (124)

ABSTRACT

The adoption of dicamba-tolerant cotton (*Gossypium hirsutum*) will increase the number of preplant and postemergence dicamba applications for control of troublesome broadleaf weeds including glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats). An increase in dicamba use will increase the risk of off target movement to non-target crops. A field study was conducted at the Texas Tech New Deal Research Farm equipped with subsurface drip irrigation in 2017 and 2018 to evaluate cotton response to dicamba when applied at four crop growth stages (first square + two weeks, first flower, first flower + two weeks, and cutout). Dicamba (Clarity 4L) at 0.50 (1X), 0.05 (1/10X), 0.01 (1/50X), 0.005 (1/100X), and 0.001 (1/500X) lb ae/a was applied to FiberMax 1830GLT using a carrier volume of 15 gallons per acre and TTI11004 nozzles. Plots, four rows spaced 102-cm apart by 9.1 meters, were replicated three times. Only the middle two rows received the herbicide treatments. Cotton was box mapped prior to harvest to determine boll number and distribution as affected by the different rates and timings of dicamba. Plots were machine harvested to determine lint yield. Relative to the non-treated control, no change in boll number and boll position was observed following dicamba at 1/500X and 1/100X regardless of application timing in both years. When applications were made at first square + two weeks, a shift in boll nodal position was observed following dicamba at 1/50X in 2017 and at 1/10X in 2018. A shift in boll distribution from the 1/50X rate of dicamba was noted at the first flower application in 2017, but not in 2018. When applications were made at first flower + two weeks, boll number was reduced following dicamba at 1X. Relative to the non-treated control, no change in boll number and boll position was noted following any dicamba rate when applied at cut out in either 2017 or 2018. Dicamba at 1/500X, 1/100X, and 1/50X did not affect yield at any application timing when compared to the non-treated control. When dicamba was applied at 1/10X, the greatest yield loss was observed when dicamba was applied at first square + two weeks followed by first flower and first flower + two weeks.

INTERACTION OF SEEDLING VIGOR, PLANTING DATE, AND FLUMIOXAZIN ON PEANUT GROWTH. N.L. Hurdle*[1], T.L. Grey[2], C. Pilon[1], E.P. Prostko[1], W.S. Monfort[1]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Titon, GA (125)

ABSTRACT

Over 50% of U.S. peanut (*Arachis hypogaea)* production can be credited to Georgia. The growing season for peanut can extend up to 150 days, it is essential to manage weeds in such a manner as to achieve maximum yield potential. This includes applications of PRE herbicides. Numerous PRE herbicides are registered for peanut including pendimethalin, diclosulam, and flumioxazin. Emerging peanuts will inevitably come into contact with these PRE applied herbicides. A study was performed in Ty Ty and Plains, GA in order to record the physiological effects of emerging peanut to PRE herbicides. A 3x2 factorial RCBD comprising of 3 herbicide treatments and 2 seedling germination rates with 4 replications was utilized at both locations in the 2018 growing season. Treatments included a nontreated control, 107 g ai ha^{-1} of flumioxazin PRE, and diclosulam at 27 g ai ha^{-1} PRE. All plots received an application of pendimethalin at 4480 g ai/ha. Physiological measurements included photosystem II efficiency, intercellular CO_2, electron transport, and stomatal conductance using a Li-COR 6800 (LI-COR Inc., Lincoln, NE 68504) to record these measurements. Peanut stand counts and diameter measures were also recorded.

Data was analyzed by location in SAS 9.4. Both Ty Ty and Plains had treatment differences in electron transport, but no trend was noted. Plains also had a difference in treatment by seed vigor. Intercellular CO_2differences were noted in Ty Ty by plant date and by seed vigor. Plains had no differences in intercellular CO_2. PRE applications of flumioxazin do affect emerging peanuts physiologically, but are not detrimental to early crop growth with no differences in stand establishment and early season growth.

DO CONTACT HERBICIDES EXACERBATE INJURY CAUSED BY DICAMBA ON NON-DICAMBA-RESISTANT SOYBEAN? M.C. Castner*, J.K. Norsworthy, G.L. Priess, M.M. Zaccaro; University of Arkansas, Fayetteville, AR (126)

ABSTRACT

With recent advancements in crop technology, growers may be given the opportunity to effectively control problematic broadleaf weeds such as Palmer amaranth (*Amaranthus palmeri*) with the Engenia formulation of dicamba applied postemergence in XtendFlex cotton and Roundup Ready 2 Xtend soybean. Despite its efficacy, Engenia along with other formulations of dicamba, are difficult to completely clean from a spray tank. Without proper tank cleanout, growers spraying non-dicamba-resistant soybean (conventional, glufosinate-resistant, or glyphosate-resistant) are at high risk for contaminating sensitive varieties. To evaluate consequences of dicamba-tank contamination on a glufosinate-resistant variety, an experiment was conducted in Fayetteville, Arkansas in 2018. Contamination rates of dicamba at 0, 5.6, 0.56, and 0.056 g ae ha^{-1} were applied alone, with glufosinate at 656 g ai ha^{-1}, with acifluorfen at 560 g ai ha^{-1}, or with glufosinate plus acifluorfen to V3 soybean. Treatments were arranged in a two-factor factorial, with the first factor being herbicide and the second being dicamba rate. All herbicides at 21 days after treatment (DAT) in combination with dicamba at 5.6 g ae ha^{-1} caused greater auxin symptomology on soybean at 70 to 75% than combinations with 0.56 and 0.056 g ae ha^{-1}. Treatments with dicamba at 0.56 g ae ha^{-1} at 21 DAT demonstrated approximately 60% auxin symptomology on soybean regardless of combination, which was greater than all treatments containing dicamba at 0.056 g ae ha^{-1}. Weight of 100 seeds was only reduced with treatments containing 5.6 g ae ha^{-1} dicamba. An interaction between dicamba rate and herbicide combination was observed for soybean maturity, with glufosinate plus acifluorfen combined with 5.6 g ae ha^{-1} dicamba delaying maturity 8 days. Overall, the herbicide applications made to soybean did not appear to interact with dicamba or cause increased auxin symptomology on soybean.

ASSESSMENT OF PREEMERGENCE HERBICIDES FOR CONTROL OF PPO-RESISTANT PALMER AMARANTH IN COTTON. W. Coffman*[1], T. Barber[2], J.K. Norsworthy[1], G.L. Priess[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (127)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) resistant to all protoporphyrinogen oxidase (PPO)-inhibiting herbicides has become widespread throughout eastern Arkansas. The presence of PPO-resistant Palmer amaranth further limits options for weed control preplant or preemergence (PRE). Additionally, some PPO-resistant Palmer amaranth populations have been observed as more difficult to control with other herbicide sites of action. To determine if residual herbicides commonly used in cotton (*Gossypium hirsutum*) were still viable control options for PPO-resistant Palmer amaranth, a field experiment was conducted on-farm in Marion and Crawfordsville, AR in 2018 with the objective of evaluating herbicides commonly used PRE in cotton. Neither site was irrigated. Treatments were arranged in a single-factor randomized complete block with three replications at Marion and four replications at Crawfordsville. Visible Palmer amaranth control ratings were recorded 2 and 4 weeks after application (WAA). Palmer amaranth density (plants m^{-2}) was measured at 4 WAA by counting surviving weeds in two 0.5 m quadrats in each plot. Treatments were applied to freshly tilled soil and included the PPO-inhibitor fomesafen and other standalone herbicides with various sites of action. Treatments also included fluridone and fluometuron in combination with the aforementioned standalone herbicides. Data were subjected to analysis of variance and orthogonal contrasts were used to test for differences between standalone herbicides and herbicide mixtures. Control levels were much higher at Marion than Crawfordsville due to differences in environmental conditions. At 2 WAA, fomesafen at Crawfordsville controlled Palmer amaranth 80%, but by 4 WAA, Palmer amaranth was controlled only 36%. In contrast, Palmer amaranth control with fomesafen at Marion was 86% 2 WAA and 60% 4 WAA. At both locations, a trend was observed where mixtures containing fluometuron provided exceptional control of Palmer amaranth. Contrasts revealed improved Palmer amaranth control with herbicide mixtures compared to standalone herbicides for both locations 4 WAA. Results indicate two effective sites of action are needed for a high level of PPO-resistant Palmer amaranth control in cotton.

ALLELOPATHY IN WEEDY RICE: A RESOURCE FOR BREEDING ALLELOPATHIC RICE CULTIVARS. T. Tseng[1], B.C. Schumaker*[2], N.R. Burgos[3], E. Castro[2], S. Shrestha[2], S.D. Stallworth[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS, [3]University of Arkansas, Fayetteville, AR (128)

ABSTRACT

Rice supplies a significant portion of the daily diet of millions worldwide, and demand for rice production is projected to increase significantly in coming years due to population growth. Unfortunately, weed competition is a limiting factor in rice production and there is a need to identify supplemental weed management strategies. Weedy rice is of the same species as cultivated rice, *Oryza*, and is a common rice weed exhibiting allopathic characteristics Allelopathy is defined as the release of chemical compounds from one plant into the environment that inhibits the growth and development of neighboring species. Identification and incorporation of allelopathic traits from weedy rice into cultivated rice lines may have a positive impact on rice yield. The overall objective of this study is to characterize weedy rice accessions based on allelopathic potential to suppress prevalent weeds like barnyardgrass. These accessions once identified may be used in identifying genes associated with their weed suppressive trait. In this study 11 weedy rice accessions, 2 non-allelopathic rice cultivars (REX CL163), and 3 allelopathic rice cultivars (RONDO PI312777 PI338046) were screened using a stair step technique. Height measurements were recorded each week for 4 weeks. At the end of 4 weeks, dry weights of all plants were recorded. Allelopathic potential was calculated based on percent inhibition of barnyardgrass. Nine weedy rice accessions expressed more height reduction of the target weed than rice line Rondo. Weedy rice accession B2 showed consistent height inhibition in both preliminary and current studies. Allelopathic genes found in weedy rice, being the same species as rice, can easily be used in rice breeding programs. These accessions should be considered in development of weed-suppressive rice cultivars.

COMPARISON OF BURNDOWN WEED CONTROL BY HALAUXIFEN-METHYL, 2,4-D, AND DICAMBA. M.C. Askew*[1], C.W. Cahoon[2], A. York[3], M.L. Flessner[4]; [1]Virginia Tech, Eure, NC, [2]North Carolina State University, Raleigh, NC, [3]North Carolina State University, Cary, NC, [4]Virginia Tech PPWS Dept., Blacksburg, VA (129)

ABSTRACT

Horseweed (*Conyza canadensis* L.) is a problematic broadleaf weed commonly found in reduced- and no-tillage systems. Prior to selection for glyphosate-resistant biotypes, horseweed was easily controlled by glyphosate applied preplant burndown. Along with the glyphosate-resistance, horseweed biotypes have also evolved resistance to paraquat and ALS-inhibiting herbicides. Halauxifen-methyl, the active ingredient in Elevore™ and a component of Quelex™, is a new auxin herbicide marketed by Corteva Agrisciences. An experiment was conducted to evaluate control of horseweed and other winter annual weeds encountered preplant burndown by halauxifen. Experiments were conducted near Painter, VA, Rocky Mount, NC, Jackson, NC, and Gates, NC during the 2017 and 2018 growing seasons. Herbicide treatments (rates in parenthesis) included halauxifen (5 g ae ha^{-1}), dicamba (280 g ae ha^{-1}), 2,4-D low rate(LR)(533 g ae ha^{-1}), 2,4-D high rate (HR)(1066 g ae ha^{-1}), glyphosate (1260 g ae ha^{-1}), glyphosate + halauxifen (1260 g ae ha^{-1} + 5 g ae ha^{-1}), glyphosate + dicamba (1260 g ae ha^{-1} + 280 g ae ha^{-1}), glyphosate + 2,4-D LR (1260 g ae ha^{-1} + 533 g ae ha^{-1}), and glyphosate + 2,4-D HR (1260 g ae ha^{-1} + 1066 g ae ha^{-1}). A nontreated check was included for comparison. Visible weed control data were collected 14 and 28 days after application (DAP). Weed densities were collected 28 DAP. Data was subjected to ANOVA using the PROC GLIMMIX procedure in SAS 9.4 and means separated using Fisher's Protected LSD at $p \leq 0.05$. Control of small horseweed (5 cm in height at application), large horseweed (15 cm in height at application), henbit (*Lamium amplexicaule* L), purple deadnettle (*Lamium purpureum* L.), daisy fleabane (*Erigeron annuus* L. Pers.), cutleaf evening-primrose (*Oenothera laciniata* Hill), curly dock (*Rumex crispus* L.), purple cudweed (*Gamochaeta purpurea* L. Cabrera), common chickweed (*Stellaria media* L. Vill.),and mousear chickweed (*Cerastium* L.) were evaluated at two locations or more. Halauxifen and dicamba controlled small horseweed similarly 4 weeks after treatment (WAT). Halauxifen (79%) controlled large horseweed greater than dicamba (77%) and 2,4-D (50 to 64%). Halauxifen was the only auxin herbicide to effectively control henbit (90%) and purple deadnettle (99%). No auxin herbicide controlled daisy fleabane effectively; however, halauxifen (66%) controlled the weed greater than 2,4-D and dicamba (24 to 55%). Halauxifen provided little control of cutleaf evening-primrose, curly dock, purple cudweed, and common chickweed (4 to 7%) and was less effective than 2,4-D for control of cutleaf evening-primrose and curly dock. No auxin herbicide provided adequate control of purple cudweed or common chickweed whereas glyphosate controlled these species well. These experiments demonstrate halauxifen needs a tank-mix partner outside of glyphosate for weeds including cutleaf evening-primrose and curly dock which are not adequately controlled by glyphosate nor halauxifen.

CUCUMBER TOLERANCE TO GLUFOSINATE APPLIED PREPLANT OR PREEMERGENCE. T.M. Randell*[1], J.C. Vance[1], A.S. Culpepper[2]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Tifton, GA (130)

ABSTRACT

Cucumber are produced on 3,300 ha each year in Georgia, and with a value of $70 million, production is ranked third nationally. Roughly half of these cucumbers are produced in bareground systems with limited herbicide options. Glufosinate, a broad-spectrum, nonselective, contact herbicide would be beneficial for vegetable growers in achieving weed-free fields critical for planting. However, cucumber tolerance to preplant or preemergence glufosinate has not been thoroughly investigated. Eight weed-free studies were conducted in 2017 and 2018 on sandy, low organic matter soils common to Georgia to address crop tolerance. A *seeded cucumber experiment* was conducted at four locations replicating each treatment four times. The experimental design was a split-plot with glufosinate rate (0, 328, 656, 984, or 1,640 g ai ha^{-1}) as the whole-plot and irrigation option (irrigation of 1 cm after glufosinate application but before seed germination or no irrigation) as the sub-plot. Three of four locations noted less than 10% injury from glufosinate with no impact on biomass, runner lengths, and marketable fruit numbers or weight. At the fourth location, injury increased as rate increased (2 to 25%) when not using irrigation; less than 10% injury was observed with the addition of irrigation. No treatment influenced late-season runner lengths or yield. For the *first transplant experiment*, treatments were identical to the seeded study except glufosinate was applied 1 d before planting (DBP) at two locations. Cucumber transplant damage increased with rate, with visual injury (8 to 60%) and shorter plants (8 to 33%) noted with no irrigation 10-14 d after planting (DAP); the addition of irrigation reduced injury by approximately 50%. Yield losses were not observed when applying glufosinate at a rate of 328 g ha^{-1} or less, but without irrigation, yield losses up to 46% occurred at the highest rate; with irrigation yields were reduced up to 32%. A *second transplant experiment* was conducted with a factorial treatment design having 3 intervals between glufosinate application and transplanting (7, 4, or 1 DBP) and three glufosinate rates (656, 1,311, and 1,967 g ai ha^{-1}). A non-treated control was included and the study was conducted twice. Visual injury, plant biomass, runner lengths, fruit number and weight all noted that rate was the dominant factor influencing crop response. Injury of less than 15% without yield loss was noted with 656 g ha^{-1} applied 7, 4, or 1 d preplant; however, these treatments reduced plant biomass and runner length at all three timings compared to the control at one location. Higher rates, regardless of application timing, caused severe visual injury, cucumber growth reduction, or yield loss. Results suggest preplant glufosinate in transplanted cucumber production must be further studied to better understand the complex relationship of use rate, irrigation, and interval between application and planting. For seeded production, preemergence glufosinate at a maximum of 656 g ai ha^{-1} in conjunction with irrigation could be applied safely.

EVALUATION OF FLORPYRAUXIFEN-BENZYL-CONTAINING WEED CONTROL PROGRAMS FOR FURROW-IRRIGATED RICE. H.E. Wright*[1], J.K. Norsworthy[1], Z.D. Lancaster[1], R.C. Scott[2], J. Ellis[3]; [1]University of Arkansas, Fayetteville, AR, [2]Univ of Arkansas Coop Extn, Lonoke, AR, [3]Dow AgroSciences, Sterlington, LA (131)

ABSTRACT

Furrow-irrigated rice hectares have sharply increased from 2017 to 2018 in Arkansas. With significant cost savings associated with this method, furrow-irrigated rice hectares are expected to continue to increase. Flooding is commonly used to control weeds in traditional rice production, however, the lack of a flood in furrow-irrigated rice makes weed control more challenging. Florpyrauxifen-benzyl is a new, broad-spectrum, synthetic auxin (WSSA Group 4) herbicide from Corteva Agriscience™. Field experiments were conducted at the Pine Tree Research Station near Colt, AR (Colt) and the Lon Mann Cotton Research Station in Marianna, AR (Marianna) in 2017 and 2018 to evaluate weed control programs containing florpyrauxifen-benzyl in furrow-irrigated rice. This experiment was a factorial arrangement in a randomized complete block design. Factor A was a combination of clomazone plus quinclorac or imazosulfuron applied preemergence followed by an early-postemergence application of fenoxaprop. Factor B was four herbicide combinations applied at mid-POST; propanil plus pendimethalin, florpyrauxifen-benzyl plus pendimethalin, florpyrauxifen-benzyl plus cyhalofop plus pendimethalin, or florpyrauxifen-benzyl alone. Factor C was a late-POST (LPOST) application of penoxsulam plus triclopyr vs. none. Weed control data were collected at LPOST and 2 and 4 weeks after the LPOST application for multiple weed species, including Palmer amaranth (*Amaranthus palmeri*), with yield data collected at harvest. At Marianna in 2017 and 2018 and Colt 2018, treatments containing florpyrauxifen-benzyl controlled Palmer amaranth >85% 4 weeks after LPOST. Yields of florpyrauxifen-benzyl-containing treatments at Marianna in 2017 and 2018 and Colt 2018 were higher than treatments without florpyrauxifen-benzyl. There was no significant difference in yields at Colt in 2017. Yield data combined with high levels of late season control of troublesome weeds indicates florpyrauxifen-benzyl will be a good fit in herbicide programs for furrow-irrigated rice.

EFFICACY OF TANK MIXES CONTAINING LINURON FOR PALMER AMARANTH CONTROL IN SWEET POTATO. L. Moore*, K.M. Jennings, D. Monks, S.C. Smith, M.D. Waldschmidt, K.C. Sims; North Carolina State University, Raleigh, NC (132)

ABSTRACT

The most troublesome weed in North Carolina sweetpotato is Palmer amaranth (*Amaranthus palmeri*). Palmer amaranth populations in North Carolina have been identified with resistance to 6 herbicide classes. Of these 6 herbicide classes, two contain herbicides (flumioxazin, glyphosate) registered in sweetpotato. A limited number of herbicides are registered for sweetpotato and none are registered for POST over-the-top application to control emerged Palmer amaranth. Thus, evaluation of new POST herbicides in sweetpotato is important. Field studies were conducted to determine the effect of weed management programs containing linuron applied POST over-the-top of sweetpotato. Data collected included Palmer amaranth control, and sweetpotato injury, yield and quality. Treatments included linuron (280, 420, 560, 700, 840 g ai ha^{-1}), *S*-metolachlor (800 g ai ha^{-1}) alone or with linuron, and oryzalin (840 g ai ha^{-1}) with and without linuron. Palmer amaranth control from linuron, linuron plus oryzalin, and linuron plus *S*-metolachlor was <30%, ≤60%, and ≤80% respectively. Crop injury was 10-15% from linuron alone and was greatest when S-metolachlor was added to linuron with 15-20% injury. Palmer amaranth control from linuron plus *S*-metolachlor resulted in greater sweetpotato marketable yield than when linuron or linuron plus oryzalin where used.

QUIZALOFOP ACTIVITY WHEN MIXED WITH REDUCED RATES OF HALOSULFURON IN PROVISIA RICE. C. Webster*[1], E. Webster[2], B. McKnight[3], M.J. Osterholt[2], S. Rustom[3], D.C. Walker[3]; [1]LSU, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA, [3]LSU AgCenter, Baton Rouge, LA (133)

ABSTRACT

A study was conducted in 2017 and 2018 at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate the antagonistic, synergistic or neutral interactions of quizalofop when mixed with reduced rates of halosulfuron. Plot size was 1.5 by 5.1 m with eight, 19.5 cm drill-seeded rows of ACCase resistant 'PVL01' long grain rice (*Oryza sativa* L.). Eight, 19.5 cm drill-seeded rows of imidazolinone resistant 'CLXL-745' and 'CL-111' were planted perpendicular to the PVL01 at 84 kg ha^{-1}. Awnless red rice (*O. sativa* L.) was broadcasted at 50 kg ha^{-1} across the research area, and the area was naturally infested with barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.].

The study was a randomized complete block with a two-factor factorial arrangement of treatments with four replications. Factor A consisted of postemergence (POST) applications of quizalofop at 0 and 120 g ai ha^{-1}. Factor B consisted of POST applications of halosulfuron at 0, 17, 35, and 53 g ai ha^{-1} or a pre-packaged mixture of halosulfuron and thifensulfuron at 34 and 53 g ai ha^{-1}. At 28 days after the initial treatment (DAIT), a second application of quizalofop was applied at 120 g ha^{-1}. All herbicide applications were applied with a crop oil concentrate at 1% v v^{-1}. Visual evaluations for this study included barnyardgrass, red rice, CL-111 and CLXL-745 control at 14 and 28 DAIT. Control data were analyzed using the Blouin augmented mixed model to determine synergistic, antagonistic, or neutral responses for herbicide mixtures by comparing an expected control calculated based on activity of each herbicide applied alone to an observed control. Rice yields were obtained and adjusted to 12% moisture.

At 14 DAIT, antagonism of quizalofop occurred when mixed with all rates of halosulfuron or halosulfuron plus thifensulfuron for barnyardgrass, CL-111, CLXL-745 and red rice control. At 28 DAIT, an antagonistic response was observed for barnyardgrass control when quizalofop was mixed with halosulfuron plus thifensulfuron at 53 g ha^{-1}. Expected control for barnyardgrass was 98%, compared with an observed control of 79%. At the same rating interval, a neutral interaction was observed for control of barnyardgrass with an expected control of 98%, compared with the observed control of 96%, when quizalofop was mixed with halosulfuron plus thifensulfuron at 34 g ha^{-1}. At 28 DAIT, antagonism of quizalofop occurred when mixed with halosulfuron at 17 and 35 g ha^{-1} or halosulfuron plus thifensulfuron at 17 and 53 g ha^{-1} for CL-111, CLXL-745 and red rice control. At 28 DAIT, neutral responses were observed when quizalofop was mixed with halosulfuron at 53 g ha^{-1} for CL-111, CLXL-745 and red rice control.

In conclusion, this research indicates that reduced rates of halosulfuron or halosulfuron plus thifensulfuron can be used in a mixture with quizalofop in Louisiana rice production. By 28 DAIT, The reduced rate of 34 g ha^{-1} of halosulfuron plus thifensulfuron overcame the antagonism of quizalofop when mixed with halosulfuron plus thifensulfuron at 53 g ha^{-1} for barnyardgrass control.

RESPONSE OF HYBRID BERMUDAGRASS (CYNODON DACTYLON) TO GLYPHOSATE APPLICATION TIMING AND RATE. C.L. Darling*[1], B. Sellers[1], J. Ferrell[2], D. Odero[3], J.C. Dubeux[4]; [1]University of Florida, Ona, FL, [2]University of Florida, Gainesville, FL, [3]University of Florida, Belle Glade, FL, [4]Committee, Marianna, FL (134)

ABSTRACT

Bermudagrass (*Cynodon dactylon*) is a popular warm season, perennial forage choice for hay production in the Southeastern region of the United States. Weed control in hay fields is essential for optimizing yield and nutritive value potential of the forage. One of the greatest challenges of weed management in bermudgrass hayfields is the control of perennial weedy grasses such as bahiagrass (*Paspalum notatum*), vaseygrass (*Paspalum urvillei*) and guineagrass (*Megathyrsus maximus*). The current recommendation is to use glyphosate for spot treatment of bahiagrass control, as bermudagrass injury has been noted. However, bermudagrass cultivars have been reported to tolerate low rates of glyphosate, allowing for the possibility of broadcast application. ’Coastal’ and ‘Jiggs’ are two popular cultivars for hay production in Florida. Therefore, the objective of this study is to evaluate the effect of glyphosate application rates and timing of application on the quality and yield of bermudagrass. Two field studies were conducted with ‘Coastal’ bermudagrass at the Plant Science Research and Education Center in Citra, FL in 2016 and 2018. Another two studies were conducted at the Range Cattle Research and Education Center in Ona, FL in 2017 and 2018 for ‘Jiggs’ bermudagrass. Both studies were conducted using a randomized complete block design with a factorial treatment arrangement of glyphosate rate (0, 0.28, 0.56, 0.84, and 1.12 kg ae ha^{-1}) and treatment timing (3, 7, and 14 d after clipping (DAC)). Bermudagrass injury was evaluated by harvesting randomly assigned areas within each plot at 14, 21, 28, 35, and 42 days after treatment (DAT), and subsamples at 21, 28, 35, and 42 DAC were used to evaluate forage quality. There was a significant interaction between application rate and application timing for both ‘Coastal’ and ‘Jiggs’ biomass. ‘Coastal’ had a 16% decrease in biomass at 1.12 kg ae ha^{-1} at 14 DAC. Conversely, applications of 0.56 kg ae ha^{-1} resulted in 42% less ‘Jiggs’ biomass at all application timings. There was no differences in crude protein or digestibility of either cultivar. Overall, less injury occurred at 3 DAC compared to 7 and 14 DAC, particularly with ‘Jiggs’ bermudagrass.

INTEGRATED MANAGEMENT OF JOHNSONGRASS IN INZEN SORGHUM. B.L. Young*[1], N. Korres[2], L.M. Lazaro[3], M.J. Walsh[4], J.K. Norsworthy[2], M. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]University of Arkansas, Fayetteville, AR, [3]Louisiana State University, Baton Rouge, LA, [4]University of Sydney, Sydney, Australia (135)

ABSTRACT

Non-transgenic sorghum (Inzen™ sorghum) tolerant to nicosulforon, an acetolactate synthase (ALS) inhibitor, will soon be available for commercial production. This technology will allow the POST application of nicosulfuron (labeled as Zest®) for controlling grass weeds such as johnsongrass in grain sorghum. Development of integrated weed managment practices and stewardship protocols are critical for long-term sustainability of the Inzen™ technology. The objective of this experiment was to evaluate several integrated tactics for managing johnsongrass in Inzen™ sorghum. Field experiments were conducted in 2016, 2017, and 2018 at College Station, TX in areas with high densities of johnsongrass infestation. The treatments included 1) *S*-metolachlor PRE followed by (fb) Atrazine applied POST at 30 cm tall sorghum (standard practice in conventional sorghum), 2) *S*-metolachlor PRE fb Atrazine plus nicosulfuron POST (standard weed management program in Inzen™ sorghum), 3) Program #2 with glyphosate as a desiccant prior to harvest, 4) Program #3 with chaff removal (removal of johnsongrass seedheads) at harvest, 5) Program #4 with shredding and disking the field after harvest and treating the johnsongrass regrowth with clethodim, and 6) Program #5, except no chaff removal at harvest. At the end of the three-year experiment in 2018, johnsongrass plant densities were the highest in program #1, with about 71,000 plants ha^{-1}. A single application of nicosulfuron POST reduced johnsongrass densities to 3,500 plants ha^{-1} (Program #2), but it was not sufficient under these high density infestations. Programs 3 to 6 were very effective on johnsongrass, with densities ranging between 7 and 21 plants ha^{-1} across the treatments. Results demonstrate that integrating multiple weed management tactics is critical for effectively managing johnsongrass within the Inzen™ sorghum technology.

FLUE-CURED TOBACCO TOLERANCE TO S-METOLACHLOR. A. Clapp*, M. Vann, C.W. Cahoon, M. Inman; North Carolina State University, Raleigh, NC (136)

ABSTRACT

Chemical weed control is critical for maximized yield and quality in the production of flue-cured tobacco. Presently, there are only seven herbicides labeled for use in U.S. tobacco production, only 4 of which are widely used. Sulfentrazone is the primary herbicide used for controlling Palmer amaranth in tobacco production. With the current risk of PPO-resistant Palmer amaranth, there is a strong need for additional herbicide options in commercial production. S-metolachlor is labeled for use in a variety of agronomic and horticultural crops in the United States, and for use in some tobacco growing countries outside of the United States. S-metolachlor has been shown to be effective in providing residual weed control of common weed species such as yellow nutsedge (*Cyperus esculentus*), Palmer amaranth (*Amaranthus palmeri*), and various annual grass species. The objectives of this research were to 1) evaluate flue-cured tobacco tolerance to S-metolachlor using different application methods and rates and 2) generate the crop tolerance data that may be required to support a federal label for U.S. tobacco production.

Field experiments were conducted in 2017 and 2018 to evaluate flue-cured tobacco tolerance to Pre-Transplanting Incorporated (PTI) and Pre-Transplanting (PRE-T) application methods of S-metolachlor delivered at 1,069 (1X) and 2,138 (2X) g ai ha^{-1}. Two additional treatments comprised of S-metolachlor (1X) plus sulfentrazone (175 g ai ha^{-1}) applied PTI and PRE-T were also evaluated. A non-treated control was included for comparison. Field experiments in 2017 were conducted at the Border Belt Tobacco Research Station (BBTRS) in Whiteville, NC and two on-farm locations in Guilford and Wayne counties in NC. Experiments were repeated in 2018 at two locations, one at the Lower Coastal Plain Research Station (LCPRS) in Kinston, NC and another on-farm location in Guilford County, NC. Herbicides were applied with a backpack sprayer calibrated to deliver 187 L ha^{-1} of spray solution. Visual estimates of percent weed suppression and percent crop injury were recorded at two, six and, nine weeks after transplanting (WAT). Plant height was recorded at 6 WAT and after final harvest. Post-harvest measurements of cured leaf yield, quality, value, and chemistry were likewise quantified. Data were subjected to analysis of variance (ANOVA) using the PROC Mixed procedure in SAS 9.4 and means separated using Fisher's Protected LSD at $P \leq 0.10$.

Severe stunting was observed at the BBTRS when S-metolachlor was applied PTI, particularly at the 2X rate. End of season plant heights from PTI treatments at this location were likewise reduced by 9-29% compared to the non-treated control. Cured leaf yield and value were significantly reduced at BBTRS when S-metolachlor was applied PTI at the 2X rate. Regardless of herbicide placement, severe stunting was observed at LCPRS when S-metolachlor was applied at the 2X rate, end of season plant heights were reduced by 11% (2X PTI) and 20% (2X PRE-T) compared to the non-treated control. Cured leaf yield was reduced at LCPRS when S-metolachlor was applied PRE-T at the 2X rate, however no differences were observed in quality or value among treatments. No differences were observed across all on-farm locations in visual injury or end of season plant height, regardless of application method or rate. No differences were observed in yield, quality or value at these same locations. Ultimately, it appears that the

injury potential from S-metolachlor is greatly increased in the presence of coarse soil texture and high early-season precipitation, both of which were documented in the BBTRS and LCPRS environments. To reduce stunting and plant injury, application rates lower than 1,069 g ai ha^{-1} may be required in these scenarios. Further research is warranted to test this hypothesis.

CRITICAL PERIOD OF WEED CONTROL FOR GRASS SPECIES IN GRAIN SORGHUM. D.J. Contreras*, W. Everman; North Carolina State University, Raleigh, NC (137)

ABSTRACT

Grain sorghum is the 5th most planted crop in the world, as well as 4th in the US. Its production is mainly concentrated in the Midwest, where precipitation is limiting for high yielding corn and soybean production. Weed management is a concern for grain sorghum growers due the limited number of herbicide options available. Grass weed species have been able to thrive under conditions were most herbicide control programs are focused on broadleaf weeds. There are many options available for broadleaf weed control but very few exist for selective annual grass weed management. Some tools to consider for grass weed management are: the use of specialized varieties such as that containing the Inzen Sorghum trait (tolerance to nicosulfuron and rimsulfuron), the use of narrow rows, and the use of the Critical Period of Weed Control (CPWC) defined as a period in a crop´s growth cycle during which weeds must be controlled to prevent yield losses. The objective of this study was to determine the CPWC for grass species in a grain sorghum using a variety containing the Inzen™ Sorghum Trait and two different row width arrangements (15 and 36 in.) in two different locations in North Carolina (Rocky Mount and Lewiston). Plots were kept weedy or weed free through 2, 3, 5, and 7 weeks after planting. Two controls consisting of weedy and weed free all season plots were used for a treatment comparison based on a regression analysis where time of weed removal was related to crop yield. The CPWC to reduce yield losses to 5% or less for 15” rows at Rocky Mount was from 3.3 – 7.1 weeks after planting, and 1.3 – 6.7 weeks after planting for 36” rows. In Lewiston, the CPWC for 15” rows was from 2.4 – 8.9 weeks after planting, and 1.4 – 7.3 weeks after planting for 36” rows.

DROPLET SIZE AND DRIFT POTENTIAL OF ROADSIDE SPRAY NOZZLES. H.B. Quick*[1], D.P. Russell[1], J.D. Byrd[2], N.H. Thorne[3]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Miss State, MS, [3]Mississippi State University, Mississippi State University, MS (138)

ABSTRACT

Studies were conducted to determine the likelihood of Roadside, Inc. boomless spray head to produce droplets with potential to drift when making right-of-way herbicide applications. Droplet pattern and size were evaluated in separate studies in Starkville, MS and North Platte, NE.

The Roadside, Inc. boomless head consists of 15 TeeJet nozzles: 2 H1/8U-0020, 3 H1/8U-0015, 2 H1/8U-0010, 1 H1/8U-0008, 2 H1/8U-0005, 1 H1/8U-0004 and 4 H1/4U-0020-4040. All H1/8U nozzles are pressurized to 200 kpa, while H1/4U nozzles are pressurized at 365 kpa to produce a spray swath of 9.1 m.

Research was conducted inside the Mississippi State University Horse Park in Starkville, Mississippi, during the spring of 2018. FD&C #1 blue powdered dye 02220 (www.flavorsandcolors.com) at .45 kg was slurried in 19 L water then added to 1135 L water in the truck mounted 6435 L spray tank. Hewlett Packard inkjet photo paper sheets (0.06 m^2) were placed on the ground linearly at 30.5 cm intervals to a distance of 9 m perpendicular to the line of travel with 6 replications spaced 3.7 m apart. The spray truck was then driven by at 18 kph (11 MPH standard operator speed) while spraying. Wind speed measured with a Kestrel 3000 parallel to the direction of travel was 2.1 kph during pattern testing. The area of droplets on paper and percent of sheet covered by spray solution were quantified using ImageJ Software analysis. Results showed that there was consistent droplet coverage 0.6 to 8.5 m from the spray head line of travel.

Droplet sizes of nozzles were measured at the University of Nebraska West Central research and Extension Center in North Platte, Nebraska, in October of 2018. One TeeJet flat-fan nozzle (H1/4U-0020-4040) and six TeeJet straight stream nozzles (H1/8U-0020, H1/8U-0015, H1/8U-0010, H1/8U-0008, H1/8U-0005, H1/8U-0004) used in the Roadside, Inc. (Roadside, Inc., 2038 Lee Rd 137 #51 Auburn, AL 36832) spray head were individually tested for droplet sizes. The flat-fan nozzle was tested under standard agricultural protocol. The 6 straight-stream nozzle droplets were measured at 8, 16, or 24 feet from the nozzle. Results from this study show that all seven nozzles produced droplets larger than the size considered prone to drift (.07% at 141 microns or less). This data is true for all nozzles tested at all distances.

Future research goals for this study include further distribution testing after sprayer head adjustments are made.

EVALUATING TIME OF DAY EFFECTS ON BROADLEAF WEED CONTROL IN XTENDFLEX® COTTON. J.R. Kalina*[1], C.B. Corkern[2], T.L. Grey[3], N.T. Basinger[4], D.G. Shilling[5]; [1]University of Georgia, williamson, GA, [2]Bayer Crop Science, Alapha, GA, [3]University of Georgia, Titon, GA, [4]The University of Georgia, Athens, GA, [5]University of Georgia, Athens, GA (139)

ABSTRACT

There are many factors that can influence the efficacy of a POST herbicide. With the inclusion of dicamba in new cotton cropping systems ,it is important to understand the most effective ways to use this new tool. Three field studies were conducted in 2018 in Tifton and Plains, GA to determine the influence of the time of day of herbicide application on the efficacy of dicamba and glyphosate applied POST on broadleaf weeds in XtendFlex™ cotton. POST application timings consisted of 1 hr before-sunrise (5:30am), 1 hr after-sunrise (7:30 am), a mid-morning (9:00 am), mid-day (12:00 pm), mid-afternoon (3:00 pm), 1 hr before-sunset (7:30 pm), 1 hr after-sunset (9:30 pm), and a midnight application (12:00 am). Experiments were conducted as factorial arrangement of treatments in a randomized complete block design with four replications. Each POST application timing (8 total) had three herbicide treatments. Dicamba and glyphosate were applied alone at 563 g ae ha^{-1}, and 1261 g ae ha^{-1}, respectively. Additionally, a tank mixture of dicamba (563 g ae ha^{-1}) and glyphosate (1261 g ae ha^{-1}) was applied. Each location was seeded with a mixture of prickly sida (*Sida spinosa* L.), sicklepod (*Senna obtusifolia* L.), and pitted morningglory (*Ipomoea lacunosa* L.), to ensure the presence of broadleaf weeds in each plot. POST treatments were applied when weeds were two sizes:7-10 cm or 15-20 cm. Visual ratings were made at 21 days after treatment (DAT) and reported as a percentage (0-100%) based on total weed control. Data were analyzed using an ANOVA (α=.05) to determine any interactions between timing and herbicide treatments. Overall, treatments made midday to late evening showed the highest efficacy across all herbicides and weed species. The tank-mix of dicamba and glyphosate increased efficacy across all application timings. However, this increase did not mitigate the observed time of day effects. Results suggest that applications of dicamba and glyphosate, alone or as a tank-mix, be made between midday and early evening to ensure the greatest efficacy. Further research will be conducted to investigate the effects of light intensity and any synergistic or antagonistic effects from tank-mixing dicamba and glyphosate.

INFLUENCE OF COVER CROP MIXTURE, COVER CROP PLACEMENT, AND HERBICIDES ON WEED CONTROL IN COTTON. A.M. Johnson*[1], A.J. Price[2]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL (140)

ABSTRACT

The inclusion of winter cover crops is a common tool for integrated weed management in both conventional and conservation systems. Two trials at E.V. Smith Research Center in Shorter, AL were established in November of 2016 to evaluate the efficacy of several cover crop systems as an additional form of weed control in cotton. One trial evaluated herbicide timing over a rye (*Secale cereal*) treatment and a mixture of rye, oats (*Avena sativa*), wheat (*Triticum aestivum*), crimson clover (*Trifolium incarnatum*), and tillage radish (*Raphanus sativus*) in comparison to winter fallow. Each cover crop system was evaluated under four herbicide regimes including non-treated, PRE only (pendimethalin and fomesafen), POST only (dicamba and glyphosate), and PRE+POST treatments. The second trial compared several cover crop mixtures and precision drill placements (under a standard PRE+POST herbicide system). The treatments included winter fallow, rye through the whole plot and between rows only, a mixture of crimson clover and tillage radish through the whole plot and in-row only, and a mixture of rye, crimson clover, and tillage radish over the whole plot and with precision placements. Cover crop biomass was lower in 2018 in both trials due to delayed planting. In the cover crop mixture and herbicide timing trial, *Amaranthus* spp. pressure was generally higher in 2018 compared to 2017, with control highest in the PRE+POST treatments and the PRE only rye treatment. Large crabgrass (*Digitaria sanguinalis*) also differed between treatments with the least control under the nontreated winter fallow system. Cover crops did not influence yield compared to winter fallow. However, yields differed between years and herbicide treatments. In the cover crop placement trial, there were no differences between cover crops and drill placements in terms of weed control and yield. Yield was higher in 2018, which varied from 4321 to 4805 kg ha^{-1}, while 2017 yield ranged from 3205 to 3600 kg ha^{-1}.

DROPLET SIZE EFFECTS ON PRE-EMERGENCE HERBICIDE EFFICACY IN SOYBEANS. P.H. Urach Ferreira[1], L.H. Merritt*[1], D.B. Reynolds[1], T. Irby[1], G. Kruger[2], J. Ferguson[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska-Lincoln, North Platte, NE (141)

ABSTRACT

Unlike post-emergence herbicides (POST), little is known about the droplet size effect on pre-emergence herbicides (PRE) efficacy. Four nozzle types were used to spray different PRE herbicides on eight soybean fields in Mississippi and Missouri in 2017 and 2018. Five herbicides, pendimethalin, metribuzin, clomazone, imazethapyr and pyroxasulfone, were selected based on their physicochemical characteristics including adsorption, volatility and solubility. Nozzle types used were XR 11002, ULD 12002, TTI60 11002 and TTI 11002 nozzles. The XR nozzle produced the smallest droplet size (DV0.5), 204 µm, followed by the ULD, TTI60 and TTI with DV0.5 of 468, 646 and 794 µm, respectively. Droplet size, spray coverage, nozzle type or physicochemical characteristics did not impact PRE herbicide efficacy, except in one field for one herbicide. The TTI60 twin fan nozzle significantly enhanced pendimethalin weed control by 91% in a high organic matter (OM) soil comprised of large clods and high weed pressure. This was due to increased herbicide contact with the soil and greater herbicide clod coverage. When soils had a higher OM content (> 2%) pendimethalin reduced weed control. When conditions included soils with low OM (< 0.7%), low cation exchange capacity (< 13.1%), and rainfall of 12.2 mm within 3 days after application, metribuzin was observed to show reduced weed control. The results indicate that droplet size does not affect PRE herbicide efficacy while nozzle type (i.e. dual fan nozzles like the TTI60), can enhance weed control in specific herbicide-field conditions.

WINTER ANNUAL WEED CONTROL WITH EARLY PLANTED COVER CROPS AND RESIDUAL HERBICIDES. L.S. Rector*[1], M.L. Flessner[2], K.W. Bamber[1], K. Pittman[1]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech PPWS Dept., Blacksburg, VA (142)

ABSTRACT

Winter annual cover crops provide many agronomic benefits such as reducing nutrient loss, reducing soil erosion, improving soil health, and suppressing weeds. While actively growing, they are competing with winter annual weeds for resources such as nutrients, water, and light. Research was conducted to evaluate the ability of late summer applied residual herbicides and early planted winter annual cover crops to control winter annual weeds.

Studies were conducted in 2017-2018 in Blacksburg and Christiansburg, Virginia and in 2018-2019 in Blacksburg, Virginia. The experiments utilized a randomized complete block design with 4 replications. Treatments consisted of a nontreated control, flumioxazin at 0.11 kg ai ha^{-1}, and 10 treatments of cover crops: monocultures of cereal rye, crimson clover, hairy vetch, and forage radish; and mixtures of cereal rye + crimson clover, cereal rye + hairy vetch, cereal rye + forage radish, cereal rye + crimson clover + forage radish, and cereal rye + hairy vetch + forage radish. Cover crops were planted on 16.5 cm rows and flumioxazin was applied with a 1.83 m wide hand boom with 4 nozzles on September 15th in both years. Data collected included visible weed control by species rated on a 0 (no control) to 100% (complete control) scale on December 1st and on April 20th, biomass of winter annual weeds on April 20th, and biomass of cover crops on December 1st and April 20th. For December 1st ratings, data only exists for Blacksburg and Christiansburg from 2018. Persian speedwell (*Veronica persica*) and purple deadnettle (*Lamium purpureum*) were rated for visible control. Data were analyzed using JMP Pro 14. Visible weed control, cover crop biomass, and winter annual weed biomass means were subject to ANOVA and mean separation using Fisher's Protected $LSD_{(0.05)}$. A non-linear regression was utilized to compare cover crop biomass with winter annual weed biomass.

Regardless of weed species, flumioxazin provided the greatest control ranging from 82 to 95% among treatments at all site years on December 1st. Cereal rye + crimson clover + forage radish, forage radish, cereal rye, and cereal rye + hairy vetch + forage radish produced the highest biomass in Blacksburg in 2018 on December 1st. Crimson clover and hairy vetch produced the lowest biomass with no other difference in treatment at Christiansburg in 2018 on December 1st. Forage radish and forage radish + cereal rye produced the greatest biomass in Blacksburg in 2019 on December 1st. Treatments containing cereal rye provided the greatest control of purple deadnettle (86-96%) and Persian speedwell (87-96%) on April 20th. Cereal rye containing treatments and crimson clover alone produced the greatest cover crop biomass on April 20th ranging from 5601 to 8562 kg ha^{-1} at Blacksburg and Christiansburg in 2018. Cereal rye alone resulted in lowest winter annual weed biomass (0.5 kg ha^{-1}), and forage radish resulted in the highest (630 kg ha^{-1}) on April 20th at Blacksburg and Christiansburg in 2018. An inverse relationship was observed between cover crop biomass and winter annual weed biomass. As cover crop biomass increased, winter annual weed biomass decreased on April 20th. Overall, treatments containing cereal rye provided the greatest winter annual weed control in the spring.

SOYBEAN PERFORMANCE FOLLOWING EXPOSURE TO DICAMBA AT MULTIPLE GROWTH STAGES. N.G. Corban*[1], B. Lawrence[1], H.M. Edwards[1], J.D. Peeples Jr.[2], T. Sanders[3], D.B. Reynolds[4], J.A. Bond[5]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville,, MS, [3]Mississippi State University, Stonevill, MS, [4]Mississippi State University, Mississippi State, MS, [5]Delta Research and Extension Center, Stoneville, MS (143)

ABSTRACT

Dicamba formulations received labeling in the U.S. in 2017 for application to dicamba-tolerant soybean [*Glycine max* (L.) Merr]. These dicamba formulations were labeled for PRE and POST applications and utilized in soybean to control herbicide-resistant weed species. Dicamba-tolerant soybean cultivars were grown in proximity to those representing other herbicide-resistant technologies, creating the potential for problems with off-target movement. Therefore, research was conducted to characterize the soybean response following exposure to different dicamba rates and evaluate the performance of soybean following multiple exposures to a sub-lethal rate of dicamba.

Two studies were conducted in 2018 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, and R.R. Foil Plant Science Research Center in Starkville, MS, to characterize soybean response to different sub-lethal rates of dicamba at multiple growth stages and evaluate the performance of soybean following multiple exposures to a sub-lethal rate of dicamba. Treatments in the Dicamba Rate Study were arranged as a two-factor factorial in a randomized complete block design with four replications. Factor A was dicamba rate and consisted of a diglycolamine (DGA) salt of dicamba applied at 0.0039 (1/128th of labeled rate) and 0.00098 lb ae/A (1/512th of the labeled rate). Factor B was timing of dicamba exposure and included dicamba at V3, R1, and R5 soybean growth stages. A nontreated control was included for comparison. Treatments in the Multiple Exposure Study were arranged as a two-factor factorial in a randomized complete block design with four replications. Factor A was timing of vegetative exposure to dicamba and included no vegetative exposure and dicamba at V3 soybean growth stage. Factor B was timing of reproductive exposure to dicamba and included no reproductive exposure and dicamba at R1, R3, R5, R1 followed by (fb) R3, R1 fb R5, R3 fb R5, and R1 fb R3 fb R5 soybean growth stages. Dicamba was applied as DGA salt at 0.0025 lb/A (1/200th of the labeled use rate). In both studies, visual estimates of soybean injury were recorded 7, 14, 21, 28, and 48 d after exposure (DAT), soybean heights were recorded 14 and 28 DAT and at maturity, and soybean yield was collected at maturity. All data were subjected to ANOVA with means separated using estimates of least square means $p \leq 0.05$.

In the Dicamba Rate Study, soybean injury 14 DAT was greater when exposed to dicamba at 0.0039 lb/A compared with 0.00098 lb/A at V3 and R1 growth stages. Soybean injury 28 DAT was 12 and 28% greater following V3 and R1 applications, respectively, with dicamba at 0.0039 compared with 0.00098 lb/A. Mature soybean height was greatest following R5 exposure and least with R1 exposure for each dicamba rate. Soybean yield was reduced at least 18% following exposure at V3 or R1 compared with R5 exposure. Soybean yield reduction was 7% greater following dicamba at 0.0039 lb/A compared to 0.00098 lb/A.

In the Multiple Exposure Study, soybean exposure to dicamba at V3 did not always translate into greater injury following exposure during reproductive growth stages. Soybean injury 21 d after R5 treatment was >60% with dicamba at R1 fb R3 fb R5 regardless of prior exposure at V3. Mature soybean height was reduced more following exposure to dicamba during reproductive growth stages with prior exposure at V3 for all treatments except R5 and R1 fb R3 fb R5. Soybean yield was least following R1 fb R3 with no vegetative exposure and following all treatments including R3 with prior exposure at V3.

Soybean were least sensitive to dicamba when exposure occurred at R5 growth stage. Reproductive growth stage at time of exposure to dicamba was more indicative of soybean agronomic performance than whether there was prior exposure at V3. Soybean were unable to recover following single or multiple dicamba exposures up to the R3 growth stage.

INTEGRATION OF UAV-BASED WEED MAPPING WITH A UAV-SPRAYER FOR INCREASING WEED CONTROL EFFICIENCY. J.E. Hunter*, R.E. Austin, R.J. Richardson, T. Gannon, J.C. Neal, R.G. Leon; North Carolina State University, Raleigh, NC (144)

ABSTRACT

Spray capable unmanned aerial vehicles (UAVs) are commercially available worldwide for agricultural applications. This technology has been marketed for conventional broadcast applications of liquid pesticides but is severely limited by battery duration and payload capacity. To increase utility, UAV spraying and imaging technology can be bundled and adapted for site-specific weed management practices. Limited research has been conducted to determine the accuracy, efficiency, and off-target drift of UAV applied herbicides. This study was conducted to identify critical differences in application strategies between UAV site-specific and conventional broadcast weed management. Herbicide applications were quantified based on efficacy and efficiency. The results indicated that the UAV management was more precise and efficacious, while the broadcast management was more accurate targeting weedy areas. UAV management was also more efficient, but its efficiency decreased as weed density and distribution increased. Based on the results, integrating weed mapping and site-specific applications using UAV technology can become a powerful new tool for increasing efficiency and reducing cost in integrated weed management programs.

RESPONSE OF PEANUT TO LOW RATES OF DICAMBA AT DIFFERENT GROWTH STAGES. J.W. Seale*[1], T. Bararpour[1], J. Gore[1], J.A. Bond[2], B.R. Golden[2], R.R. Hale[2]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS (145)

ABSTRACT

Off- target movement of dicamba is a potential problem facing peanut (*Arachis hypogaea*) growers in Mississippi. Peanut is sensitive to dicamba herbicides due to their growth and development habits. A field study was conducted in 2018 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate low rates of Clarity (dicamba) on peanut at three growth stages. Peanut (Georgia-D6G) was planted on beds with 40-inch row spacing at a seeding rate of 8 seeds/foot. This study was designed as a three (peanut growth stage) by five (treatment) factorial arrangement in a randomized complete block. Each treatment was replicated three times. Applications were made at three peanut growth stages: beginning bloom (R1), beginning peg (R2), and beginning pod (R3). A nontreated control was included as the fifth treatment. Clarity treatments were 1/16 X (1 fl oz/A) and 1/32 X (0.5 fl oz/A) of the labeled rate (1 X). Treatments were as follows: 1) Clarity at 1/16 X; 2) Clarity at 1/16 X + NIS (non-ionic surfactant) at 0.25% (v/v); 3) Clarity at 1/32 X; 4) Clarity at 1/32 X + NIS. The labeled rate (1 X) of Clarity is 16 fl oz/A.

Peanut injury was not significantly different when comparing low rates of Clarity with and without NIS. However, treatments containing NIS showed greater (numerical) injury. Visual injury was highest at 9 wk after emergence (WAE) following R2 application timing. Clarity at 1/16 X (with or without NIS) caused 24% (highest) peanut injury at 9 WAE. Clarity at 1/32 X (with or without NIS) caused 20 to 22% peanut injury at 9 WAE. At 13 WAE, injury from 1/16X (with or without NIS) and 1/32X (with or without NIS) was 10.5 and 7.3%, respectively. Peanut height 11 WAE was reduced 11.3 and 16.8% following exposure to 1/32X and 1/16X rates, respectively. Lateral growth (width) of peanut was reduced 23 and 27% following exposure to Clarity at 1/32X and 1/16X rates, respectively. Clarity at 1/32X and 1/16X reduced peanut yield (averaged over growth stage) 20 and 26%, respectively. Peanut exposure to low rates of Clarity will show visual injury symptoms and reduction in height, width, and yield.

DIFFERENTIAL RESPONSE OF COWPEA VARIETIES TO PREPLANT AND PREEMERGENCE HERBICIDES. P.C. Lima*, N.R. Burgos, A. Shi, L. Benedetti; University of Arkansas, Fayetteville, AR (146)

ABSTRACT

Cowpea is an important specialty crop in the mid-south and the southeastern US. Due to the relatively small nationwide acreage of cowpea production, there has been a lack of research to investigate diversified weed control programs and test varietal tolerance to relatively newer herbicides. This research was conducted in 2018 at the Vegetable Research Station, Kibler, AR to assess the response of six cowpea varieties to preplant (PPL) and preemergence (PRE) herbicides. The varieties were: 09-529, AR blackeye #1, Early Acre, Early Scarlet, Empire and Red Holstein. Five herbicide treatments were tested including fomesafen (0.22 kg ha^{-1}) PPL, flumioxazin (0.07 kg ha^{-1}) PPL, a premix of sulfentrazone (0.16 kg ha^{-1}) and S-metolachlor (1.42 kg ha^{-1}) PPL or PRE, and a sequential application of S-metolachlor (1.42 kg ha^{-1}) + imazethapyr (0.07 kg ha^{-1}) PRE followed by fomesafen (0.22 kg ha^{-1}) postemergence (POST). The treatments were arranged in a split plot design with 3 replications. Plots were four rows wide, with 91 cm between rows, and 6.1 m long. The center two rows of each plot were sprayed with herbicide. Injury (%) was scored at 3 and 5 WAP. Plot yield was obtained from the two treated rows. At approximately 1 week after planting (WAP), heavy rainfall eroded some plots, particularly affecting AR blackeye #1, which was excluded from the analysis. Data were analyzed using ANOVA. At 3 and 5 WAP, injury levels were higher when the premix of sulfentrazone + S-metolachlor was applied PPL. Early Acre and Early Scarlet were injured by this treatment more than the others. Fomesafen applied POST caused 30% to 50% injury of all varieties 2 weeks after treatment. All varieties yielded best when treated with flumioxazin PPL, without incurring any yield loss compared to the respective non-treated plants. Corroborating the injury data, Early Acre had a 30% yield loss when treated with sulfentrazone + S-metolachlor PPL. Red Holstein was the variety that showed higher tolerance to most of the applied herbicides (except to fomesafen applied POST) exhibiting no yield loss and satisfactory productivity ha^{-1}.

PLANTING DATE EFFECT ON SOYBEAN RESPONSE TO DICAMBA. M.A. Granadino*, W. Everman, J. Sanders, D.J. Contreras, E.A. Jones; North Carolina State University, Raleigh, NC (147)

ABSTRACT

In the last two decades, the use of dicamba has increased to control glyphosate-resistant weeds (Alves et al 2018). Dicamba-resistant crop varieties have the potential to become widely utilized as a tool to manage glyphosate-resistant weeds in North Carolina. Dicamba sprayed as low as 0.04 g ae h^{-1} has been reported to reduce yield by up to 10% (Weidenhamer et al 1989). Soybean has been found to be more susceptible to dicamba applications when exposed at flowering (R1 and R2) compared to vegetative stages (V1 to V7) (Kniss 2018). This research was conducted to evaluate injury of sub-lethal rates of dicamba in maturity group V and VI soybean cultivars at V4 and R2, and evaluate if visual injury is an accurate method of estimating yield loss. Two separate studies were conducted in 2018 in Kinston and Rocky Mount, NC. Study group was organized by soybean maturity group and planting timing (May and June). Plots consisted of two borders rows to minimize potential drift. Dicamba applications were made with a pressurized CO_2 backpack sprayer. Dicamba was sprayed at 0.44, 1.76 and 7.04 g ae a^{-1} at V4 and R2 at each respective planting date. Weekly visual injury ratings and height measurements as well as final yield were collected. At 7.06 g ae a-1 applied at V4, dicamba had a more significant effect on injury than applied at R2. There was no significant difference on injury at 0.44 and 1.76 g ae a-1 between application timing. Soybean that was planted in May and sprayed at R2 had no significant difference in injury during the whole season as soybean planted in June and sprayed at V4. Soybean planted in May all rates had a significant impact on yield, with no significant difference in yield reduction among applications. There was no significant impact on yield between application timings for soybeans planted in May, but there was a difference between application dates when planted in June. Application timing had a greater impact on yield on soybean planted in June and sprayed at R2. Applications at V4 have no significant impact on yield regardless of planting date. Planting date has no significant effect on injury. Visual injury is not an accurate method of estimating yield loss.

INFLUENCE OF CARRIER VOLUME, NOZZLE TYPE, AND WEED SIZE ON GLUFOSINATE EFFICACY. J. Calhoun*[1], D.B. Reynolds[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (148)

ABSTRACT

Field studies were conducted over a two year time period (2017 and 2018) in Starkville, MS to evaluate the influence carrier volume and weed size at application have on weed control efficacy of glufosinate when applied using two different drift reduction nozzles. Glufosinate was applied at rates of 0.66 kg ai ha^{-1} and 0.88 kg ai ha^{-1} using TTI and TDXL nozzles. Treatments were applied at 140 L ha^{-1} and 94 L ha^{-1} to weeds 8 and 15 cm in height. Plots were evaluated for weed control and crop injury every seven days until 28 days after treatment. No significant crop injury was recorded from any treatment. Averaged across both rates, control of *Amaranthus tuberculatus* (AMATU) increased 8% or greater at all ratings when glufosinate was applied at weed sizes of 8 cm compared to 15 cm. AMATU control was the same for treatments applied using TTI and TDXL nozzles at seven days after application. At 14, 21, and 28 days after application, treatments using a TDXL resulted in a 5 to 6% increase in weed control compared to TTI treatments. At all ratings, treatments applied at 140 L ha^{-1} resulted in greater weed control compared to 94 L ha^{-1} treatment applications. Therefore, this research suggests to achieve optimum weed control efficacy using glufosinate, timely applications at smaller weed sizes in combination with 140 L ha^{-1} should be utilized. Additionally, when using drift reduction nozzles, TDXL nozzles resulted in greater weed control than TTI.

CEREAL RYE COVER CROP TERMINATION TIMING AFFECT ON COMMON RAGWEED IN VIRGINIA SOYBEAN. S.C. Beam*[1], M.L. Flessner[2], S. Mirsky[3]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech PPWS Dept., Blacksburg, VA, [3]USDA, Beltsville, MD (149)

ABSTRACT

Common ragweed (*Ambrosia artemisiifolia* L.) is a problematic weed in Virginia soybean production due in part to resistance to glyphosate and ALS inhibiting herbicides. Alternative management methods, like cover crops are gaining popularity. Field studies were conducted in Blacksburg, VA in 2017 and 2018 to determine the effect of cereal rye (*Secale cereale* L.) cover crop termination timing on common ragweed emergence and suppression in soybean. These experiments were arranged in a randomized split plot design with 4 replications. The main plot (6 by 12 m) consisted of varying cereal rye biomasses, achieved by terminating with glyphosate at 1260 g ae ha^{-1} 6, 4, and 2 wk prior to soybean planting and a no cover check. These plots were divided based on herbicide program, subplots measured 3 by 12 m. At soybean planting, half of each plot was burned down with paraquat at 840 g ai ha^{-1}, and the other half received no herbicide application. In the subplot that was burned down, common ragweed emergence was counted using two 0.5 m^2 quadrats biweekly for 10 wk. Following each assessment, half the plot was sprayed with glyphosate + dicamba at 1260 + 558 g ae ha^{-1}. The other subplots received no herbicide application throughout the season and common ragweed density was assessed at soybean leaf drop in two 0.5 m^2 quadrats. Cereal rye was drilled at 134 kg ha^{-1} on October 5, and November 29 in 2016 and 2017, respectively. Dicamba resistant soybeans were planted at 370,500 seed ha^{-1} on 76 cm centers into standing cereal rye residue 2 wk after the final cover crop termination on 19 May 2017 and 15 May 2018. Cereal rye biomass, common ragweed counts, and soybean yield data were analyzed using ANOVA and means separated using Fisher's Protected LSD (α=0.05). Cereal rye biomass varied between year. In 2017 at the latest termination timing, 2 wk prior to soybean planting, cereal rye biomass was 7062 kg ha^{-1} compared to 1318 and 6903 kg ha^{-1} at the other termination timings. In 2018, no difference could be detected in cereal rye biomass, which ranged from 1660 to 2386 kg ha^{-1}. At 2 wk after planting (WAP) all cereal rye cover crop treatments had less common ragweed emergence (2.6 to 12.8 plants m^{-2}) than in the no cover plots (32.8 plants m^{-2}). This same trend was observed 4 WAP but by 6 WAP and later no differences were observed in common ragweed counts per plot between any of the treatments, due to little to no emergence. For the end of season counts, taken in the subplots that received no herbicide application beyond the application to terminate the cereal rye, results varied by year. In 2017, all cereal rye termination timings had significantly less common ragweed plants 6 to 14.5 plants m^{-2} compared to the no cover plot (27 plants m^{-2}). In 2018, there was no difference in common ragweed density between cover crop plots and the no cover plot. Soybean yield, taken from subplots where herbicides were applied, was not affected by cereal rye biomass. Using cereal rye as a cover crop regardless of biomass accumulation can reduce the number of common ragweed plants that emerge early season in a soybean crop. Future research should evaluate the effectiveness of a cereal rye cover crop on different weeds such as *Amaranthus ssp.* that have a longer germination window than common ragweed.

EVALUATION OF AN INTEGRATED WEED MANAGEMENT (IWM) PROGRAM FOR CONTROL OF GIANT SMUTGRASS IN 'PENSACOLA' BAHIAGRASS PASTURES.

J.C. Dias*[1], B. Sellers[2], J. Ferrell[3], S.F. Enloe[3], J.M. Vendramini[4], P. Moriel[4]; [1]University of Florida, ONA, FL, [2]University of Florida, Ona, FL, [3]University of Florida, Gainesville, FL, [4]UNIVERSITY OF FLORIDA, Ona, FL (150)

ABSTRACT

Giant smutgrass, a nonnative species, is rapidly increasing in abundance in Florida pastures, negatively impacting the ability to efficiently grow forages and raise beef cattle. As a result of its invasiveness, giant smutgrass management has not been easily accomplished. In the search for a more efficient and affordable giant smutgrass management plan, an integrated weed management (IWM) strategy was evaluated in this study. Two experiments were conducted to investigate the effects of spring burning fb different grazing intensities on (i) giant smutgrass and bahiagrass herbage responses, and on (ii) hexazinone activity. Both experiments were conducted in 2014 (near Okeechobee, FL), and repeated in 2016 (near Zolfo Springs, FL). Treatments in experiment 1 were the combination of two burning strategies and two grazing intensities in a simulated rotational stocking method; therefore, treatments were: (i) burned fb grazing with 4.0 AU ha^{-1} (burned-low), (ii) burned fb grazing with 8.0 AU ha^{-1} (burned-high), (iii) unburned fb grazing with 4.0 AU ha^{-1} (unburned-low), and (iv) unburned fb grazing with 8.0 AU ha^{-1} (unburned-high). In general, bahiagrass total season herbage mass tended to be the greatest for unburned-low and the lowest for burned-high treatments; whereas unburned-high and burned-low treatments showed similar responses to all the other treatments. All treatments negatively affected giant smutgrass at both locations by decreasing its height and diameter; although the impacts of the unburned-low treatment were the lowest (5.2 and 15% reduction, respectively). Conversely, a decrease in percent cover was only recorded at Okeechobee while an increase was recorded at Zolfo Springs. Experiment 2 was conducted after the grazing period at the same experimental sites where experiment 1 was performed with the addition of hexazinone rate (0, 0.56 and 1.12 kg ai ka^{-1}), which was included in the experiment as sub-plot treatments. Visual estimates of giant smutgrass control 30 DAT was not affected by treatment-by-herbicide rate interaction nor by hexazinone rate at both locations. However, this might have been confounded by excessive rainfall within a week after application. In conclusion, while hexazinone activity was not enhanced as a result of this particular integrated weed management study, burning in conjunction with rotational stocking might work as a tool in IWM plans slowing the rate of giant smutgrass biomass production and spread in bahiagrass pastures in FL. In addition, the overall vigor and competitive ability of the bahiagrass stand appears to play an important role on giant smutgrass cover responses. Finally, further work should be conducted on more bahiagrass cultivars, soil types, locations and years to truly identify the effectiveness of this IWM plan in the short- and long-term, as well as its impact on hexazinone activity.

DETERMINING DICAMBA RETENTION IN SPRAY TANKS AND ITS IMPACT ON FLUE-CURED TOBACCO. M. Inman*, M. Vann, T. Gannon, D. Jordan, K.M. Jennings; North Carolina State University, Raleigh, NC (151)

ABSTRACT

The deregulation of dicamba-tolerant cotton and soybean has increased the potential for dicamba exposure to tobacco through various avenues including tank contamination. Improper cleaning of sprayer equipment and off-target dicamba exposure can have detrimental consequences to the crop and future marketing opportunities. The objectives of this study were to document the contamination potential of dicamba residues, from three different formulations, in a spray tank after using a standard rinsing procedure. Also, evaluate flue-cured tobacco response to the reduced rates of dicamba found from tank contamination.

Objective 1. Two and a half gallon polyethylene vessels, similar to a commercial spray tank, were used to simulate various tank cleaning scenarios. Spray vessels were contaminated with 560 g ae ha^{-1} of dicamba; simulating a use rate to that applied to dicamba-tolerant soybean or cotton. Three dicamba formulations were evaluated separately; dimethylamine salt (Banvel), diglycolamine salt (Xtendimax), and N, N-Bis(3-aminopropyl)methylamine salt (Engenia). Each formulation was replicated three times across two separate runs. A “triple rinse” cleanout method was used as a standard cleaning procedure. Water only, a commercial cleaner, and ammonia were evaluated as cleaning agents. A no cleanout treatment was also included. The tanks then underwent a triple rinse cleanout, adding the cleaner on the second rinse cycle. Rinse volumes were 10% of the mix size (7.8L). A 20mL sample of each rinsate was collected from each rinse within each cleaner and analyzed via HPLC to determine herbicide concentrations. Once the triple rinse procedure was completed, the vessel was again filled with water representing follow-up tank use and another 20 mL sample was collected.

No difference was observed across formulation or cleaning agent (water, tank cleaner, and ammonia). Measurable differences were observed across the number of rinses. Residue decreased with increasing rinse number. No difference was observed between the third rinse and follow-up tank use sampling. Recovered dicamba amounts after triple rinsing could potentially cause visual injury and yield reduction to sensitive crops.

Objective 2. Field experiments were conducted during 2018 in North Carolina across three environments near Oxford, Kinston, and Whiteville, NC. Treatments consisted of nine different reduced rates of dicamba at two separate timings. Rates included: 0.056, 0.112, 0.224, 0.56, 1.12, 2.24, 5.6, 28, and 112 g ae ha^{-1}. Application timings were 7 or 11 weeks after transplanting. These timings were chosen to represent times of the season when dicamba would be applied to tolerant soybean or cotton in neighboring fields. Treatments were applied with a CO^2 backpack sprayer calibrated to deliver 140 L ha^{-1} at 152 kPa. Plot sizes were three row plots with application to the center row only. Weekly visual injury estimates after each application and yield were recorded.

Visual injury estimates and total yield widely varied across environments, however, in general the early application timing was more injurious compared the later timing. Visual injury ranged from 0 to 95% with the early application timing and 0 to 68% with the late application timing; depending on rate and environment. Yield reductions ranged from 12 to 80% and 0 to 38% with the early and late application timings, respectively, depending on rate and environment. Peak visual injury was 24 days after application (DAA). Estimated visual injury 24DAA seems to be a poor indicator of yield response.

Plant stress as well as management factors before and after exposure are critical in how plants will respond to an exposure event. Yield reductions were still observed when little to no injury was noticed 24DAA. In general, exposure from a drift or contamination event would be more desirable later in the season in regards to injury and yield. However, because of strict residue guidelines, late season exposure may be more harmful to overall marketability of the product and operation as a whole.

GENETIC DIVERSITY OF PHENOTYPICALLY DISTINCT GOOSEGRASS (ELEUSINE INDICA) ECOTYPES. B. Kerr*, B. McCarty, C. Saski; Clemson University, Clemson, SC (152)

ABSTRACT

Goosegrass (*Eleusine indica* L. Gaertn.) is a troublesome weed in turfgrass systems throughout the world. The development of herbicide resistant ecotypes has occurred to multiple modes of action. Goosegrass is a prolific seed producer (~50,000 per plant), fast growing and diverse weed. Such growing attributes make it essential to have a better understanding of the genetic diversity of various ecotypes. The objectives of this study were to determine if morphologically distinct goosegrass ecotypes collected in Florida were phenotypically distinct and genetically different from traditional ecotypes. Phenotypically, the goosegrass ecotypes can be classified into four groups; dwarf, intermediate 1 (int_I), intermediate 2 (int_II) and wild. The dwarf and wild ecotype had least seedheads; 5 and 17 respectively, while int_I and int_II had highest number of seedheads; 22 and 34 respectively. The dwarf ecotype had lowest height of 6 cm and the wild ecotype had highest height of 36 cm. Dwarf and int_II ecotypes had shortest internode length of 0.2 cm and 1 cm, respectively, while the wild ecotype had longest internode length of 7 cm. The dwarf ecotype had lowest number of racemes per plant of 1, while the wild ecotype had highest number of racemes per plant of 7. Total biomass was lowest for the dwarf and int_II ecotype; 0.7 g and 1.5 g, respectively, and total biomass was highest for the wild ecotype at 5 g. Gene sequencing and subsequent phylogenetic analysis suggest the ecotypes are genetically different. Three single nucleotide polymorphisms (SNP) of interest were discovered indicating allelic differences between ecotypes.

EFFECT OF CARRIER VOLUME AND SPRAY QUALITY ON SOYBEAN RESPONSE TO DICAMBA.

B. Sperry*[1], J. Calhoun[2], D.B. Reynolds[1], J. Ferguson[1], G. Kruger[3]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS, [3]University of Nebraska-Lincoln, North Platte, NE (153)

ABSTRACT

Previous research has suggested that a proportional carrier volume with a herbicide solution concentration similar to the concentration of a full-labeled rate better represents plant response to sublethal herbicide rates in simulated drift studies. However, due to soybean's extremely high sensitivity to dicamba, achieving a proportional carrier volume to doses that cause low levels of injury or yield is almost impossible with standard equipment. Therefore, field experiments were conducted across three sites in Mississippi in 2018 to evaluate the effect of carrier volume and spray quality on non-dicamba-resistant soybean response to a sublethal dicamba dose under field conditions. Dicamba plus glyphosate were applied at 1% of the standard use-rate to soybean at the R1 growth stage with a pulse-width-modulation (PWM) sprayer calibrated to deliver 140, 105, 70, 35, 14, and 7 L ha^{-1} (LPH) using either Fine or Coarse spray qualities. Significant effects of spray quality were not detected for soybean injury or plant height evaluations; however, carrier volume profoundly affected these parameters. Soybean injury 3 days after treatment (DAT) from carrier volumes of 70 to 140 LPH ranged from 6 to 16%; however, treatments applied at 7 or 14 LPH resulted in 49 and 42% injury, respectively. By 28 DAT, soybean injury ranged from 38 to 56% with higher injury resulting from reduced carrier volumes. Soybean height 28 DAT was similar amongst carrier volumes of 35 to 140 LPH (39 to 42% reduction); however, when carrier volume was reduced to 14 or 7 LPH soybean height was reduced 46 and 51%, respectively. Both the main effects of spray quality and carrier volume influenced soybean grain yield. Averaged across carrier volumes, Fine and Coarse spray qualities resulted in 30 and 26% yield loss, respectively. Likewise, yield loss ranged from 41 to 14% and increased as carrier volume decreased. Consequently, these data indicate that carrier volume can severely influence results in studies investigating sublethal dose exposure to soybean. These data demonstrate that with some active ingredients, a rate titration applied at the same delivery volume may not be the same as what may happen with true OTM such as particle drift. That is not to say that existing studies are not valid but instead that they may be more reflective of effects from contaminated spray equipment than from particle drift.

CHARACTERIZATION OF FUNCTIONAL TRAIT DIVERSITY AMONG RYEGRASS (LOLIUM SPP.) ACCESSIONS FROM TEXAS BLACKLANDS. A. Maity*[1], S.E. Abugho[2], V. Singh[2], N. Subramanian[2], G.R. Smith[2], M. Bagavathiannan[2]; [1]Texas A&M university, College Station Texas, College Station, TX, [2]Texas A&M University, College Station, TX (154)

ABSTRACT

Ryegrass (*Lolium* spp.) exhibits versatile growth habit and high level of adaptation. It is considered a major weed in wheat production worldwide, though it is widely used as a forage crop in grazing systems across the world, besides as a turf or cover crop species. Little is known on the diversity and adaptive characteristics of ryegrass biotypes infesting wheat production fields in Texas. Fifty-five ryegrass accessions were collected randomly from wheat fields across the Texas Blacklands region and were assessed for seed dormancy as well as seed and plant morphological traits such as hundred seed weight, seed length, awn length, number of tillers, node color, leaf color and width, plant regrowth rate after clipping, and panicle and spikelet type. Seed dormancy levels varied from 27 to 97% across the accessions evaluated. Such levels of variability were also observed across the accessions for the different seed and plant morphological traits evaluated. Information generated from this study provides insight into the adaptive characteristics of ryegrass biotypes in Texas wheat fields, which will assist with the selection of appropriate management approaches, and breeding for ryegrass cultivar improvement.

EVALUATING EFFECTIVENESS OF DICAMBA REMOVAL FROM CONTAMINATED SPRAYERS FOLLOWING VARIOUS INCUBATION PERIODS FROM CONTAMINATION TO CLEAN OUT. Z.A. Carpenter*, D.B. Reynolds, A.B. Johnson; Mississippi State University, Mississippi State, MS (155)

ABSTRACT

The release of dicamba tolerant soybeans allows growers to control troublesome glyphosate resistant weeds; however, several challenges are also forthcoming, one being sprayer hygiene. Glyphosate is water soluble, allowing it to be easily removed from spray tanks through three rinses with water alone. Synthetic auxin herbicides are not as water soluble and therefore can be difficult to completely remove from sprayer components. Additionally, many crop species are highly sensitive to synthetic auxins at very low concentrations. The objective of this study was to determine the effectiveness of standard sprayer cleanout methods following various incubation periods from contamination with dicamba to the time of cleanout. Cleanouts were conducted in 2017 and 2018, with field experiments being conducted in Brooksville and Starkville, MS in 2018. Treatments consisted of various incubation timing (0, 24, 48, 72, and one week) and cleaner used (wipeout and water). A small-scale sprayer was designed to replicate the cleanout procedures used on commercial sprayers. The system was first contaminated with dicamba (Xtendimax) at 560 kg ae ha^{-1} and rhodamine WT dye at 0.2% v/v. Following an incubation period, the sprayer then underwent a 3-rinse cleanout, utilizing one of the tank cleaners during the second rinse step. During each rinse, the solution was recirculated through the system for 15 minutes and samples were collected for both field and lab analysis. Once the sprayer was cleaned using the triple rinse procedure it was filled with an 867 g ae ha^{-1} rate of glyphosate (Roundup Powermax), and another sample was collected. All samples were sprayed over actively growing non-dicamba tolerant soybeans (*Glycine max* L.) at the R1 growth stage. Visual ratings for phytotoxicity were taken 7, 14, 21, and 28 DAT 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 cleanout efficacy. Plants were harvested at end of the growing season for yield. All data were subjected to ANOVA using the PROC GLIMMIX procedure in SAS 9.4 and means were separated using Fisher's Protected LSD at α=0.05. Data reveal that visual injury incrementally decreased from 65% during the first rinse to under 20% at the glyphosate rinse, with the 48-hour, 72-hour, and 1-week incubation timing producing significantly more injury than the untreated check. Plant heights did not differ from the untreated check following the first rinse. The main effects of incubation time and cleaner did not significantly influence soybean yield reductions. Following the first rinse no significant reductions in soybean yield occur. Averaged across rinses and cleaners, all incubation times resulted in yield reductions of <10%. HPLC analysis of this spray solution confirmed that analyte concentration did not differ among tank incubation time, with all solutions containing less than 1 PPM by the third rinse. These data would indicate that a triple rinse system is necessary to achieve analyte concentrations low enough to avoid losses. These data also show that no differences were detected among the cleaners and incubation times tested in regard to effectiveness.

GENETIC DIVERSITY, MOLECULAR MARKERS, AND GENES FOR ABIOTIC STRESS TOLERANCE IN WEEDY RICE. S.D. Stallworth*[1], T. Tseng[1], S. Shrestha[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (156)

ABSTRACT

As global temperatures continue to rise and fluctuate, it is imperative that crop breeding programs continue to improve. In regions where rice is the staple food product, impacts from cold, heat, and submergence stress could be devastating and felt for generations to come. In rice, it has been demonstrated that exposure to higher than 38C for 8 hours or more can completely wipe out a rice harvest. Others have found that temperatures greater than 34C can cause spikelet infertility resulting in a yield reduction of up to 60%. Cold stress, at temperatures below 17C, can result in poor germination, seedling injury, and reduced yield. Moreover, in areas where flash flooding is unpredictable, submergence stress in rice fields can lead to a 10-100% yield loss. Due to the high impact value of rice, discovering abiotic stress tolerant rice cultivars is necessary to ensure economic stability. Currently, rice breeding programs lack genetic diversity and suffer from a loss in traits through domestication. To combat these shortcomings, it has been suggested that weedy rice, a noxious subspecies of rice with increased competition within rice fields, and high genetic diversity, can potentially be used for the discovery of novel genes related to abiotic stress tolerance. In this study, a population of 54 weedy rice accessions were selected and phenotypically screened for responses to cold, heat, and submergence stress tolerance. Selected accessions that performed better than rice cultivars were used in a simple sequence repeat (SSR) marker study containing 30 SSR markers to discover markers associated with tolerance to the selected stresses. Screenings show that all markers were polymorphic with an average genetic diversity of 44% amongst the 54 weedy rice accessions. For the three stresses analyzed, the average genetic diversity among the selected population was 41.37%. For cold, heat, and submergence stress screening, diversity was 41.27, 37.86, and 37.65, respectively. Specific clusters were identified within the population that showed separation between the tolerant weedy rice lines and the susceptible rice cultivars. To further analyze the population, additional markers will be screened to better notate patterns associated with tolerance within the weedy rice population. Successful identification of SSR markers associated with abiotic stress tolerance in weedy rice could lead to rapid identification of tolerant rice cultivars and better improve marker-assisted breeding techniques.

DETECTING AND CLASSIFYING WEEDS IN ROW CROPS USING SPECTRAL AND CONTEXTUAL INFORMATION. B.B. Sapkota*[1], V. Singh[1], D. Cope[2], M. Bagavathiannan[1]; [1]Texas A&M University, College station, TX, [2]Department of Mechancical Engineering, Texas A&M University, College Station, TX (157)

ABSTRACT

Unmanned Aerial Systems (UAS) have emerged as an innovative technology in recent years to provide spatio-temporal information about existing weed species and their density in crop fields. Such information is a critical input for any site-specific weed management program. A field study was conducted at the Texas A&M field research farm near College Station, TX in the summer of 2017 to evaluate UAS-based remote sensing data for classifying early- to mid-season weed infestations. Three weed species, morning glory (*Ipomoea* spp.), Palmer amaranth (*Amaranthus palmeri* S. Watson), and red sprangletop (*Leptochloa mucronata* Michx.) with three levels of infestations (low, moderate and high) were established by broadcast planting in cotton (*Gossypium hirsutum* L.). A multi-rotor UAS (Phantom 4 pro) equipped with RGB (three bands: red, green, blue) sensor was used to collect aerial images with a spatial resolution of 0.8cm/pixel. The plot imageries were preprocessed and the Hough transformation technique was applied to delineate crop rows using straight lines. Multi-level classification coupled with machine learning algorithm was used to detect intra- and inter-row weed species.
The overall accuracy of 88, 90, and 94% was achieved for detecting weed species with high, medium, and low density, respectively. Field measured weed density were fairly correlated (r^2=0.76) with image-based weed coverage estimation based on data from 46 quadrats (2m×2 m). Species-wise, Palmer amaranth (r^2=0.96) showed higher correlation compared to red sprangletop (r^2=0.87). Results suggest the applicability of UAS borne RGB imagery for early- to mid-season weed detection, which may assist with cost-effective spot herbicide applications for precision weed management.

AQUATIC WEED RESPONSE TO TITRATED APPLICATION RATES OF FLORPYRAUXIFEN-BENZYL IN LOUISIANA RICE. S. Rustom*[1], E. Webster[2], B. McKnight[1], C. Webster[3], D.C. Walker[1]; [1]LSU AgCenter, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA, [3]LSU, Baton Rouge, LA (158)

ABSTRACT

Weeds adapted for growth in aquatic environments are common in Louisiana rice, due to extended field inundation periods from water seeding or crawfish production. Florpyrauxifen-benzyl is an auxin mimicking herbicide in the arylpicolinate family with a unique plant binding affinity, providing an alternative mechanism of action for postemergence broadleaf, grass, and sedge management in rice production. In 2018, a field study was conducted at two locations at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate the response of aquatic weeds treated with titrated rates of florpyrauxifen-benzyl from 0 to 30 g ai ha^{-1}. The experimental design was a randomized complete block with four replications. Aquatic weeds were transplanted into a 91 x 91 cm galvanized ring for herbicide containment within each plot with no rice planted in the research area. Evaluations included percent control with 0 = no control and 100 = complete plant death at 14, 28, 42, and 56 days after treatment (DAT) and above ground fresh weight biomass at 56 DAT. Control and biomass data were subjected to ANOVA and means were separated using Tukey's HSD where P<.05. Nonparemetric regression was performed using PROC LOESS in SAS to characterize the effects of rate on control and biomass for each weed species. Control for broadleaf cattail (*Typha latifolia* L.), alligatorweed [*Alternanthera philoxeroides* (Mart.) Griesb.], and yellow nutsedge (*Cyperus esculentus* L.) treated with florpyrauxifen-benzyl at 25.6 g ha^{-1} was greater than 85%, similar to each weed treated with florpyrauxifen-benzyl at 30 g ha^{-1}. A similar response was observed for pickerelweed (*Pontederia cordata* L.) treated with florpyrauxifen-benzyl at 22 g ha^{-1}, and grassy arrowhead (*Sagittaria graminea* Michx.) or ducksalad [*Heteranthera limosa* (Sw.) Willd.] treated with 14.6 g ha^{-1}. Control of water primrose [*Ludwigia peploides* (Kunth.) P.H. Raven)] did not exceed 48% regardless of florpyrauxifen-benzyl rate. These data indicate reduced rates of florpyrauxifen-benzyl have similar activity to the maximum labeled rate for managing broadleaf cattail, alligatorweed, yellow nutsedge, pickerelweed, grassy arrowhead, and ducksalad; however, the herbicide should be avoided when water primrose is present

NON-SYNTHETIC HERBICIDES TO CONTROL RICE WEEDS: DO THEY WORK?

S.E. Abugho*[1], A.V. Pagenotto[2], X. Zhou[3], M. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]University of Sao Paulo, Sao Paulo, Brazil, [3]Texas A&M AgriLife Research, Beaumont, TX (159)

ABSTRACT

Organic rice is gaining popularity in Texas, but effective weed management is vital for successful production of organic rice. Non-synthetic herbicides may be useful for weed management in these systems, but limited investigations have been conducted on the efficacy of different non-synthetic herbicides on dominant weeds present in organic rice. A greenhouse experiment was conducted in 2018 at Texas A&M University, College Station, TX to evaluate the spectrum of activity of seven non-synthetic herbicides (20% vinegar, 30% vinegar, Alldown, BurnOut, WeedZap, Avenger, and Suppress) on barnyardgrass (*Echinochloa crus-galli*), broadleaf signalgrass (*Urochloa platyphylla*), large crabgrass (*Digitaria sanguinalis*), hemp sesbania (*Sesbania herbacea*), tall morningglory (*Ipomoea purpurea*), and yellow nutsedge (*Cyperus esculentus*). The experimental design was a randomized complete block with four replications. Five seeds (or tubers) each of the study species were planted in plastic pots (20 cm length x 8 cm width) filled with potting soil mix. Suppress (31 ml L^{-1} Volume/Volume) was highly injurious to large crabgrass (81% injury) and barnyardgrass (59% injury) at 3 days after treatment (DAT), and it reduced the biomass of both species by about 60% at 21 DAT. No biomass reduction at 21 DAT and very minimal injury at 3 DAT were observed in yellow nutsedge regardless of the treatment applied. Vinegar provided satisfactory suppression of morningglory (55 to 65%), but higher rates can be more effective. These products are typically useful in burn-down or non-selective application scenarios. Nevertheless, some of these non-synthetic herbicides do possess value for use as a tool in the integrated weed management toolbox in organic rice production systems.

IMPROVED HERBICIDE SELECTIVITY IN TOMATO BY SAFENING ACTION OFBENOXACOR AND FENCLORIN. C.P. Moraes*[1], E. Castro[1], S. Duarte[1], B.M. Silva[1], B.C. Schumaker[1], N.R. Burgos[2], T. Tseng[3]; [1]Mississippi State University, Starkville, MS, [2]University of Arkansas, Fayetteville, AR, [3]Mississippi State University, Mississippi State, MS (160)

ABSTRACT

Safeners have been widely used to achieve selectivity of herbicides without causing phytotoxicity to crops, thus serving as an alternative weed control strategy. Benoxacor and fenclorim safeners may protect tomato by increasing Glutathione S-transferase (GST) activity in tomato when treated with herbicides. The study evaluated the safening potential of benoxacor and fenclorim on tomato against selected herbicides. The experiment was conducted in greenhouse in a CRD with 4 replications, in factorial scheme 9 x 3, where Factor A consisted of 8 herbicides treatments, and Factor B contained three safener treatments. Herbicides treatments were sulfentrazone (0.200 lb a.i./acre), fomesafen (0.250 lb a.i./acre), flumioxazin (0.063 lb a.i./acre), linuron (1.00 lb a.i./acre), metribuzin (0.750 lb a.i./acre), pyroxasulfone (0.200 lb a.i./acre), bicyclopyrone (0.0370 lb a.i./acre) and untreated control. Safeners treatments were benoxacor (0.67 g L^{-1}), fenclorim (10 µM), and control. Tomato seeds were immersed in safener solution before sowing and herbicides were applied when tomato plants were at 3-leaf stage. Were recorded visual injury at 3, 7, 14, and 21 days after application (DAA), and dry biomass was recorded at 21 DAA. Data were subjected to ANOVA and means were compared by the Student's t test ($p = 0.05$). Results indicated that pre-treatment with benoxacor and fenclorim reduced, respectively, 1.08 and 1.2 times injury of flumioxazin, and 1.12 and 1.15 times of fomesafen. While fenclorim reduced 3 times injury of imazamox. In addition, tomato plants treated with fenclorim showed 2.5, 1.8 and 6.24 times less biomass reduction after application of bicyclopyrone, flumioxazin and imazamox.

HAYFIELD SWARD RESPONSE TO HERBICIDE IMPREGNATED DRY FERTILIZER. W.C. Greene*[1], M.L. Flessner[2], K.W. Bamber[3], P.L. Burch[4], S. Flynn[5]; [1]Virginia Tech, Virginia Tech, VA, [2]Virginia Tech PPWS Dept., Blacksburg, VA, [3]Virginia Tech, Blacksburg, VA, [4]Corteva Agriscience, Christiansburg, VA, [5]Corteva Agriscience, Lees Summit, MO (161)

ABSTRACT

Effective weed control in hayfields and pastures is essential in maximizing desirable forage production. Applying herbicides impregnated on fertilizer reduces application cost and allows greater flexibility in weather conditions at application. However, little information is available regrading weed control efficacy and sward response to herbicides on fertilizer. A study was conducted in 2018 in Blacksburg, Virginia in order to evaluate the effect of herbicide impregnated fertilizer applications on weed control and forage production. Aminopyralid plus 2,4-D, and aminopyralid plus metsulfuron-methyl was impregnated onto dry fertilizer and applied to a hayfield. Fertilizer without herbicide was applied as a nontreated control. Biomass production and transect data were taken every 30 days for forage, legume, weedy grasses, and broadleaf weed species following application up to 150 days following application. Cumulative forage biomass was highest with aminopyralid plus 2, 4-D (4873 kg ha^{-1}) compared to aminopyralid plus metsulfuron-methyl (2845 kg ha^{-1}) and the nontreated control (2852 kg ha^{-1}). Cumulative legume biomass and cumulative broadleaf weed biomass were greatest in the nontreated control compared to both herbicide treatments. Cumulative weedy grass biomass was highest with aminopyralid plus metsulfuron-methyl compared to the nontreated control. There was no difference between treatments for cumulative forage transect data and cumulative weedy grass transect data. The nontreated control resulted in greater coverage of legume species and broadleaf weed species compared to both herbicide treatments. This study indicates that herbicides on fertilizer are a viable option for weed control and improve hayfield productivity. Future research is needed to corroborate these findings and evaluate efficacy on other weeds, particularly difficult-to-control perennial weeds.

FOMESAFEN DEGRADATION FROM THE SURFACE OF LOW-DENSITY POLYETHYLENE MULCH. K.M. Eason*[1], T.L. Grey[2], A.S. Culpepper[3]; [1]The University of Georgia, Tifton, GA, [2]University of Georgia, Titon, GA, [3]University of Georgia, Tifton, GA (162)

ABSTRACT

Field and laboratory studies were conducted to establish information about fomesafen dissipation when applied to bare soil and soil under low density polyethylene (LDPE) mulch. Trials were conducted in Ty Ty, Georgia on Tifton loamy sand soil. Fomesafen was applied at 141, 282, and 561 g ai ha^{-1} and multiple soil samples were taken over and up to 150 days after application. Data indicated that fomesafen dissipation was rapid for bare soil as compared to soil under LDPE mulch. The half-life (LD_{50}), as defined in time for 50% degradation, for fomesafen on bare soil was 2 d and soil under LDPE mulch was 58 d, indicating that LDPE reduced dissipation and could extend weed control for crop registrations. For bioassay data, herbicide rate had no effect. Watermelon vine length (cm) was greater when grown on LDPE mulch (5 to 62 cm) as compared to bare soil vine length (2 to 25 cm). From the data, using fomesafen on bare soil can result in loss of residual weed control and reduced watermelon vine length.

WEED MANAGEMENT IN CONVENTIONAL AND CONSERVATION TILLAGE SYSTEMS WITH BOLLGARD II XTENDFLEX COTTON. C.D. White*[1], W. Keeling[2], P.A. Dotray[3]; [1]Texas A&M AgriLife, Lubbock, TX, [2]Texas A&M AgriLife Research, Lubbock, TX, [3]Texas Tech University, Lubbock, TX (163)

ABSTRACT

The registration of XtendiMax® with VaporGrip® Technology herbicide for use in Bollgard II® XtendFlex® cotton provides a new option for control of troublesome weeds including glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*). XtendiMax can be applied as an early preplant burndown (EPP), preemergence (PRE), or postemergence treatment (EPOST, MPOST). Information is needed to determine most effective uses of XtendiMax as part of an overall weed management system, in both conventional and conservation tillage. A field study was conducted in 2017 and 2018 at Lubbock, Texas to evaluate residual herbicides and XtendiMax for both preplant and in-season weed control. Control of Russian thistle (*Salsola tragus*), kochia (*Kochia scoparia*), and Palmer amaranth was evaluated. The objective of these studies was to determine effective herbicide programs using XtendiMax with VaporGrip Technology in both conventional and conservation tillage systems in Bollgard II XtendFlex cotton. Applications were made using a CO_2-pressurized backpack sprayer at a volume of 15 gallons per acre. Dicamba treatments were sprayed with Turbo TeeJet Induction 11002 nozzles with an appropriate drift reducing agent. The non-dicamba treatments were applied using Turbo TeeJet 11002 nozzles. Trifluralin preplant incorporated (PPI) controlled all weeds greater than 85% at planting. At 14 days after planting (DAP), trifluralin PPI fb Caparol PRE was more effective than either herbicide alone. Roundup + XtendiMax + Rowel controlled all weeds greater than 90% at planting in conservation tillage. Gramoxone and Caparol PRE following this EPP treatment controlled all weeds greater than 99% at 14 DAP. With conventional tillage, PPI fb PRE treatments fb Roundup + XtendiMax fb Roundup + XtendiMax + Warrant controlled Palmer amaranth 95% season-long. With conservation tillage, the same in-season treatments controlled Palmer amaranth 98%, and these herbicide systems resulted in highest lint yields in both tillage systems. Both conventional and conservation tillage herbicide systems offer strategies for effective weed resistance management.

REGIONAL ZOYSIAGRASS RESPONSE TO GLYPHOSATE AND GLUFOSINATE APPLIED AT VARIABLE TIMINGS IN SPRING. J.M. Craft*, S. Askew; Virginia Tech, Blacksburg, VA (164)

ABSTRACT

Nonselective herbicides like glyphosate and glufosinate are registered for use in dormant zoysiagrass (*Zoysia* spp.) turf but rarely recommended by turf extension specialist. Zoysiagrass retains green leaf and stem tissue in all but the northernmost portion of its growing region. University extension publications as far north as Tennessee warn against using glyphosate in zoysiagrass while recommending the practice on dormant bermudagrass (*Cynodon* spp.).The two peer-reviewed papers published regarding this issue indicate that zoysiagrass was not harmed if glyphosate or glufosinate were applied to "fully dormant" turf. Concerns about partially-green zoysiagrass turf precluding the use of nonselective herbicides have not been characterized in scientific literature. Based on available literature, we hypothesized that zoysiagrass would respond similarly to glufosinate and glyphosate and that severity of turf injury would be positively correlated to increasing green tissue at time of treatment regardless of growing region.

Four trials were initiate in Blacksburg, and Virginia Beach, VA and in Starkville, MS to evaluate zoysiagrass response to glyphosate at 700 g ai ha^{-1} and glufosinate at 1680 g ai ha^{-1} applied at four application timings in spring 2018. Growing degree-day at base 32 F (0 C, GDD_{32}) accumulation began on February 1, 2018 for all sites and application timings were 200, 400, 600, and 800 GDD_{32}. A mixture of 'Zenith' and 'Companion' zoysiagrass (ZC Blacksburg) mown at 6.3 cm and a 'Meyer' zoysiagrass (M Blacksburg) mown at 1.2 cm served as trial sites in Blacksburg, VA. A 'Meyer' zoysiagrass mown at 2 cm was evaluated in Starkville, MS and a 'Compadre' zoysiagrass mown at 6.3 cm was evaluated at Virginia Beach, VA. All experiments were arranged as randomized complete block designs with four replications. Visually-estimated zoysiagrass injury data were collected biweekly and temporal trends were fit to the Gaussian function using Proc NLIN in SAS 9.4 for each experimental unit and resulting estimated parameters were subjected to ANOVA and means separated using Fisher's Protected LSD $P \leq 0.05$. The *c* parameter was used to calculate the number of days over a threshold of 30% injury (DOT_{30}) which was also subjected to ANOVA and means separation.

The two locations that utilized 'Meyer' zoysiagrass mown at 1.2 to 2 cm had 26±13, 67±30, 154±35, and 218±42 green leaves dm^{-1} at 200, 400, 600, and 800 GDD_{32}, respectively. CZ Blacksburg and Virginia Beach zoysiagrass mown at 6.3 cm had approximately 35% less leaves dm^{-1} at equivalent timings. Glyphosate applied at 200 GDD_{32} did not injure zoysiagrass above threshold level at any location. Glufosinate applied at 200 GDD_{32} timing caused unacceptable injury at Starkville with a maximum injury (parameter *a*) of 40% and a DOT_{30} of 5 days. Glyphosate applied at 400 GDD_{32} injured zoysiagrass over threshold level for 25 days at M Blacksburg but did not injure zoysiagrass at other locations. Glufosinate applied at 400 GDD injured zoysiagrass over threshold level for 19 to 41 days at three locations but did not injure zoysiagrass at Virginia Beach. At 600 and 800 GDD_{32} timings, glufosinate caused maximum zoysiagrass injury of over 80% regardless of location while glyphosate injury maxima ranged

from 30 to 65% at 3 of 4 locations. These data suggest glyphosate injures zoysiagrass less than glufosinate counter to our hypothesis. Glyphosate can safely be applied to zoysiagrass at 200 GDD_{32} regardless of growing regions between northern Mississippi and Virginia. Our data agree with our hypothesis regarding increased zoysiagrass injury when herbicides are applied later in the season when more green foliage is present regardless of growing region.

EVALUATION OF THE SUITABILITY OF 13 WINTER COVER CROP SPECIES FOR SOUTHEAST TEXAS. S.L. Samuelson*, J. Hernandez, M. Bagavathiannan; Texas A&M University, College Station, TX (165)

ABSTRACT

With the increased dependence on herbicides and the proliferation of herbicide-resistant weed species, alternative methods of weed control are of great interest and demand. Cover crops have been a successful addition to manage troublesome weeds in North Central and North Eastern United States, but still have unused potential in the Southwestern regions of the US. The objectives of this study were to determine which cover crop species offer the greatest impact on weed suppression, overall biomass accumulation, and to assess the cover crops impact on soil moisture dynamics. Thirteen winter cover crop species were planted at the Texas A&M University research farm near College Station, TX in November 2017 & 2018 and arranged in a randomized complete block design with four replications. Plots measured 3.5 x 9 m^2. Ground cover and cover crop density measurements were estimated along with weed infestation (%) and density (number m^{-2}) at 21 days after planting and at cover crop termination. Soil moisture content was recorded at weekly intervals at 10, 20, 30, and 40 cm depths. Further, surface soil temperature was also documented at each observation. Weed and cover crop above ground biomass were separated, dried, and recorded at cover crop termination. Winter annual weed emergence was documented and then harvested for biomass during the last week of March. The winter annual cover crops such as oat, mustard, winter pea, and triticale showed promising results with respect to weed suppression and moisture demand. Results from this assessment will help in developing effective cover crop systems for this region.

PREVALENCE AND DISTRIBUTION OF PPO MUTATIONS ON PALMER AMARANTH POPULATIONS FROM THE US MID-SOUTH. M. Machado Noguera*[1], J.W. Heiser[2], T. Bararpour[3], L.E. Steckel[4], R.L. Nichols[5], S.C. Beam[6], L. Benedetti[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Missouri, Portageville, MO, [3]Mississippi State University, Stoneville, MS, [4]University of Tennessee, Jackson, TN, [5]Cotton Incorporated, Cary, NC, [6]Virginia Tech, Blacksburg, VA (166)

ABSTRACT

During the 2017 late summer season, Palmer amaranth inflorescences were collected from 42 to 85 fields from Arkansas, Mississippi and Missouri. One-hundred fifty samples were collected. Plant materials were dried, threshed, and clean seeds were stored in glass vials. The samples were tested for resistance to fomesafen in greenhouse bioassays. Seeds were sown in 50-cell trays filled with commercial potting soil and thinned to one plant per cell after a week. Each accession was planted in two trays; thus, a total of 100 seedlings were tested per accession. . Seedlings were treated when 2- to 3-in tall, with 264 g ai/ha fomesafen (Flexstar 1.88L, Syngenta) + 0.25% by volume NIS (Induce, Helena Agri-Enterprises). The herbicide was applied using a laboratory sprayer calibrated to deliver 187 L/ha of herbicide solution. at The number of survivors was recorded and the level of injury per survivor was evaluated visually, 21 days after treatment. Injury was scored on a 0 to 100% scale, where 0 represents no symptoms and 100% represents plant death. Accessions were classified according to injury: ≤ 39% as highly resistant (HR), 40 to 59% as moderately resistant (MR), 60 to 89% as slightly resistant (SR), and ≥90% injury or 0 survivors as susceptible (S). Survival frequency and injury on survivors differed widely between and within states. Forty-seven out of 63 accessions from Arkansas had survivors, with 15 of them being classified as HR, 19 as MR, 9 as SR and 4 S. Missouri and Mississippi showed greater survivor frequencies: 41 out of 42 accessions and 44 out of 45 accessions, respectively. Regarding survivor injury, Missouri samples showed a greater resistance level overall. From the 44 accessions with survivors from Missouri, 37 were classified as MR, and 2 for SR and HR. The 44 accessions from Mississippi consisted of 37 SR, 6 MR and 2 S. Therefore, considering both the survival frequency and injury of survivors, resistance to fomesafen was highest and more prevalent among Missouri samples.

DRILLING DEPTH EFFECTS ON CROP STAND AND WEED CONTROL IN CALIFORNIA RICE. A. Ceseski*, A. Godar, k. al-khatib; UC Davis, davis, CA (167)

ABSTRACT

California rice has been grown almost exclusively under an aerially-seeded, continuous-flood system for almost a century. However locally adapted grasses and sedges can escape flooding, and the efficacy of the limited palette of available herbicides has become increasingly imperiled due to the continued development of herbicide resistant weed populations.

Drill-seeding rice is a practice that is common in the US South but that is in very limited use in California. Deep drilling may allow novel methods of weed control, for example early cultivation or the use of burndown herbicides prior to rice emergence. In this way drilling may also aid in weedy (red) rice control in California, as weedy rice is unable to be controlled in-season with labeled rice herbicides.

The present research continues to examine the feasibility of a deep-drilling program for California rice. Greenhouse studies suggested that *cv.* M-209 is better suited than *cv*. M-206 to seeding at depths exceeding 3cm. Therefore, a field study was conducted to evaluate weed control and compare crop performance of rice cultivars M-206 and M-209, when drilled at 3.5cm and 6cm and treated with four herbicide regimes using Regiment (bispyribac), Command (clomazone), and/ or Prowl (pendimethalin). Weed control for all treated plots hinged on using glyphosate as a postplant-preemergence burndown treatment prior to using other herbicides.

Late-emerging sprangletop necessitated the use of Clincher (cyhalofop) as a cleanup treatment. Weed control was excellent for all treated plots, with essentially zero weeds/ m^2. Glyphosate applied just as rice emerged reduced *Echinochloa spp.* 50-70%. Untreated plots were exceptionally weedy and dominated by watergrasses. Watergrass densities in untreated plots approached 1500 plants/ m^2, and there were no differences in weediness between cultivars or seeding depths. Sedges and aquatic weeds were virtually nonexistent in untreated plots due to *Echinochloa spp.* density. Treated plots were essentially weed-free, regardless of treatment combination.

Yields were very good for both cultivars across depths, with M-206 averaging 10100 kg ha^{-1}, and M-209 averaging 12100 kg ha^{-1}. There were no differences in yields between depths for either cultivar.

Our field results have thus far indicated that, given proper seedbed preparation, good water management, and good scouting, competitive yields and economical weed control can be achieved with deep-drilling of either rice cultivar in California, though *cv.* M-209 may be more vigorous under less than ideal conditions.

SWEETPOTATO TOLERANCE TO INDAZIFLAM. S.C. Smith*[1], K.M. Jennings[1], D. Monks[1], M. Schwarz[2], L. Moore[1], M.D. Waldschmidt[1]; [1]North Carolina State University, Raleigh, NC, [2]Bayer U.S. LLC, Research Triangle Park, NC (168)

ABSTRACT

Indaziflam is a cellulose biosynthesis inhibiting herbicide registered for use in grape, citrus, pome and stone fruit, and tree nuts. Although not registered in sweetpotato, it is effective in controlling many of the most common weeds found in sweetpotato including Palmer amaranth, common purslane, Florida pusley, and certain morningglory species. However, sweetpotato tolerance to indaziflam is not known. Thus, field studies were conducted in commercial sweetpotato fields and at the Horticultural Crops Research Station in Clinton, NC in 2018. Studies were maintained weed-free to determine the effect of indaziflam on sweetpotato tolerance. Treatments included in the studies were indaziflam PREPLANT, or POST over-the-top 1 or 2 wk after transplanting at 29, 44, 58, or 73 g ai ha-1 and a nontreated check. Indaziflam POST caused transient foliar injury to sweetpotato. At the 4 WAP rating, indaziflam (58 or 73 g ai ha-1) POST 2 WAP caused the greatest stunting. By 8 WAP <15% stunting was observed for all treatments. Marketable yield was not affected by application timing or rate of indaziflam. However, no.1 yield was reduced by indaziflam (44, 58, or 73 g ai ha-1) POST 2 WAP. Indaziflam (73 g ai ha-1) reduced storage root length to width ratio.

REDUCING THE OFF-TARGET MOVEMENT OF DICAMBA WITH SEE AND SPRAY TECHNOLOGY. Z.D. Lancaster*[1], J.K. Norsworthy[1], J.T. Richburg[1], M.M. Houston[2], T. Barber[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, fayetteville, AR, [3]University of Arkansas, Lonoke, AR (169)

ABSTRACT

The rise of herbicide resistance increasingly challenges current production practices across multiple cropping systems in the Midsouth. Dicamba-resistant soybean and cotton varieties are currently available that allow dicamba use in crop. Over the past two years, off-target movement of dicamba has been a major issue for Arkansas producers. Blue River Technologies is currently developing a See & Spray technology that utilizes computer vision and machine learning to make selective herbicide applications to individual weeds. Reduced herbicide product per acre along with proprietary nozzle design could lead to a reduction in off-target movement of herbicides. A study was conducted in the summer of 2018 at the Northeast Research and Extension Center near Keiser, AR to compare the off-target movement of dicamba when applied using See & Spray technology compared to a current standard commercial application. Simultaneously, a See & Spray applicator and a commercial sprayer applied dicamba at 560 g ae ha^{-1} + glyphosate at 867 g ae ha^{-1} to 12 rows by 91.4 m of XtendFlex cotton surrounded by a sensitive soybean variety. Two transects were established in the soybean crop perpendicular to each spray application where visible injury ratings were taken at established distances downwind and upwind from the sprayed area. Buckets were placed over 3 soybean plants at each rating location and removed 30 minutes after application to better observe injury from secondary drift mechanisms. At 14 days after application, off-target movement from the See & Spray application did not move further than the 5-m rating location from the sprayed area, with injury ratings no higher than 1%. Off-target movement from the commercial application was observed out to the 20.1 m from the sprayed area with injury ratings as high as 33% 5 m from the sprayed area. Overall area of damaged soybean with the See & Spray application was reduced 9.5 fold compared to the commercial dicamba application. Based on this research, See & Spray technology could help reduce off-target movement of dicamba.

SORGOLEONE HAS VARYING EFFICACY ON SELECT WHEAT (TRITICUM AESTIVUM SSP.) CULTIVARS AND WEED SPECIES. E.A. Jones*, M. Bansal, W. Everman, J. Sanders, D.J. Contreras, M.A. Granadino; North Carolina State University, Raleigh, NC (170)

ABSTRACT

Sorghum-wheat rotations have been examined as a potential crop system for North Carolina to provide animal producers with an in-state source of feed. Sorghum produces an allelochemical, sorgoleone, which interferes with germination and growth of other plants. Sorgoleone persisting in the soil could negatively impact wheat following sorghum as well as weeds. The research objective was to determine if sorgoleone negatively impacted germinating wheat and weeds. Lab studies were conducted to evaluate the impact of sorgoleone on growth of wheat and Italian ryegrass. Seeds of two wheat varieties and Italian ryegrass were pre-germinated and transferred to sorgoleone-treated agar in petri dishes. Sorgoleone was applied at 0, 25, 50, 100, 150, 200, and 300 µg ml^{-1}. The shoot length of treated plants were measured and compared to the shoot length of the nontreated plants 10 days after treatment. The two wheat varieties were not affected by the sorgoleone at any concentration. The Italian ryegrass shoot length was reduced at all sorgoleone concentrations. Further evaluations of five different wheat varieties from each of four type of winter wheat (soft red, soft white, hard red, and hard white) underwent the aforementioned sorgoleone tolerance screen. Sorgoleone at 300 µg ml^{-1} reduced the shoot length of the hard red and white more than the soft red and white wheat varieties. The shoot length of the hard red and white varieties was not reduced more than 20% at the highest concentration tested. This incurred reduction to the hard red and white varieties not be detrimental to the crop in field environment. Thus, the results of the experiment provide evidence that sorgoleone does negatively impact germination wheat but will suppress germinating Italian ryegrass.

PALMER AMARANTH (AMARANTHUS PALMERI) AND TARNISHED PLANT BUG (LYGUS LINEOLARIS) CONTROL WITH VARIOUS DICAMBA + INSECTICIDE TANK-MIXES IN COTTON (GOSSYPIUM HIRSUTUM). J.P. McNeal*[1], D. Dodds[2], A. Catchot[3], L.X. Franca[2], S. Davis[2]; [1]Mississippi State University, Mississippi State, Mississippi, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State University, Starkville, MS (171)

ABSTRACT

A field experiment was conducted to evaluate the effect of carrier volume and spray droplet size on the efficacy of dicamba + insecticide tank mixtures to control Palmer amaranth (*Amaranthus palmeri*) and Tarnished plant bug (*Lygus lineolaris.*) in cotton (*Gossypium hirsutum*). This experiment consisted of field two locations: the Delta Research and Extension Center in Stoneville, Mississippi, and Hood Farms in Dundee, Mississippi. Four row plots were planted with a single cotton variety: DP 1646 B2XF, and plot dimensions were 3.9m x 14.2m (Stoneville, MS) and 3.8m x 9.1m (Dundee, MS). Applications were made on 17 and 17 July in Dundee and Stoneville, respectively, and were initiated prior to first bloom.

Applications were made with a Capstan Pinpoint Pulse-Width Modulation (PWM) sprayer on a high-clearance Bowman Mudmaster at a ground speed of 14.5 km hour^{-1}. A single formulation of dicamba: (XtendiMAX® with VaporGrip) applied at 1.5 kg ha^{-1}, and two insecticides: thiomethoxam (Centric® 40WG) applied at 0.14 kg ha^{-1}, and sulfloxaflor (Transform® WG) applied at 0.11 kg ha^{-1} were chosen. This experiment utilized two carrier volumes: 140 and 280 L ha^{-1} and two droplet sizes: 200µm and 800µm.

Pesticide - Carrier Volume - Droplet Size treatment combinations included [1] dicamba-141 L ha^{-1}-800 µm, [2] dicamba + thiomethoxam-141 L ha^{-1}-800 µm, [3] dicamba + sulfloxaflor-141 L ha^{-1}-800 µm, [4] dicamba + thiomethoxam-280 L ha^{-1}-800 µm, [5] dicamba + sulfloxaflor-280 L ha^{-1}-800 µm, [6] thiomethoxam-141 L ha^{-1}-200 µm, [7] thiomethoxam-141 L ha^{-1}-800 µm, [8] sulfloxaflor-141 L ha^{-1}-200 µm, [9] sulfloxaflor-141 L ha^{-1}-800 µm. Each replication contained both a weed/pest free check in addition to an untreated control.

Drop cloth counts for Tarnished plant bugs (adults and nymphs) were taken at 3 and 7 DAT. Visual Palmer amaranth control (0-100) was evaluated at 7, 14, 21, and 28 DAT, and visual cotton injury (0-100) was evaluated at 7, 14, and 21 DAT. Seed cotton yield was collected using a spindle picker modified for plot research. Additionally, 25 boll -samples were collected prior to mechanical harvest and ginned on a laboratory micro-gin to determine lint turnout. The experimental design was a Randomized Complete Block and data were analyzed using PROC MIXED in SAS v. 9.4. Means were separated using Fisher's Protected LSD at an alpha level of 0.05.

At 7, 14, 21, and 28 DAT, visual Palmer amaranth control varied due to treatment ($p = < 0.0001$). All treatments resulted in significantly less Palmer amaranth control relative to the weed free check. Dicamba + sulfloxaflor applied at a carrier volume of 280 L ha^{-1} resulted in significantly greater control (≥ 27.5%) relative to dicamba + sulfloxaflor when applied at 141 L

ha^{-1}. Across carrier volume and tank-mix, all applications resulted in the same level of Palmer amaranth control as dicamba when applied alone at a carrier volume of 141 L ha^{-1}.

Across carrier volume, droplet size, and tank mix, no effect on Tarnished plant bug counts was observed 3 DAT, and no effect on adults was observed 7 DAT. However, 7 DAT Tarnished plant bug nymphs varied due to treatment ($p = 0.0014$). Dicamba + sulfloxaflor applied at a carrier volume of 141 or 280 L ha^{-1} with 800µm droplets, sulfloxaflor applied at 141 L ha^{-1} with either 200 or 800µm droplets, and thiomethoxam applied at 141 L ha^{-1} with 800 µm spray droplet sizes all resulted in the same level of control as the pest free check, and significantly more control than both the untreated control and dicamba + thiomethoxam applied at 141 L ha^{-1} with 800µm droplet sizes.

Across carrier volume, droplet size and tank-mix, no effect on visual cotton injury, turnout, or seed cotton yield was observed. These data indicate dicamba + sulfloxaflor applied at a carrier volume 280 L ha^{-1}, or dicamba + thiomethoxam applied at 141 or 280 L ha^{-1} resulted in the same level of Palmer amaranth control relative to dicamba when applied alone at 141 L ha^{-1}.

Additionally, dicamba + sulfloxaflor applied at a carrier volume of 141 or 280 L ha^{-1} with 800 µm droplets resulted in the same level of tarnished plant bug control 7 DAT as thiomethoxam applied at a carrier volume of 141 L ha^{-1} with 800 µm spray droplets, or sulfloxaflor applied at a carrier volume of 141 L ha^{-1} with either 200 or 800µm droplets, primarily through controlling nymphs. Although not currently labeled, multiple options exist with respect to Palmer amaranth and Tarnished plant bug control with dicamba + sulfloxaflor and thiomethoxam tank-mixes relative to dicamba, sulfloxaflor, or thiomethoxam when applied alone.

ROOT SYSTEM ARCHITECTURE AND GENES ASSOCIATED WITH ALLELOPATHY IN WEEDY RICE. A.P. Tucker*[1], B.C. Schumaker[1], S. Shrestha[1], S.D. Stallworth[2], N.R. Burgos[3], T. Tseng[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]University of Arkansas, Fayetteville, AR (172)

ABSTRACT

The unique hardiness of weedy rice species allows them to thrive in dynamic and stressful environments. Weedy rice thrives because it has retained traits such as the potential to grow taller, produce more tillers, and consume more nutrients. These findings collectively suggest that weedy rice is an untapped source of novel genes for competitive traits that can be used in rice breeding programs, since they are of the same species as rice. One such trait is allelopathy, a process where the secondary metabolites produced by one plant species suppresses growth and development of neighboring species. Our preliminary study with a small subset of weedy rice accessions (10 accessions) identified 2 accessions able to suppress barnyardgrass weed seedlings by causing more than 50% height reduction, and of these, one weedy rice accession caused greater than 75% height reduction. Weed management is often considered a leading factor limiting rice productivity, and among the weeds, barnyardgrass is most damaging to rice causing up to 70% loss in rice grain yield. Allelopathy can therefore be bred into rice and act as a natural and sustainable weed control strategy. However, the extent to which weedy rice varieties exhibit superior competitive traits such as allelopathy is unknown, as are the genetic pathways potentially associated with allelopathy. Thus, there is a critical need to identify the specific allelopathic weedy rice accessions and the precise mechanisms through which these varieties are allelopathic.

The goal of this study is to identify root system architectural changes associated with allelopathic phenotypes; and use genome-wide association study to map root system architectural traits associated with allelopathy in weedy rice. As wild relative is often explored by plant breeders for crop improvement program, 54 weedy rice accessions- weedy relatives of cultivated rice were evaluated for their interference or weed suppressive potential against barnyardgrass and amazon sprangletop. Accession B2 (61%) had higher interference potential against barnyardgrass and accession B81 (52%) had greatest interference potential against Amazon sprangletop. Accession B81 had more than 50% inhibition on the growth of both barnyardgrass and Amazon sprangletop, two major weeds of rice. Nei's genetic diversity among weedy rice (0.45) was found to be higher than cultivated rice (0.24) but less than allelopathic rice (0.56). Accession B2, which had high weed suppressive potential was found to be genetically distinct than other weedy rice accessions. This information will be helpful for marker assisted breeding in the future. This knowledge will also be vital in further understanding the physiological mechanisms associated with allelopathy in weedy rice, and thereby utilize such knowledge in rice/crop improvement.

SICKLEPOD EXTRACT AS AN EFFECTIVE DEER REPELLENT: FROM CAPTIVE FACILITY TO FIELD TESTING. Z. Yue*[1], T. Tseng[1], M. Lashley[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (173)

ABSTRACT

Deer, particularly white-tailed deer (*Odocoileus virginianus*), damage row crops such as soybean (*Glycine max* L.) and are a perceived problem in the continental US. Currently, the only widely used technique to control deer from crop browsing is establishment of fences, which is expensive, labor intensive, and mostly ineffective. Studies have shown that sicklepod, *Senna obtusifolia* (L), contains anthraquinone derivatives, which in separate studies were shown to be toxic to cattle, rats, rabbits, and horses, and repel herbivores primarily birds. However, information of the deer-repelling property of anthraquinone in sicklepod is lacking. Field tests conducted at the Captive Deer Facility at Mississippi State University confirmed the deer-repelling property of anthraquinone extracts from sicklepod. Soybean plants applied with control treatment (water) were browsed by deer, while plants applied with sicklepod extracts were avoided. To further confirm the deer-repelling property of sicklepod extract we conducted field experiments in two locations: North Farm (NF) (33°26’42”N88°46’36”W) and Andrew’s Forest and Wildlife Laboratory at Longview (LV) (33°24’40”N88°56’31”W). The experimental design was to compare the repelling effect of sicklepod extract with three commercial deer repellents (Hinder (H), Liquid Fence (LF) and Flight control plus (FCP)), including water as control. Deer repellent application rates were following the commercial label instructions. Sicklepod seed-water extract was prepared at 500 mL/100 g fruit meal. After two seasons of field tests, the repelling property was found to be in the order: LF > Sicklepod > Hinder > FCP > Water. At present, Hinder is the only deer repellent authorized by EPA to apply on food crops, and our study suggests sicklepod extract having same or higher deer repelling effect as Hinder. Sicklepod seed and its extract are traditionally used as herbal medicine and as health tea and could be taken orally by humans, thus being safe on humans. Sicklepod extract can therefore be used as an effective and safe deer repellent in food crops and vegetables.

CHARACTERIZATION OF HYBRID PROGENIES OF SORGHUM BICOLOR AND ITS WEEDY CONGENER, SORGHUM HALEPENSE. C. Sias*, S. Ohadi, G. Hodnett, W. Rooney, M. Bagavathiannan; Texas A&M University, College Station, TX (175)

ABSTRACT

Gene flow between cultivated crops and their wild relatives in agricultural landscapes can have agronomic and environmental consequences. In grain sorghum (*Sorghum bicolor*) production systems of Texas, potential for gene flow between *S. bicolor* and its weedy relative *S. halepense* (johnsongrass) is an emerging concern, given the anticipated commercial cultivation of the acetolactate synthase-inhibitor tolerant grain sorghum in the near future. Little is known on the fate of gene flow, especially the phenotypic characteristics of the F_1 hybrid progenies. Greenhouse and field experiments were conducted at Texas A&M University, College Station to characterize the F_1 progenies produced between *S. bicolor* (different genetic backgrounds) and *S. halepense* (a wild population) when sorghum was used as the female parent. Several morphological traits are being measured and compared between the F_1 progenies produced with different sorghum lines. Preliminary results showed that there were significant differences among the F_1 progeny groups (i.e. parental origins) for traits such as number of tillers, number of panicles, total biomass, plant height, length of panicle, and crown regrowth. When measured under field conditions, the differences among the progeny groups were more evident for traits such as number of tillers, number of panicles, and total biomass collected, compared to greenhouse observations, which could be attributed to relatively limited resource availability in the latter environment. In particular, rhizome production was profuse in the field environment, whereas very minimal in the greenhouse environment. Findings provide valuable insight into the growth characteristics of F_1 hybrid progenies between *S. bicolor* and *S. halepense*, and will be useful for risk assessment of gene flow between the two species.

SEED VIABILITY OF PALMER AMARANTH AS AFFECTED BY HERBICIDE APPLICATIONS. D. Sarangi*[1], K.M. Werner[1], B. Pilipovic[1], P.A. Dotray[2], M.V. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas Tech University, Lubbock, TX (176)

ABSTRACT

Palmer amaranth is one of the most problematic weeds in the United States and poses a great threat to cotton production in Texas. It exhibits prolonged emergence patters, leading to late-season escapes that can contribute to seedbank persistence. The objective of this study was to evaluate the effect of different cotton desiccants on seed viability of Palmer amaranth when they were applied at four specific seed developmental stages (green, white, brown, and black). Experiments were conducted during the late-summer of 2018 at College Station, TX, laid out using a factorial randomized complete block design with ten replications. Eight desiccant treatments, along with a hand-clipped treatment and a nontreated control were included in this study. The seedheads were harvested 28 days after treatment, dried, and threshed. The number of fully developed and aborted seeds (shriveled seed coat) were counted, and the viability and dormancy of the fully developed seed were tested by germinating them in Petri-dishes followed by tetrazolium test of the non-germinated seeds. Results showed that viable seed production by Palmer amaranth was affected by the desiccant treatments. Application of paraquat, glufosinate, dicamba, 2,4-D, and pyraflufen-ethyl at black seed developmental stage reduced viable seed production by 39 to 55% compared to nontreated control. Desiccants with contact activity (e.g. paraquat, glufosinate, and MSMA), and dicamba applied at early seed developmental stages (green and white) had the highest efficacy in reducing seed viability. Therefore, late-season application of cotton desiccants can reduce viable seed production in Palmer amaranth, but proper selection of the desiccants and stage of application influence efficacy levels.

IS GLYPHOSATE AN OPTION FOR SELECTIVE CONTROL OF SMUTGRASS IN BAHIAGRASS PASTURES IN FLORIDA? B. Sellers*[1], J.C. Dias[2]; [1]University of Florida, Ona, FL, [2]University of Florida, ONA, FL (177)

ABSTRACT

Giant smutgrass (*Sporobolus indicus* var. *pyramidalis*) is rarely utilized as a forage, but interest in using this invasive species has grown as some pastures no longer warrant the application of a selective herbicide as densities approach 75% ground cover, if not greater. It has long been known that burning or mowing smutgrass results in smutgrass regrowth that is comparable to that of bahiagrass (*Paspalum notatum*). However, the time period for increased palatability and increased nutritive values is relatively short, and, in most cases, lasts for approximately 2 to 3 weeks following cultural or mechanical treatment of smutgrass. The purpose of this study was to examine the effect of several herbicides on reducing smutgrass regrowth in order to increase the duration of smutgrass forage quality and to examine the use of glyphosate as a method for smutgrass management. Experiments were conducted in 2017 and 2018 near Brighton and Hobe Sound, FL. Prior to glyphosate application, the experimental areas were mowed to 15 cm. Glyphosate was applied at 0, 0.14, 0.28, 0.42, 0.56, 0.7, 0.84, 0.98, 1.12, and 1.40 kg ae ha^{-1} using an ATV sprayer calibrated to deliver 281 l ha^{-1} approximately 2 weeks after mowing; rates above 0.56 kg ha^{-1} were not applied at the Brighton location. Fresh weight biomass of untreated smutgrass was nearly 4-times greater than when treated with 0.56 kg ha^{-1} glyphosate at Brighton at 28 DAT. At least 0.28 kg ha^{-1} was required to significantly reduce smutgrass height. Crude protein and digestibility were unaffected by glyphosate application at Brighton. At the Hobe Sound location, glyphosate at 1.12 kg ae ha^{-1} or greater was required to have a significant negative impact on smutgrass biomass. However, seed head counts were reduced by at least 77% with glyphosate rates of at least 0.56 kg ha^{-1}. Crude protein was not different from the untreated until 60 days after treatment and digestibility was not affected. These data indicate that there is some potential for use of glyphosate as a chemical mowing treatment to increase the length of higher crude protein values. Since 3.33 kg ae ha^{-1} glyphosate is required to control bahiagrass, this herbicide has some potential use as a method for selective smutgrass management in bahiagrass pastures.

GRASS WEED MANAGEMENT IN SOUTHERN PASTURES / SPRAY FIELDS USING INDAZIFLAM. L.S. Warren*[1], D. Spak[2]; [1]Warren QA and Weed Research, Surf City, NC, [2]Bayer Crop Science, RTP, NC (178)

ABSTRACT

Indaziflam is a Group 29 alkylazine herbicide that is a cellulose – biosynthesis inhibitor (Myers et al. 2009). Indaziflam provides extended residual and limited early POST control of many common or troublesome summer and winter annual grassy weeds found in NC pastures (SWSS Weed Survey – Southern States 2012). Research trials were established at various timings in 2017 and 2018 to evaluate the efficacy of indaziflam applied PRE and early POST to Italian ryegrass [*lolium perenne L. ssp. multiflorum (Lam.) Husnot*] and PRE to large crabgrass [*digitaria sanguinalis (L.) Scop*.] and goosegrass [*elusine indica (L.) Gaertn*.] in a 'Coastal' bermudagrass [*cynodon dactylon (L.) Pers.*] spray field.

Depending on the trial, single and sequential applications of indaziflam were evaluated at rates ranging from 0.63 to 1.04 oz ai/A (3 to 5 fl oz/A) with and without Induce® (NIS) applied at 0.25% v/v. Comparison treatments included 2 to 4 lb ai/A Prowl H_20 (2.1 to 4.2 qt/A) and Pastora® + Induce® applied at 1.07 oz ai/A (1.5 oz/A) + 0.25% v/v. All trials were RCB designed with treatments replicated 4 times. Plot sizes were 8 x 10 ft or 8 x 20 ft with the center 6 ft of each plot being treated. Treatments were applied at 20 gpa spray volume with 31 psi at 3 mph using a 4-nozzle, 18-inch spacing boom containing XR 8002VS nozzles. Data are presented using a 0-100 scale where visual weed control observations of 0 = no control and 100 = complete control and percent bermudagrass green cover of 0 = no live bermudagrass and 100 = complete live, green plot coverage.

0.63 oz indaziflam applied PRE in Aug 2017 controlled Italian ryegrass 60% through late spring 2018. >90% control was achieved when applied POST in Feb 2018 and also with sequential Aug 2017 and Feb 2018 timings. Italian ryegrass was controlled 83 to 85% with early Oct 2017 indaziflam applications ranging from 0.73 (3.5 fl oz/A) to 1.04 oz. 3.8 lb Prowl H20 (4 qt/A) applied Aug 2017 only provided 28% Italian ryegrass control. 1.07 oz Pastora® + 0.25% v/v Induce® applied PRE / early POST in Oct 2017 and POST Feb 2018 controlled Italian ryegrass 0% and 92%, respectively. Through late spring 2018, common chickweed [*stellaria media (L.) Vill.*] and henbit (*lamium amplexicaule L.*) were controlled 93% and 100%, respectively, with the sequential treatment of 0.63 oz indaziflam applied Aug 2017 and Feb 2018. Common chickweed control dropped to 58 to 69%, and henbit control dropped to 0% when indaziflam was applied PRE / early POST in early Oct 2017 at rates ranging from 0.73 to 1.04 oz. 3.8 lb Prowl H_20 provided 0% PRE common chickweed and henbit control when applied Aug 2017. 1.07 oz Pastora® + 0.25% v/v Induce® applied PRE / early POST in Oct 2017 and POST in Feb 2018 controlled common chickweed 38% and 100%, respectively, and also controlled henbit 0% and 100%, respectively.

All 0.63 to 1.04 oz single and sequential indaziflam applications in Aug and Oct 2017 and Feb 2018 provided >90% goosegrass and large crabgrass control through late summer 2018 except for one treatment applied in Aug 2017 at 1.04 oz where control was only 68% and 75%, respectively. 0.73 and 1.04 oz indaziflam applied in Feb 2017 controlled goosegrass 60% and 75%, respectively, through late summer 2017 and large crabgrass 71% and 94%, respectively, while Prowl H_20 applied at 2 and 4 lb in Feb 2017 achieved 36% and 88% goosegrass control, respectively, and 30% and 95% large crabgrass control, respectively. Through late summer 2018, 3.8 lb Prowl H_20 applied in Aug 2017 provided 41% and 48% goosegrass and large crabgrass control, respectively. Pastora® + Induce® applied in Aug 2017 and Feb 2018 at 1.07 oz + 0.25% v/v controlled goosegrass 29% and 55%, respectively, through late summer 2018.

MANAGING BRUNSWICKGRASS IN BAHIAGRASS SEED PRODUCTION FIELDS IN FLORIDA. C.T. Cooper*[1], B. Sellers[2]; [1]UF/IFAS Extension Citrus County, Lecanto, FL, [2]University of Florida, Ona, FL (179)

ABSTRACT

Brunswickgrass (*Paspalum nicorae* Parodi), sometimes referred to as "Brown seeded paspalum", is becoming a problematic weed in summer perennial grass pastures in the southeast. In Florida we have seen increasing pressure to control this weed contaminate as it is becoming a major threat to livestock and bahiagrass seed industries. This rhizomatous grass is refused by cattle and seed could potentially restrict sales of contaminated bahiagrass seed lots. Currently, management options are limited; therefore the objective of this research is to develop a management plan and potentially eradicate Brunswickgrass in Bahiagrass seed production fields. Two experiments are currently underway with one evaluating the effectiveness of mechanical cultivation and annual crop rotations, while the other focuses on herbicide efficacy. Research was initiated in Citrus County monitoring the difference in conventional- vs. no-tillage in the implementation of four separate crop rotations in 2017. In addition, experiments were established at various locations within Citrus, Sumter and Pasco counties in 2018 to address Brunswickgrass response to the application of hexazinone at 0.13, 0.25, 0.50, 0.75, and 1.0 lb ai/acre. In the crop rotation study, there was less Brunswickgrass regeneration in no-tillage vs. conventional tillage plots. Also, less Brunswickgrass was observed in the plots that had been planted in bahiagrass and annual grasses versus broadleaf crops. In the herbicide study, hexazinone appears to have significant activity. With an application of 0.50 lb/acre 80% Brunswickgrass control was achieved. When the rate was increased to at least 0.75 lb/acre control increased to at least 94%. Even though there is still more to be discovered with regards to long-term management, these data appear promising for beginning to develop a long-term management plan.

WEED CONTROL AND BERMUDAGRASS TOLERANCE TO INDAZIFLAM IN BERMUDAGRASS HAY PRODUCTION. J. Belcher*[1], D. Spak[2]; [1]Bayer Crop Protection, Auburn, AL, [2]Bayer Crop Science, RTP, NC (180)

ABSTRACT

Bermudagrass hay producers have limited options for controlling annual grass weeds, either from PRE or POST herbicide applications. While many products are available to control broadleaf weeds, removing grass weeds from grass production systems remains one of most difficult challenges that producers face. Currently, there is only one herbicide, Prowl H20 (pendimethalin), that is labelled for PRE control of annual weeds in pastures.

Two trials were conducted to evaluate indaziflam (proposed trade name Rezilon) for both weed control and tolerance in Auburn, AL. The first trial was initiated in the fall of 2017 to determine efficacy of indaziflam on both winter and summer annual weeds. The trial was a randomized complete block design with four replications per treatment. Indaziflam rates evaluated were 43.84, 73.1, and 102.3 g ai ha^{-1} applied 6 October 2017, 14 February 2018, and/or 8 June 2018. Repeat applications of the 43.84 g ai ha^{-1} rate were also applied October+February or February+June. Prowl H20 was included as the standard at 4.5 kg ha^{-1}. All treatments applied in February included glyphosate at 1.2 lb ae ha^{-1} to control existing weeds.

The second trial was established in a relatively weed-free pasture in order to evaluate bermudagrass (*Cynodon dactylon*) tolerance to indaziflam. Indaziflam rates evaluated were 43.84, 73.1, 146, and 219 g ai ha^{-1} on 19 February 2018. An additional treatment evaluated 43.84 g ai ha^{-1} repeated, and was applied after the initial application immediately following the first harvest, on 11 June 2018. Prowl H20 was included at 4.5 kg ha^{-1} was included as the standard.

Visual control ratings were taken for all weed species on a scale of 0 to 100%, with 100% corresponding to complete control when compared to the nontreated check plots). At 199 days after application (DAA), ryegrass (*Lolium multiforum*) control ranged from 72% with the lowest rate of indaziflam to 86% with the high rate when applied in October. Control provided by Prowl H20 for this species was 45%. When assessing control of large crabgrass (*Digitaria sanguinalis*) at 294 DAA (July 2018), all rates of indaziflam were providing 92% control or greater, regardless of application timing. Prowl H20 provided 35% and 79% control, respectively, when applied either October or February.

In the tolerance trial, there were no statistical differences between treatments in terms of bermudagrass yield. The standard treatment of Prowl H20 yielded 10,718 kg ha^{-1}, while the yield taken from the untreated plots was 9429 kg ha^{-1}. Yields taken from indaziflam-treated plots ranged from 11585 kg ha^{-1} for the 43.84 g ai ha^{-1} rate to 12210 kg ha^{-1} for the 146 g ai ha^{-1} rate. The highest indaziflam rate tested, 219 g ai ha^{-1}, yielded 11062 kg ha^{-1}.

The results from this research indicate that indaziflam provides control of ryegrass and crabgrass in bermudagrass hayfields while not negatively impacting yield.

COMMON COCKLEBUR AND COMMON RAGWEED CONTROL WITH SAFLUFENACIL AND HALOSULFURON IN COOL-SEASON PASTURES. J. Green*[1], K. Vanzant[2]; [1]Univ of Kentucky, Lexington, KY, [2]Univ of Kentucky, Versailles, KY (181)

ABSTRACT

Summer annual weeds such as common cocklebur and common ragweed limit livestock grazing in cool-season grass pastures. Herbicide applications in midsummer with synthetic auxin based herbicides are often constrained by the presence of nearby susceptible crops and vegetation. A field study in 2018 was conducted to evaluate saflufenacil (0.033 lb ai/A) and halosulfuron (0.047 lb ai/A) as possible alternative herbicide modes of activity that could minimize the potential for off target movement. These two herbicide treatments were compared to 2,4-D [choline salt] (0.95 lb ae/A), premixtures of dicamba + 2,4-D (0.25 + 0.7 lb ae/A), aminopyralid + 2,4-D (0.08 + 0.62 lb ae/A), and triclopyr + fluroxypyr (0.38 + 0.12 lb ae/A). Slight herbicide injury (12% visual response) on cool-season grasses was observed with salflufenacil and halosulfuron at 10 days after application but was not evident at 30 days after treatment. Saflufenacil and halosulfuron provided 99 and 96% common cocklebur control, respectively, at 60 days after treatment. These treatments were not significantly different than the 100% control observed with 2,4-D, dicamba + 2,4-D, and aminopyralid + 2,4-D. Triclopyr + fluroxypyr provided 92% common cocklebur control, which was significantly lower than all the other herbicide treatments. Greater than 99% control of common ragweed was achieved with saflufenacil, dicamba + 2,4-D, and aminopyralid + 2,4-D at 60 days after application. Whereas, common ragweed control with halosulfuron, 2,4-D alone, and triclopyr + fluroxypyr ranged from 75 to 82% control. Differences in plant density measurements among herbicide treatments was similar to the visual control observed. All herbicide treatments reduced common cocklebur populations by ≥ 97% compared to an untreated check. Halosulfuron reduced the common ragweed population by 75% compared to the untreated plots; whereas, all other herbicide treatments evaluated reduced density by >90% including saflufenacil which resulted in a 100% reduction in the common ragweed population.

WEED CONTROL AND CROP SAFETY WITH INDAZIFLAM IN PASTURES. M. Matocha*[1], S.A. Nolte[2], J.R. Jackson[3]; [1]Texas AgriLife Extension Service, College Station, TX, [2]Texas A&M AgriLife Extension, College Station, TX, [3]Texas A&M AgriLife Extension, Stephenville, TX (182)

ABSTRACT

Weed control in Texas pastures continues to be a challenge for Texas producers. Annual weeds such as large crabgrass (*Digitaria sanguinalis*), field sandbur (*Cenchrus spinifex*), and annual ryegrass (*Lolium multiflorum*) can plague improved pastureland and negatively impact forage production and quality. Research was conducted from 2016 to 2018 in Brazos, Burleson, Ellis and Wise Counties to evaluate annual weed control and forage tolerance from preemergent herbicides. Indaziflam, a new herbicide being developed for the pasture market, was evaluated at 2.5-15 oz/A alone and in sequential applications in addition to other pasture herbicides such as Prowl H_2O.

In Brazos County, the large crabgrass treatments consisted of either 3 or 5 oz/A of indaziflam, or 2.1 qt/A of Prowl H20. Both products were evaluated using sequential and non-sequential applications of each. Crabgrass control ranged from 74 to 100 percent control and no significant differences at 112 days after treatment (DAT). Annual ryegrass control in Brazos County was between 88 and 96 percent at 89 DAT with indaziflam at 3.5 to 7 oz/A alone or with a tank-mix partner. Field sandbur control with indaziflam at 2.5 to 7 oz/A in Brazos County was between 40 and 71 percent at 41 DAT. In Burleson County, forage tolerance studies were conducted in 2017 and 2018 with indaziflam applied at 2.5 to 15 oz/A and a standard treatment of Prowl H_2O up to 4.2 qt/A. No significant yield differences were observed for any cutting in either year. Finally, stunting was minimal in both years with no differences detected.

Studies on large crabgrass and annual ryegrass were also evaluated in Wise and Ellis Counties. In October, the Ellis County annual ryegrass study compared indaziflam at 3 to 7 oz/A to Prowl H20 at 128 oz/A. Likewise, a February timing in this study also utilized indaziflam rates of 3 to7 oz/A, but with the addition of Roundup PRO as a tank-mix partner. The indaziflam treatments produced 94-99 percent ryegrass control with no significant differences between indaziflam treatments. However, significant differences occurred between the indaziflam and Prowl H_2O treatments; Prowl provided 25-28 percent control across timings. In Wise County, the large crabgrass trial consisted of indaziflam at 3 and 5 oz/A and Prowl H_2O at 2.1 qt/A, with and without sequential applications. Large crabgrass control was 71-90% in all treatments with no significant differences.

TOLERANCE OF TIFTON 9 SEEDLING BAHIAGRASS TO SEDGE-INHIBITING HERBICIDES. D.P. Russell*1, J.D. Byrd2, N.H. Thorne3, H.B. Quick1; 1Mississippi State University, Mississippi State, MS, 2Mississippi State University, Miss State, MS, 3Mississippi State University, Mississippi State University, MS (183)

ABSTRACT

Bahiagrass (Paspalum notatum Flugge.) is a warm season perennial grass grown on millions of acres across the mid-South in improved turf, rights-of-way, and forage pasture. Livestock producers find value in its low input requirements, relative drought and pest resistance, adaptability, and good response to fertility. However, broadleaf weeds and sedges are often major competitors of seedling bahiagrass during establishment, but its tolerance to herbicides is negligible below 15 to 20 cm of growth. At this point, broadleaf weeds may be controlled, but perennial sedges often compete for resources and reduce overall forage quality. Therefore, the objective of this study evaluated overall tolerance of seedling bahiagrass to four sedge-inhibiting herbicides applied at the two-leaf and 6-leaf growth stage. Studies were applied at two locations during the summer of 2018. Halosulfuron at 26.3 and 70.1 g ha-1, imazamox at 35.1 and 52.7 g ha-1, sulfosulfuron at 39.5 and 79.0 g ha-1, and imazethapyr applied at 52.7 and 105.4 g ha-1 were compared to an untreated check at each application timing. Response variables measured bahiagrass height, percent cover, and percent phytotoxicity at 21/7, 42/28, and 70/56 days after treatment (DAT) as well as dry weight yield at 70/56 DAT. Heights varied by location, but no herbicide treatment consistently resulted in bahiagrass as tall as the untreated by 70/56 DAT. Both rates of halosulfuron and 35.1 g ha-1imazamox applied at the 6-leaf stage resulted in percent cover equal to the untreated by 70/56 DAT. No phytotoxic symptoms were visible by the 70/56 DAT harvest, but halosulfuron at 26.3 g ha-1 was the only treatment with which bahiagrass consistently produced yield equal to the untreated. These data suggest ‘Tifton-9’ bahiagrass is tolerant to low rates of halosulfuon past the 6-leaf growth stage, which also provides excellent yellow and purple nutsedge control under normal growing conditions.

COMPLEMENTARY APPLICATIONS OF ANALYTIC TECHNIQUES IN FIELD RESEARCH. J.T. Buol*[1], A. Brown[2], D.B. Reynolds[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State Chemical Laboratory, Mississippi State, MS (184)

ABSTRACT

Continued developments in analytic chemistry have led to refined or novel techniques for analyzing samples of various media important in agriculture such as soil, plant tissue, solutions, and captured air. Knowledge of the availability and capability of these analytic techniques among field scientists is often limited to those with previous experience or training in analytic chemistry. An improved awareness and basic understanding of available analyses and analytic approaches may help inform future research endeavors and refine research questions and objectives in weed science and agricultural research in general. This work presents information regarding the availability of and basic concepts behind various techniques in analytic chemistry and how they may be (and are) applied to agricultural research. Key principles and terminology regarding chromatography and spectrometry/spectroscopy are discussed, with in-depth explanation of the processes underlying each technique provided. An overview behind the mechanics of HPTLC, HPLC/MS, GC/MS, IR spectroscopy, ICP-OES/MS, and fluorescence spectroscopy is presented, and current applications of these techniques in published and ongoing agricultural research are highlighted. There are many more analytic techniques available to support and augment applied agricultural research than are discussed here. Future graduate curricula and training programs for agricultural scientists should seek to go beyond topical discussion of molecular biology and include an emphasis on analytic chemistry techniques. Increasing the interface between applied and analytic techniques in agricultural research will be pivotal towards maximizing research potential in the future.

DICAMBA ACCUMULATION IN SOYBEAN FOLLOWING LOW-DOSE EXPOSURE IN REPRODUCTIVE DEVELOPMENT. M.M. Zaccaro*, J.K. Norsworthy, C.B. Brabham; University of Arkansas, Fayetteville, AR (185)

ABSTRACT

The release of new formulations of dicamba for post-emergence applications to Xtend® (dicamba-resistant) soybean (*Glycine max*) and XtendFlex® (dicamba-resistant) cotton (*Gossypium hirsutum*) have provided an option to control weeds multiple herbicide resistance, such as Palmer amaranth (*Amaranthus palmeri*). However, applications can be problematic because of the sensitivity of non-dicamba-resistant soybean in neighboring fields. Non-dicamba-resistant soybean is sensitive to dicamba; however, recovery is often observed when injury from drift rates occurs during the early stages of development. Previous research indicated that dicamba may damage soybean offspring when the parent is exposed to the herbicide post-flowering. The purpose of this experiment was to determine if dicamba could be detected in seed of non-dicamba-resistant soybean exposed to the herbicide at late reproduction. The experiments were established in 2017 and 2018 at the Arkansas Agricultural Research and Extension Center in Fayetteville, AR where Fiskeby-III (maturity group 00) soybean plants were grown in the greenhouse until R5 growth stage. Plants were sprayed with 1/200X rate of dicamba, with the full labeled rate for dicamba-resistant soybean being 560 g ae ha^{-1}. Plants were then spotted with 387,000 dpm (disintegrations per minute) $plant^{-1}$ of radiolabeled dicamba. At 14 and 21 days after treatment, the plants were divided into sections of interest, then samples were dried, oxidized, and the radioactivity in each section of the plant was determined using a liquid scintillation counter. Results showed no statistical difference among samples collected at 14 or 21 DAT. On average, 26% and 27% of the radioactivity applied per plant was recovered in the pods and seeds, respectively.

SPATIAL-TEMPORAL ANALYSIS OF THE BENZOBICYCLON RICE TOLERANCE GENE . C. Brabham*[1], J.K. Norsworthy[1], V.K. Varanasi[1], C. Sandoski[2]; [1]University of Arkansas, Fayetteville, AR, [2]Gowan USA, Collierville, TN (187)

ABSTRACT

In rice, tolerance to the group 27 inhibitor benzobicyclon is conferred by the *HPPD-INHIBITOR SENSITIVE-1* (*HIS1*) gene. Interestingly, small-plot research has shown benzobicyclon to have activity on several weedy rice accessions and varying crop tolerance. Research was conducted to investigate the role of *HIS1* expression in rice sensitivity. The expression of *HIS1* in rice cultivars Diamond, RoyJ, LaKast, CL XL753, and CL XL745 at the 2 to 3 and 5 to 6-leaf growth stage was determined. A subsample of five plants from each cultivar was collected and sectioned into whorl, mature leaf, and sheath to compare the spatial expression of *HIS1* among tissue types, cultivars, and growth stages. The remaining plants were sprayed with benzobicyclon at 371 g ai ha^{-1} plus 1% v/v methylated seed oil and rated for injury at 28 days after treatment (DAT). At 28 DAT, less than 7% injury was observed on 5 to 6-leaf cultivars while 48 to 80% injury was observed on the same cultivars at the 2 to 3-leaf growth stage. In regards to gene expression, *HIS1* expression was moderate to low and in general from highest to lowest was whorl ≥ shoot ≥ sheath. Within a tissue type, no difference in *HIS1* expression was detected among and between cultivars at the 2 to 3 and 5 to 6 leaf stage. Overall, the expression profile of *HIS1* cannot be used to explain the difference in sensitivity to benzobicyclon. However, based on the moderate to low expression of *HIS1*, we believe rice tolerance and weedy rice sensitivity to benzobicyclon at 371 g ai ha^{-1} plus 1% v/v methylated seed oil is a function of biomass (by overloading HIS1) and the homozygosity of HIS1.

EARLY RESPONSE TO PINE CONTROL TREATMENTS IN FORESTRY SITE PREPARATION APPLICATIONS. A.B. Self*[1], A.W. Ezell[2]; [1]Mississippi State University, Grenada, MS, [2]Mississippi State University, Miss State, MS (188)

ABSTRACT

Control of natural pine continues to be problematic in site preparation efforts during plantation establishment. Thirteen treatments were used in a study testing efficacy of two numbered BASF products (BAS 850H and BAS 851H) for natural pine control in combinations with imazapyr and glyphosate. This study was established on a cutover forestry site in northeast Mississippi on August 31, 2018. Natural pine and hardwood stems were recorded prior to treatment applications and again at 14DAT, 56DAT, 90DAT. Results clearly indicate that the addition of glyphosate is necessary for adequate control of natural pines and BAS 850H or BAS 851H serve to enhance glyphosate efficacy.

CONTROL OF NATURAL PINES WITH A MIX OF IMAZAPYR, GLYPHOSATE, AND SAFLUFENACIL. **A.W. Ezell*[1], A.B. Self[2]; 1Mississippi State University, Miss State, MS, 2Mississippi State** University, Grenada, MS (189)

ABSTRACT

Control of natural pine was excellent following application of this mixture to loblolly pines ranging in height from less than 1-ft. to 9-ft.

TWO-YEAR LOBLOLLY PINE GROWTH FOLLOWING HERBACEOUS WEED CONTROL WITH MIXTURES CONTAINING INDAZIFLAM. A.W. Ezell*[1], A.B. Self[2], J. Belcher[3]; [1]Mississippi State University, Miss State, MS, [2]Mississippi State University, Grenada, MS, [3]Bayer Crop Protection, Auburn, AL (190)

ABSTRACT

Loblolly pines exhibited excellent growth in this study involving multiple treatments applied to recently planted seedlings in an operational pine plantation in MS.

RESPONSE OF COTTON TO LOW RATES OF CLARITY, ENGENIA, AND ENLIST DUO AT DIFFERENT GROWTH STAGES. R.R. Hale*[1], T. Bararpour[2], J.W. Seale[2]; [1]Delta Research and Extension Center, Stoneville, MS, [2]Mississippi State University, Stoneville, MS (191)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) is one of the most troublesome weeds to control in cotton (*Gossypium hirsutum*) due to its competitive growth habit and prolific seed production. To help in combating Palmer amaranth, new cotton technologies have been introduced that are tolerant to 2,4-D (Enlist) or dicamba (RoundupReady Xtend). Since the introduction, herbicide drift (vapor or particle) of 2,4-D and dicamba has been a major concern and can be detrimental to sensitive crops. A field study was conducted at the Delta Research and Extension Center, in Stoneville, MS, to evaluate the response of cotton to low rates of Clarity (dicamba), Engenia (dicamba), and Enlist Duo (2,4-D choline + glyphosate) at different growth stages. Stoneville cotton (ST 4747GLB2) was planted on bed with 40-inch row spacing with a seeding rate of 4 seed ft^{-1} on May 1, 2018 and emerged on May 8. The experiment was arranged as a randomized complete block design with a factorial treatment structure and three replications. Two factors were included: growth stage (3- to 4-leaf, square, flower) and herbicide (Enlist Duo, Clarity, Engenia). Each herbicide was applied at 1/16 of the recommended 1 X rate. The 1X rate of Enlist Duo, Clarity, and Engenia were 75 fl. oz/A, 16 fl. oz/A, and 12.8 fl. oz/A. All applications contained non-ionic surfactant (NIS) at 0.25% (v/v) and a nontreated check was included.

An interaction of herbicide by growth stage was significant for cotton injury at 14 and 28 d after treatment (DAT). Enlist Duo applied at 3- to 4-leaf and at square stage showed 42 and 27% injury at 14 DAT, respectively. By 28 DAT, only Enlist Duo applied at 3- to 4-leaf showed highest injury (37%). Cotton height was reduced with Enlist Duo by 40 and 30% compared to the nontreated check at 14 and 28 DAT (averaged over growth stage), respectively. At the 3- to 4-leaf growth stage, cotton height was reduced by 40 and 35% at 14 and 28 DAT (average over herbicide), respectively. Seedcotton yield for the nontreated check was 5,888 lb/A. Enlist Duo application caused 37, 27, and 15% cotton injury (28 DAT) which resulted in 70, 79, and 82% seedcotton yield reduction for 3- to 4-leaf, square, and flowering stage, respectively. Seedcotton yield was reduced 14, 31, and 45% for treatments with Clarity at 3- to 4-leaf, square, and flowering stages, respectively. For Engenia, seedcotton yield was reduced 17, 22, and 35% for treatments applied at 3- to 4-leaf, square, and flowering growth stage, respectively. Physical injury was more severe with Enlist Duo than Clarity or Engenia. Cotton exposed at reproductive growth stages (square and flowering) showed greatest reductions in seedcotton yield. Overall, applicators should be cautious when applying Enlist Duo, Clarity, or Engenia at any time in the growing season to help decrease the likelihood of a drift event.

ASSESSING DICAMBA DRIFT: LARGE SCALE FIELD STUDIES. G. Kruger*[1], G. Sousa Alves[1], D.B. Reynolds[2], J.K. Norsworthy[3], B.G. Young[4], C. Sprague[5], R. Werle[6], C. Sias[7], P.H. Sikkema[8]; [1]University of Nebraska-Lincoln, North Platte, NE, [2]Mississippi State University, Mississippi State, MS, [3]University of Arkansas, Fayetteville, AR, [4]Purdue University, West Lafayette, IN, [5]Michigan State University, East Lansing, MI, [6]University of Wisconsin, Madison, WI, [7]Texas A&M University, College Station, TX, [8]University of Guelph, Ridgetown, ON (192)

ABSTRACT

Off-target movement of dicamba has dominated the headlines in agriculture over the last two years. The off-target movement of dicamba has occurred because of tank contamination, physical particle drift, volatility and run-off among other things. The new products (Engenia, FeXapan and Xtendimax) have been widely purported to reduce volatility, but yet massive areas of non-dicamba-tolerant soybeans have been reported to be damaged. A more thorough understanding of off-target movement of dicamba is necessary. The objective of this research was to quantify the off-target movement of dicamba from applications that followed the label across the Midwest and Mid-south US. Studies were conducted in Ontario, Canada and in Wisconsin, Michigan, Indiana, Nebraska, and Arkansas in the summer of 2018. Air samples were collected from the center mast in each location as well as the perimeter. Additionally, filter papers were collected from three transects in the downwind direction of the application area. Samples were analyzed using LC-MS-MS-MS and data modelled using the Aerodynamic Flux Model (AD) and/or the Integrated Horizontal Flux Model (IHF) as appropriate for the available data. When modelling each location, they were all within four fold of each other in terms of predicted flux. Sites, other than NE, were within one fold. Sites showed the diurnal flux across the three days following application with peaks during the daytime and lulls during the night. Also, each location showed a maximum peak, in terms of flux, during the first 24 hr and it dropped each day following. The AD and IHF were similar, but the AD seemed to be more stable and predictive of the actual numbers measured, likely due to the addition of wind speed and temperature measurements at each sampling height into the model. Either way, despite drastic differences in other measurements made (i.e. reported crop injury), the flux off of the applications sites seemed to be low and consistent between locations and within the reported flux values of previously reported studies on dicamba flux.

AN ATTEMPT AT PARTITIONING DICAMBA PARTICLES AND VAPORS. G. Kruger*[1], G. Sousa Alves[1], D.B. Reynolds[2], D. Dodds[2], A. Brown[3], A. Meredith[3], L.X. Franca[2], B.K. Fritz[4], C. Hoffmann[5], J.A. Golus[1], K. Schroeder[1]; [1]University of Nebraska-Lincoln, North Platte, NE, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State Chemical Laboratory, Mississippi State, MS, [4]USDA:ARS Aerawide Pest Management Research Unit, College Station, TX, [5]Prology Consulting, Bryan, TX (193)

ABSTRACT

Dicamba drift and volatility have caused significant concern over the last three years in dicamba-tolerant crops. The approved dicamba labels for postemergence dicamba applications in soybean and cotton have extensive restrictions compared to many other pesticide labels. While some restrictions such as boom height, nozzle selection, and maximum operating pressure have clear direct impacts. Other things such as soybean growth stage likely have an effect as well, but it is not clear if the impact is from a direct effect or if it is indirectly affecting off-target movement because drift goes up later in the season because of increased temperatures, lower humidity and larger and more sensitive crops. The objective of this study was to determine if crop growth stage had a direct impact on off-target movement of dicamba. The study was designed with a center mast with air samplers with corresponding wind speed, wind direction, temperature and humidity at each height. Perimeter air samplers were located 16 m from the application area in all eight of the cardinal and intercardinal directions. Three downwind deposition transects were set up with filter papers along with the appropriate upwind controls. Two blocks, four ha each, of dicamba-tolerant soybean were set up a minimum of one km apart. One block was planted approximately three wk prior to the planting of the second block. Each block was surrounded by non-dicamba-tolerant soybean for a total of 16 ha blocks. The study was conducted in two fields near Sutherland, Nebraska and two fields near Brooksville, Mississippi during the summer of 2018. Applications were made with two sprayers set up identically at each location. Applications were made using TTI11004 nozzles operated at 276 kPa to deliver 141 L ha^{-1}. Applications were made using a tank-mixture of dicamba, glyphosate and gaur gum. Like other field drift and flux studies, we observed diurnal flux values with daytime samples being higher than nighttime samples and the first 24 hour samples being higher than the following 72 hours. The samples however showed very different results between the two locations with the first planted soybeans having higher flux values in one location and the later planted soybeans having higher flux values in the other location. More work is needed to better understand how crop growth stage affects (or doesn't affect) off-target movement.

PREDICTING THE RELATIVE LONG-TERM EFFECTIVENESS OF HERBICIDE PROGRAMS ON AMARANTHUS USING SYNGENTA'S RESISTANCE FIGHTER MODEL.

E.T. Parker*[1], R. Wuerffel[2], E. Palmer[3], D.L. Bowers[4], C.L. Dunne[5], D. Kaundun[6], C. Liu[6]; [1]Syngenta, Vero Beach, FL, [2]Syngenta, Sebastian, FL, [3]Syngenta Crop Protection, Greensboro, NC, [4]Syngenta, Greensboro, NC, [5]Syngenta Crop Protection, Vero Beach, FL, [6]Syngenta, Bracknell, England (194)

ABSTRACT

Successful stewardship of weed management tools (herbicides, tillage, cover crops, etc.) requires a focus on weed seed bank management; however, there are numerous logistical and experimental challenges when attempting to address these long-term research questions using traditional field trials. Even more challenging is convincing growers to adopt practices that do not necessarily afford short-term gain, but may reduce soil seed bank densities subsequently providing a potential return on investment after multiple years. Modeling weed management practices can be useful to meet these objectives given that modeling is not limited to time constraints and uncontrollable environmental factors. A generalized individual-based model was developed by Liu et al. (2017) that uses a novel approach for herbicide resistance modeling. In this model, biological parameters influence individual weeds and weed seeds as opposed to influencing the population as a whole. Furthermore, biological parameters such as seed production, emergence time, and quantitative resistance are represented by a range of responses which allows every individual in the model to have a stochastic and unique response, thereby accounting for natural variation. This model has been adapted specifically for *Amaranthus tuberculatus* in corn and soybeans and a user interface was developed to allow for direct interaction with standard computing capabilities.

USE OF UNMANNED AERIAL SYSTEMS FOR WEED DETECTION AND MANAGEMENT. V. Singh*[1], D. Martin[2], B. Sapkota[1], M. Latheef[2], M. Bishop[1], M. Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]USDA, College Station, TX (195)

ABSTRACT

Sustainable crop yields needed to feed the increasing population would require innovative platforms for automation, precise data collection, and analysis. Recent advances in Unmanned Aerial Systems (UAS) technologies have opened new opportunities for future agricultural systems. Weeds are the major pests of agricultural crops and biggest concern for sustainable crop production, wherein UAS technologies can favor improved weed management. A field study was carried out during summer 2018 at College Station, TX to 1) identify various weed species in soybean, sorghum, corn, and cotton crops based on UAS imagery, and 2) evaluate the efficacy of UAS-based postemergence herbicide applications in comparison with conventional backpack sprayer applications. A spray mix of water with fluorescent dyes were applied on Palmer amaranth and ivyleaf morningglory with an UAS at 18.7 and 37.4 L ha^{-1}, and a CO_2 pressurized backpack sprayer at 140 L ha^{-1}. Stratified classification coupled with machine learning algorithms classified weeds in cotton with an accuracy of 88, 90 and 94% with low, medium, and high weed densities. UAS-based spray applications had significant spray deposition at lower leaf surface, in addition to the upper surface, which may increase the efficacy of contact herbicides. Results demonstrated that UAS has the potential for improving weed detection and management in crop fields.

STATE OF RESISTANCE FOR PALMER AMARANTH POPULATIONS FROM THE NORTH CAROLINA COASTAL PLAIN. D.J. Mahoney*[1], D. Jordan[2], A.T. Hare[2], N.R. Burgos[3], M. Vann[2]; [1]North Carolina State Univ., Raleigh, NC, [2]North Carolina State University, Raleigh, NC, [3]University of Arkansas, Fayetteville, AR (196)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S. Wats.) is one the most problematic weeds in the United States. It is a highly competitive weed with immense fecundity and has the ability to replenish the soil-seed bank in one generation. Palmer amaranth is an obligate cross-pollinator, possesses a high amount of genetic variation and its pollen has been shown to move significant distances. Along with immense herbicide selection pressure, these characteristics have led to Palmer amaranth populations resistant to several mechanisms of action (MOA) with some populations expressing multiple resistance. In North Carolina (NC), resistance to acetolactate synthase (ALS) and 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase inhibitors is widespread and suspicion of resistance to protoporphyrinogen oxidase (PPO) inhibitors within Palmer amaranth exists. Greenhouse research was completed to determine the presence and distribution of Palmer amaranth population from the NC Coastal Plain expressing possible resistance to multiple MOA. In fall 2016, 110 Palmer amaranth populations were collected from fields predominantly in the NC Coastal Plain, the state's primary peanut producing region. Following inflorescences being dried, threshed, and cleaned, seeds were sown into cellular trays thinned to one plant cell^{-1}. When plants reached the 2- to 4-leaf stage, they were treated with glufosinate (451 g ai ha^{-1}), glyphosate (840 g ae ha^{-1}), fomesafen (280 g ai ha^{-1}), mesotrione (105 g ai ha^{-1}) or thifensulfuron-methyl (17.5 g ai ha^{-1}) in separate experiments (two per herbicide). Plant injury was estimated visually (0 to 100%) and mortality was recorded 3 wks after application.

Only 4 populations had no survivors following application of thifensulfuron-methyl. Of the other populations with survivors (< 90% injury), 69 had survival frequencies of 1 – 30%, 35 with 31 – 70%, and the remaining 2 with 71 – 80%. Following glyphosate, only 1 population was completely controlled with 9 populations having survival frequencies in the 1 – 30% range. Higher survival frequencies were more common with glyphosate as 38 and 62 populations had survival frequencies of 31 – 70% and 71 – 100%, respectively. Survival following mesotrione was less frequent with 68 populations being completely controlled. While 41 populations had survival frequencies of 1 – 10%, 37 fell below 5% survival rate with the 1 population having 17% survival. Fomesafen controlled 106 of the populations completely with the remaining 4 falling in the 1 – 10% survival frequency. All populations were completely controlled following glufosinate application. In total, none of the tested populations were completely controlled by all herbicides and only 3 survived only one MOA. Within the other 107 populations, 65, 40, and 2 populations had survivors to 2, 3, and 4 MOA, respectively. These data suggest that Palmer amaranth resistant to EPSP synthase and ALS inhibitors remains commonplace throughout the NC Coastal Plain. There is now greater cause for concern with populations which have individuals surviving PPO- and 4-hydroxyphenylpyruval dioxygenase inhibitors. While glufosinate currently remains active on these populations, extra caution should be taken to ensure proper application timing as decreased efficacy of this herbicide would be detrimental for many row crop systems in North Carolina.

PYRACLONIL EFFICACY IN CALIFORNIA WATER SEEDED RICE. K.E. Driver*[1], A. Godar[2], k. al-khatib[2], J. Gutierrez[3]; [1]UC Davis, Davis, CA, [2]UC Davis, davis, CA, [3]Nichino USA, Fresno, CA (198)

ABSTRACT

California rice production is heavily dependent on herbicides for weed control. Repeated use of herbicides has resulted in widespread herbicide resistance, however, there is no documented cases of PPO inhibitor resistance. Pyraclonil, a PPO inhibitor is widely used in the Asian rice market and would offer California rice producers another application timing for PPO inhibitors in rice. In 2018, a field experiment was conducted in Biggs, CA to determine the efficacy and safety of Pyraclonil. This experiment was arranged in a randomized complete block design. Treatments included 1.) pyraclonil, 2.) pyraclonil + benzobicyclon, 3.) pyraclonil fb. benzobicyclon, 4.) pyraclonil + clomazone, 5.) pyraclonil fb thiobencarb, and 6.) pyraclonil fb bispyribac. Weed control was visually assessed weekly on a scale of 0-100 (0 = no control and 100 = complete mortality). Rice safety in the form of stunting and bleaching was also evaluated weekly. Rice was stunted with all treatments at 21 DAT but was within the acceptable range and recovered. Bleaching was observed at 14 DAT when pyraclonil was applied with benzobicyclon and clomazone, however at 21 DAT benzobicyclon injury had recovered and at 48 DAT clomazone injury recovered. Weed control at 42 DAT was 100 for all treatments and species evaluated. Yields were not significantly different between herbicide treatments.

POST-DIRECT OPTIONS IN ENLIST COTTON. R.C. Doherty*1, T. Barber2, Z.T. Hill3, A. Ross2; 1University of Arkansas, Division of Agriculture, Cooperative Extension, Monticello, AR, 2University of Arkansas, Lonoke, AR, 3University of Arkansas Cooperative Extension Service, Monticello, AR (199)

ABSTRACT

Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) remains a major concern for cotton (*Gossypium hirsutum*) growers in Arkansas. Herbicide systems that contain multiple modes of action and are applied timely are essential in controlling this troublesome weed. The Enlist technology provides an opportunity and the flexibility to use multiple modes of action, over-the-top and post-directed, for control of a wide variety of weeds including Palmer amaranth. Two trials were established, one in 2017 and the second trial in 2018. In 2017, the trial was established at Marianna, AR in a Loring silt loam soil and at Rohwer, AR in a Herbert silt loam soil. In 2018, the second trial was established at Marianna, AR in a Loring silt loam soil and at Tillar, AR in a Herbert silt loam soil. The trials were arranged in a randomized complete block design with four replications. All treatments received Brake FX preemerge at 1.13 lb ai/A (fluometuron 0.94lb ai/A + fluridone 0.19 lb ai/A) followed by Liberty (glufosinate) at 0.53 lb ai/A plus Dual Magnum (metolachlor) at 0.95 lb ai/A at 3-4 leaf cotton. Post-directed herbicides evaluated included Valor SX (flumioxazin), MSMA, Diuron, Clarity (dicamba), Loyant (florpyrauxifen-benzyl), Starane Ultra (fluroxypyr), and Enlist Duo (2,4-D choline plus glyphosate). Visual weed control ratings of Palmer amaranth, morningglory, barnyardgrass, broadleaf signalgrass, and Southwestern cupgrass were recorded at 20 days after post-direct applications.

In 2017, all treatments provided 99% control of morningglory, barnyardgrass, and broadleaf signalgrass at Rohwer and Marianna. Palmer control however, was 99% at Marianna and 83 to 84% at Rohwer. No visual crop injury was caused by any treatment at either location in 2017. Cotton yield was not impacted by any treatment other than Clarity, which caused a significant yield loss. All other treatments were equal at the respective location.

In 2018, all treatments provided 99% control of Palmer amaranth, morningglory, barnyardgrass, and Southwestern cupgrass at Tillar, while control of Palmer amaranth and barnyardgrass ranged from 88-98% at Marianna. No visual crop injury was caused by any treatment at either location in 2018. Cotton yield was not impacted negatively by any treatment at either Marianna or Tillar. All treatments provided equal cotton yields at the respective location.

SUSCEPTIBILITY OF ARKANSAS PALMER AMARANTH ACCESSIONS TO COMMON SITES OF ACTION. C. Brabham*, J.K. Norsworthy, V.K. Varanasi; University of Arkansas, Fayetteville, AR (200)

ABSTRACT

A late-season weed escape survey was conducted to determine the efficacy of common sites of action on Palmer amaranth accessions from Arkansas. Sites of action evaluated were group 2, 4, 5, 9, 10, 14, 15, and 27 and the number of accessions screened for each group ranged from 134 to 227. As expected, nearly all accessions (140 tested) but two exhibited some level of resistance to glyphosate at 860 g ha^{-1} + imazethapyr at 79 g ha^{-1}. For fomesafen at 395 g ha^{-1}, 167 of 227 screened accessions had alive plants at 14 days after treatment (DAT) and of the 167 accessions, 141 were segregating for the Δ210 and/or R128G/M target-site resistance mechanisms. Averaged over 142 accessions, dicamba at 280 g ha^{-1} had a 50% mortality rating, while dicamba at 560 g ha^{-1} increased mortality to 83% at 21 DAT. The response to tembotrione at 92 g ha^{-1} varied considerably ranging from 6 to 94% mortality. Alternatively, glufosinate at 594 g ha^{-1}, atrazine POST at 560 g ha^{-1}, and *S*-metolachlor at 1,064 g ha^{-1} averaged 99, 85, and 99% mortality, respectively. However, there were a number of accessions with less than expected mortality from each herbicide and is concerning. Overall, resistance to group 2, 9, and 14 herbicides is wide-spread in Arkansas thus, the activity of group 4, 5, 15, and 27 herbicide needs to be protected in order to control Palmer amaranth in the future.

TAVIUM™ PLUS VAPORGRIP® TECHNOLOGY – A TOOL FOR WEED MANAGEMENT IN CONVENTIONAL AND NO-TILL DICAMBA TOLERANT SOYBEANS AND COTTON. P.M. Eure*[1], J. Holloway[2], D. Porter[3], T. Beckett[3]; [1]Syngenta Crop Protection, Richmond, TX, [2]Syngenta Crop Protection, Jackson, TN, [3]Syngenta Crop Protection, Greensboro, NC (203)

ABSTRACT

Tavium® Plus VaporGrip® Technology is a new herbicide premix developed by Syngenta Crop Protection for use in dicamba tolerant soybean and pending registration with the EPA. It will contain three key components: dicamba, a Group 4 herbicide, *S*-metolachlor, a Group 15 herbicide, and VaporGrip Technology which decreases the volatility of dicamba and reduces the chance for off-site movement. Upon registration, Tavium Plus VaporGrip Technology will provide postemergence control of over 50 broadleaf weeds as well as extended residual control of key broadleaf species such as waterhemp and Palmer amaranth as well as troublesome grasses. Tavium Plus VaporGrip Technology will offer flexibility in application timing by allowing one application from preplant burndown through preemergence and one application postemergence in dicamba tolerant soybean and cotton. By employing two modes of action, Tavium Plus VaporGrip Technology will be an effective resistance management tool which will fit well into either conventional or no-till systems by delivering postemergence control and enabling overlapping residual activity.

EFFECT OF POST-APPLIED PPO- AND ALS-INHIBITING HERBCIDIES ON SOYBEAN YIELD AND CANOPY FORMATION. O.W. France*, J.K. Norsworthy, M.C. Castner, G.L. Priess; University of Arkansas, Fayetteville, AR (204)

ABSTRACT

Glyphosate-resistant Palmer amaranth is widespread in the Mississippi Delta region of Arkansas. Because grower's options are limited, reliance on LibertyLink soybean technology has played a significant role in combatting glyphosate-resistant Palmer amaranth. As herbicide resistance continues to threaten Arkansas soybean production, postemergence (POST)-applied protoporphyrinogen oxidase (PPO)-inhibiting herbicides continue to be an essential resource for growers, especially in fields lacking PPO-resistant Palmer amaranth. Field experiments were conducted in 2017 in Crawfordsville, Arkansas, to further evaluate the impact of combinations of POST-applied PPO- and acetolactate synthase (ALS)-inhibiting herbicides in soybean. A non-sulfonylurea-tolerant, glufosinate-resistant soybean variety was planted and treated with flumioxazin at 71.42 g ai ha^{-1} 3 days after planting (DAP). At 28 DAP, PPO herbicides alone and combinations of PPO herbicides with chlorimuron were applied alone or tank-mixed with glufosinate. Injury, soybean canopy formation, height, and width were evaluated 7, 14, and 21 days after treatment (DAT). In the experiment, acifluorfen exhibited the greatest amount of injury at 14% 7 DAT and 20% 14 DAT but did not significantly impact soybean plant volume. The addition of glufosinate with PPO herbicides and PPO herbicides plus chlorimuron demonstrated a slight significant reduction in canopy development in comparison to treatments without glufosinate but did not delay maturity or adversely affect yield.

PEANUT INJURY EVALUATION OF PPO INHIBITOR HERBICIDES AS AFFECTED BY APPLICATION TIMINGS AND SURFACTANTS. K.J. Price*, S. Li; Auburn University, Auburn, AL (205)

ABSTRACT

Due to the prevalence of ALS-inhibitor resistant weeds such as Palmer amaranth, more PPO-inhibitors are being utilized to control weeds in peanuts. Some PPO-inhibitors, such as carfentrazone and lactofen, are often used as late-season clean up options since they have short pre-harvest interval. However, PPO-inhibitors often cause crop injury or foliar burns. This issue can be further compounded by different surfactants, application timings, and interactions with environmental stresses, especially at the peanut reproductive stages. Therefore, two studies conducted in Henry and Escambia counties in Alabama in 2018, were designed to evaluate three objectives: 1) the effect of PPO-inhibitor based treatments on dryland peanut growth and yield when applied during sensitive reproduction stages 60 (R4-R5), 75 (R6), and 90 days (R6-R7) after planting (DAP) 2) study the role of surfactants and chloroacetamide herbicides on peanut injury and 3) assess the level of correlation of NDVI data to traditional visual injury ratings. At 60 DAP, tank mixes of lactofen and 2,4-DB with pyroxasulfone, *S*-metolachlor, dimethenamid-P with high surfactant oil concentrate (HSOC), a crop oil, were applied at recommended labeled rates. At 75 DAP tank mixes of lactofen, carfentrazone-ethyl, acifluorfen plus 2,4-DB and either non-ionic surfactant (NIS) or HSOC, were applied at 1) the recommended labeled rates and 2) 1.5 times over the label rate. At 90 DAP tank mixes of 2,4-DB, carfentrazone-ethyl, lactofen were applied at the highest labeled rates with either HSOC or NIS. Visual injury ratings and normalized difference vegetation index (NDVI) readings using a hand held Trimble GreenSeeker were conducted at approximately 7, 14, 21, and 28 days after treatment. Yield was collected at the end of the growing season. Results showed peanuts are more sensitive 75 days after planting to PPO inhibitors in combination with HSOC than any other application timing. Yields losses ranged from 13-31 % with carfentrazone-ethyl 52 g ai ha^{-1} + 2,4-DB 420 g ai ha^{-1} + HSOC 0.9 % v/v causing the most significant yield loss among all treatments evaluated. For treatments applied 60 DAP, lactofen 219 g ai ha^{-1} + 2,4-DB 420 g ai ha^{-1} + *S*-metolachlor 1,700 g ai ha^{-1} + HSOC 0.75% v/v was the only chloroacetamide tank mix evaluated to cause a significant yield loss of 13% relative to NTC. Carfentrazone-ethyl at 35 g ai ha^{-1} + 2,4-DB at 420 g ai ha^{-1} + HSOC 0.75% v/v applied at 90 DAP caused a 21% yield reduction compared to the NTC. A Pearson correlation of injury ratings and NDVI readings, for all applications dates, showed a significant negative correlation ($R= -0.69$, $p<0.0001$), suggesting NDVI readings can provide additional support to subjective visual injury ratings. Overall, treatments with HSOC and/or carfentrazone-ethyl were more likely to cause significant injury, NDVI reductions as well as yield loss than treatments with NIS. Peanuts are most sensitive to injury from PPO-inhibitor herbicides at 75 days after planting (around R6 growth stage).

COTTON TOLERANCE TO HALAUXIFEN-METHYL AND FLORASULAM APPLIED PREPLANT BURNDOWN. C.W. Cahoon*[1], M.C. Askew[2], M.L. Flessner[3], A. York[4]; [1]North Carolina State University, Raleigh, NC, [2]Virginia Tech, Eure, NC, [3]Virginia Tech PPWS Dept., Blacksburg, VA, [4]North Carolina State University, Cary, NC (206)

ABSTRACT

Auxin herbicides are widely used preplant burndown prior to planting cotton to control glyphosate- and ALS-resistant horseweed. Halauxifen-methyl, the active ingredient in Elevore™ and a component of Quelex™, is a new auxin herbicide marketed by Corteva Agrisciences for horseweed control. Unlike 2,4-D and dicamba, cotton tolerance to halauxifen applied preplant burndown is not well established. Labels for Elevore™ and Quelex™ require at least 30 and 90 days between application of these herbicides and cotton planting, respectively. The objective of this study was to evaluate cotton tolerance to Elevore™ and Quelex™ applied preplant burndown at intervals shorter than 30 days. Experiments were established at 8 locations across North Carolina and Virginia during 2017 and 2018. Cotton was planted either strip- or no-till at all locations; if planted strip-till, tillage was performed at least 30 days prior to cotton planting and before any herbicide treatments were applied. Cotton cultivars ‘ST 4946 GLB2’ and ‘ST 5020 GLT’ were planted early to mid-May. Experiments consisted of a 5x4 factorial arrangement of treatments including 5 burndown timings and 4 herbicide treatments. Burndown herbicides were applied 4, 3, 2, and 1 weeks before planting (WBP) and at planting. Herbicide treatments included Elevore (1 fl oz/A), Clarity (8 fl oz/A), Weedar 64 (32 fl oz/A) and no herbicide. Plots were organized in a randomized complete block design with treatments replicated 4 times. During 2018, additional treatments included Quelex (0.75 oz wt/A) applied at 2 and 4 WBP. Herbicides were applied using a CO2-pressurized backpack sprayer calibrated to deliver 15 GPA. Data collected included cotton injury 7, 14, and 28 days after emergence (DAE), cotton stand and percent cotton plants with distorted leaves 14 and 28 DAE, cotton height 28 and 56 DAE, and seed cotton yield. Analysis of variance was preformed using PROC GLIMMIX procedure in SAS 9.4 and means were separated using Fisher’s protected LSD at P = 0.05 where appropriate. Cotton response was greatest from auxin herbicides applied at planting; therefore, data for this timing are presented separately. Data for burndown timings 1-4 WBP are presented pooled across timings. Dicamba and 2,4-D applied at planting were most injurious, causing 17 to 20, 21 to 26, and 17 to 22% growth reduction, total injury, and distorted leaves 14 days after emergence (DAE), respectively. In contrast, Elevore applied at the same timing caused 3, 9, and 6% growth reduction, total injury, and distorted leaves 14 DAE, respectively. Furthermore, 2,4-D and dicamba applied at planting reduced cotton stand 14 DAE compared to the nontreated check whereas Elevore did not. Cotton injury from all auxin herbicides applied 1 to 4 WBP was minimal and had no effect on cotton stand. Despite early season injury from auxin herbicides applied at planting, cotton yield was not affected. Quelex applied 2 or 4 WBP injured cotton 2% or less. In conclusion, cotton tolerance to Elevore and Quelex is good if current label requirements are followed. At shorter intervals, cotton was more tolerant to Elevore than 2,4-D and dicamba. It should be noted that wet springs were experienced during 2017 and 2018. Like other auxin herbicides, it is expected that dry conditions between application and planting will exacerbate cotton injury resulting from Elevore and Quelex; future research efforts should focus on these conditions.

EVALUATION OF SOYBEAN TOLERANCE TO OFF-TARGET LOYANTTM (FLORPYRAUXIFEN-BENZYL) DEPOSITION. D.C. Walker*[1], E. Webster[2], B. McKnight[1], S. Rustom[1], M.J. Osterholt[2], C. Webster[3]; [1]LSU AgCenter, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA, [3]LSU, Baton Rouge, LA (207)

ABSTRACT

In 2018, Corteva Agriscience released a new postemergence herbicide florpyrauxifen-benzyl, sold under the trade name Loyant, which allows growers to control broadleaf, grass and sedge weeds in rice. This product is a group 4 synthetic auxin with a unique site of action that is different than other group 4 herbicides. With the introduction of this herbicide also came complaints of off-target movement, similar to that of other auxin herbicides. Off-target deposition of this herbicide has proven to be injurious to susceptible vegetation including soybean. Therefore, soybean tolerance to this product must be evaluated.

The objectives of this study were: 1) to determine the effect of florpyrauxifen-benzyl application timing and deposition rate on soybean growth and yield; 2) to determine if there is differential tolerance between dicamba-tolerant (DT) and non-DT soybean. Trials were conducted in 2018 in Alexandria, Crowley and Iowa, LA with DT soybean at one location and non-DT soybean at the other two locations. Soybean were treated with a single application of florpyrauxifen-benzyl at either the V3 to V4 or R1 to R2 growth stage with 7.34, 1.84, 0.46, 0.11, or 0.03 g ai ha^{-1} which is equivalent to 1/4X, 1/16X, 1/64X, 1/256X and 1024X of the full labeled rate of florpyrauxifen-benzyl at 29.44 g ai ha^{-1}. Also, two rates of dicamba in the Xtendimax® formulation at 7.09 and 0.24 g ae ha^{-1} which is equivalent to 1/32X and 1/1000X of the full labeled rate of dicamba at 558 g ae ha^{-1} were included as a comparison.

Results indicate that florpyrauxifen-benzyl deposition on soybean at the R1 to R2 application timing will result in greater yield reduction compared with soybean treated at the V3 to V4 application timing. Furthermore, all florpyrauxifen-benzyl treatments resulted in a yield reduction with 1/4X causing a 100% yield loss and 1/1024X causing 15% yield reduction.

MECHANICAL OPTIONS TO IMPROVE IN-ROW WEED CONTROL IN ORGANIC PEANUT PRODUCTION. W.C. Johnson III*; USDA-ARS, Tifton, GA (209)

ABSTRACT

Weed management in organic peanut production is difficult. Compared to all possible forms of weed control suitable for organic production systems, cultivation using the tine weeder provides the most consistent and effective weed control in organic peanut. Even using the tine weeder, weed control in the row remains difficult. Research trials were conducted in Tifton, GA in 2017 and 2018 to evaluate additional cultivation implements for weed control in organic peanut. These implements are designed to shallowly till over the peanut row and bury seedling weeds without disrupting peanut. Implements evaluated were a finger weeder mounted in tandem on a sweep cultivator, rolling cultivator, and a tine weeder. Treatments were a factorial arrangement of six early-season cultivation regimes and three mid-season cultivation regimes. Early-season cultivation regimes included: (1.) finger weeder four times, (2.) finger weeder twice followed by the tine weeder twice, (3.) rolling cultivator four times, (4.) rolling cultivator twice followed by the tine weeder twice, (5.) tine weeder four times, (6.) no cultivation early season for four weeks. Mid-season cultivation implements were the tine weeder three times, sweep cultivator three times, and no cultivation mid-season for three weeks. The growing conditions in 2017 did not cause any obvious effects on the weed control treatments. In 2018, the initial planting was in mid-May and for two weeks after planting rainfall was recorded for twelve days which affected both the scheduling of cultivation and performance of the implements. The result was numerous weeds surviving cultivation. An additional planting was initiated as an expedient in mid-June 2018. Rainfall was less frequent two weeks after the June planting and weed control was much better compared to the May planting. Across the 2017 experiment and both 2018 plantings, four early-season cultivations with the tine weeder was among the most effective early season cultivation regimes evaluated. Early-season cultivation with the finger weeder for two weeks followed by the tine weeder for two weeks was equally effective. Early season cultivation with the rolling cultivator was inconsistent due to difficulties in precise adjustment necessary for optimal performance. Weed control from mid-season cultivation using either the tine weeder three times or sweep cultivator three times were similar. The tine weeder remains the most consistent and versatile implement for cultivation in organic peanut production. An alternative to the tine weeder is the finger weeder mounted in tandem on a sweep cultivator. However, all implements evaluated were vulnerable to rainy conditions and weed control was greatly reduced from the rainy conditions encountered in the May 2018 planting. While weed control was better from all forms of cultivation in the June 2018 planting compared to the May 2018 planting, disease epidemics were much greater with the later planting and peanut yields were severely affected. While beyond the scope of these experiments, it is clear that late planting creates a high-risk condition for organic peanut production.

MANAGING PPO-RESISTANT AMARANTHUS SP. IN ROUNDUP READY 2 XTEND SOYBEANS. G.B. Montgomery*[1], N. Rana[2], L.M. Etheredge[3]; [1]Bayer CropScience, Rives, TN, [2]Bayer CropScience, St. Louis, MO, [3]Monsanto Company, Llano, TX (210)

ABSTRACT

Glyphosate-resistant Amaranthus species was detected in the mid 2000's and since then growers have relied upon protoporphyrinogen oxidase- (PPO) inhibitor herbicides for weed control in soybean and cotton. PPO-inhibitor-resistance in Amaranthus species was recently detected when applied pre and post-emergent. With the heavy reliance upon PPO-inhibitor chemistry and glufosinate in soybean weed control systems, XtendiMax® herbicide with VaporGrip® Technology provides an effective site of action (SOA) to control PPO-inhibitor-resistant weed species. In 2018, fifteen field trials were conducted in IA, IN, IL, AR, MO, TN, KY, NE, MN, MD, and NC to evaluate control of PPO-inhibitor-resistant weed species using one or more effective SOA applied pre-emergence (PRE) followed by postemergence (POST) applications. Twelve of these trials were conducted with university academics on sites with confirmed PPO-inhibitor-resistant weed populations. PPO-inhibiting herbicides alone provided ≤ 50% control of PPO-inhibitor-resistant weed species five week after PRE treatment. Adding another effective SOA to the PPO-inhibiting herbicides PRE followed by a POST application of XtendiMax® herbicide with VaporGrip® Technology + Roundup PowerMAX® herbicide + Intact™ provided greater (≥ 96%) control of PPO-inhibitor-resistant waterhemp (Amaranthus tuberculatus) compared to PPO-inhibiting herbicides applied PRE alone followed by XtendiMax® herbicide with VaporGrip® Technology + Roundup PowerMAX® herbicide + Intact™ 21 days after treatment.

THE FULLPAGE RICE CROPPING SOLUTION AND PREFACE AND POSTSCRIPT HERBICIDES- A NEW IMI-TOLERANT RICE WEED CONTROL SYSTEM.

A. Kendig*[1], D. Feist[2], B. Ottis[3]; [1]ADAMA, Chesterfield, MO, [2]ADAMA, Ft. Collins, CO, [3]RiceTec, Alvin, TX (211)

ABSTRACT

RiceTec® and ADAMA® are collaborating to launch The FullPage® Rice Cropping Solution, (an imidazolinone-tolerant system) and Preface® and Postscript® herbicides (imazethapyr and imazamox, respectively) in 2019, pending regulatory approval. FullPage is a novel trait package based on two unique imidazolinone-resistance genes combined in hybrid rice. By federal label, FullPage rice must be treated with Preface and Postscript herbicides and Clearfield® rice must be treated with associated BASF® herbicides. A program study was initiated in 2018 to evaluate the weed control efficacy of the system, the tolerance of the FullPage rice hybrids and selected weed control programs. The base program centered on preemergence clomazone, an early post application of Preface plus quinclorac, a preflood application of Preface and a postflood application of imazamox. The trial contained 10 treatments based on variations around this base program with rates and herbicides. At four times the labeled rate Clearfield hybrid rice was generally stunted (as much as 55%) while stunting on FullPage rice was 0 to 15%. Yields were not affected by crop response. Standard programs provided excellent control of weedy rice and barnyardgrass. A program where imazamox was substituted at preflood timings also provided excellent control. Programs without postflood imazamox provided excellent control of barnyardgrass and red rice; however, at one location, Amazon sprangletop control was reduced. A program of Preface and Postscript with no conventional herbicides resulted in reduced barnyardgrass control at one location and a tendency for Palmer amaranth and hemp sesbania escapes. A program using a tank mixture of Postscript and florpyrauxifen (without clomazone, quinclorac and imazamox) provided excellent control of grass weeds and legumes in most locations, but sprangletop control was reduced in one location. The reduction in sprangletop control may be due to this program not having a postflood imazamox treatment. Within standard weed control programs, the FullPage hybrid yielded an average of 32 bushels per acre more versus selected Clearfield inbreds and 19 bushels per acer more than selected Clearfield hybrids. FullPage rice and Preface and Postscript herbicides, when used in appropriate weed control programs, will provide growers with excellent weed control and high yields. Improved herbicide tolerance of FullPage rice also supports flexibility and will reduce crop response risk during stressful weather conditions.

WEED MANAGEMENT PROGRAMS IN MISSISSIPPI CORN. T. Bararpour*[1], R.R. Hale[2], J.A. Bond[2], J.W. Seale[1], B.R. Golden[2]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS (212)

ABSTRACT

Weed management programs are an essential component of corn (*Zea mays*) production in Mississippi. A field study was conducted in 2018 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate: 1) the efficacy of herbicides available to Mississippi producers for controlling weeds in corn, and 2) the possible use of Sencor (metribuzin) in weed control programs and corn tolerance. Corn (Pioneer P1637 YHR) was planted on beds with 40-inch row spacing at a seeding rate of 2.5 seeds ft^{-1} on April 12, 2018 and emerged on April 24. The plot area contained Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), broadleaf signalgrass (*Urochloa platyphylla*), barnyardgrass (*Echinochloa crus-galli*), and hemp sesbania (*Sesbania herbacea*). The study was designed as a randomized complete block with 18 treatments and four replications. Treatments were as follows: 1) AAtrex (atrazine) at 1.5 qt/A + crop oil concentrate (COC) at 1% (v/v) at V2-V3 followed by (fb) Liberty (glufosinate) at 29 fl oz/A at V4-V5; 2) AAtrex + COC at V2-V3 fb Roundup PowerMax (glyphosate); 3) RPM (Roundup PowerMax) at V2-V3 fb RPM at V4-V5; 4) Liberty at V2-V3 fb Liberty at V4-V5; 5) Halex GT (mesotrione + *S*-metolachlor + glyphosate) at 3.6 pt/A +AAtrex + COC at V3-V4; 6) Zidua SC (pyroxasulfone) At 3.3 fl oz/A + Armezon (topramezone) at 0.75 fl oz/A + RPM + COC at V3-V4; 7) Zidua SC +Sencor (metribuzin) at 3 oz/A + Armezon + RPM + COC at V3-V4; 8) Zidua SC + Sencor + Armezon + RPM + COC at V2-V3; 9) Zidua SC + Armezon + RPM + COC at V2-V3; 10) Sencor + Armezon + RPM + COC at V3-V4; 11) Sencor + Armezon + RPM + COC at V2-V3; 12) Dual II Magnum (*S*-metolachlor) at 1.3 pt/A + AAtrex at 1 qt/A PRE fb AAtrex + COC at V3-V4; 13) Capreno (thiencarbazone-methyl + tembotrione) at 3 fl oz/A + RPM + AAtrex + Ammonium sulfate (AMS) at 2.5% (v/v); 14) Armezon at 0.57 fl oz/A + Status (diflufenzopyr + dicamba) at 3 oz/A + RPM + AAtrex + AMS at V2-V3; 15) Verdict (saflufenacil + dimethenamid) at 10 fl oz/A + Zidua SC + AAtrex at 2 qt/A PRE; 16) Acuron (*S*-metolachlor + atrazine + mesotrione + bicyclopyrone) at 80 fl oz/A PRE; 17) Resicore (acetochlor + mesotrione + clopyralid) at 2.25 qt/A PRE fb Durango DMA (glyphosate) at 32 fl oz/A + AAtrex at 1 qt/A at V2-V3; and 18) nontreated check. RPM rate was 32 fl oz/A except for treatment 2 and 3 (22 fl oz/A).

Corn Injury level was 4 to 5% for V2-V3 and 10 to 15% for V3-V4 for Sencor (tank-mix combinations) 1 wk after application (WAA), but there was no corn injury by 7 WAA. All treatments provided 94 to 100% control of prickly sida and hemp sesbania. Palmer amaranth and pitted morningglory control were 96 and 100, 91 and 95, 18 and 94, 90 and 89, 91 and 94, 83 and 84, 96 and 95, 90 and 86, 99 and 81, 96 and 88, 93 and 78, 89 and 80, 98 and 95, 91, and 90, 96 and 90, 93 and 85, 95 and 98% at 7 WAA, respectively. Barnyardgrass and broadleaf signalgrass control were 84 and 76, 93 and 88, 93 and 88, 89 and 80, 98 and 93, 93 and 92, 96 and 91, 91 and 88, 93 and 91, 90 and 79, 86 and 76, 94 and 89, 90 and 88, 88 and 84, 91 and 86, 95 and 93, 91 and 85% at 7 WAA, respectively. Corn yield was 132, 121, 169, 172, 177, 253, 174, 169, 192, 136, 146, 179, 207, 174, 177, 176, and 197 bu/A for plots received the application of treatment 1 through 17, respectively. Weed interference reduced corn yield 75% as compared to the treatment with the highest yield (trt. 6). In conclusion, plots that received the tank-mix

combinations of Sencor provided comparable corn yield as standard treatments (trt. 5 and 13). Therefore, Sencor could be used in weed management programs in Mississippi corn.

EFFICACY OF QUIZALOFOP MIXTURES WITH AUXINIC HEBICIDES. T.L. Sanders*[1], H.M. Edwards[2], B. Lawrence[2], J.D. Peeples Jr.[3], N.G. Corban[2], B.R. Golden[4], J.A. Bond[4]; [1]Mississippi State University: Delta Research & Extension Center, Stoneville, MS, [2]Mississippi State University, Stoneville, MS, [3]Delta Research and Extension Center, Stoneville,, MS, [4]Delta Research and Extension Center, Stoneville, MS (213)

ABSTRACT

The spread of herbicide-resistant weeds across the midsouthern U.S. led to increasing demand for new weed control technologies in rice-producing areas. Provisia™, with enhanced resistance to herbicides that inhibit acetyl coA carboxylase (ACCase), rice technology allows for POST applications of quizalofop, an ACCase-inhibiting herbicide. Quizalofop was first registered for use in soybean [*Glycine max* (L.) Merr] in the late-1980s followed by registration on cotton [*Gossypium hirisutum* (L.)] in the early-1990's. Quizalofop controls annual and perennial grasses but does not control sedges or broadleaf weeds. Research was conducted to evaluate the efficacy of quizalofop applied alone and in mixtures with auxinic herbicides on grass and broadleaf weed species.

Concurrent field studies established at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, in 2017 to 2018 determine the efficacy of quizalofop-based herbicide mixtures grass or broadleaf weeds common in Mississippi rice production. Treatments were arranged as a two-factor factorial within a randomized complete block design and four replications. Factor A was application timing and consisted of treatments applied to rice in the one- to two-leaf (EPOST) growth stage and to rice in the four-leaf to one-tiller (LPOST) growth stage. Factor B was auxinic herbicide treatment and consisted of no auxinic herbicide, florpyrauxifen-benzyl at 29 g ai ha^{-1}, quinclorac at 420 g ai ha^{-1}, triclopyr at 235 g ai ha^{-1}, penoxsulam plus triclopyr at 67.5 plus 402.5 g ai ha^{-1}, and orthosulfamuron plus quinclorac at 52 plus 315 g ai ha^{-1}. Quizalofop at 119 g ai ha^{-1} was applied at both EPOST and LPOST timings. A nontreated control was included for comparison. All treatments contained crop oil concentrate at 1% v/v. Visual estimates of aboveground rice injury and grass and broadleaf weed control were recorded at time of LPOST application and 14, 28, 42, and 56 d after LPOST (DA-LPOST). Rice heights and density were recorded 14 DA-LPOST and at maturity, and rough rice yield was collected at maturity. All data were subjected to ANOVA with means separated with estimates of the least square means at P=0.05.

No differences in rice injury or control of volunteer rice (CL 151 and Rex) were detected 14 and 28 DA-LPOST. Barnyardgrass control 14 and 28 DA-LPOST with quizalofop applied alone or with auxinic herbicides EPOST was ≥ 93% for all auxinic herbicide treatments except penoxsulam plus triclopyr. Barnyardgrass control was ≥ 96% with quizalofop applied alone and with auxinic herbicides LPOST. Rough rice yield was similar following quizalofop applied alone and in mixtures with auxinic herbicides except penoxsulam plus triclopyr EPOST and orthosulfamuron plus quinclorac LPOST.

Quizalofop plus florpyrauxifen-benzyl controlled more Palmer amaranth 14 DA-LPOST than other mixtures with auxinic herbicides, and control with this treatment was greater EPOST

compared with LPOST. Hemp sesbania control 14 DA-LPOST was ≤ 90% with quizalofop plus quinclorac and orthosulfamuron plus quinclorac LPOST and triclopyr EPOST or LPOST. All mixtures controlled ivyleaf morningglory ≥ 91% 14 DA-LPOST except quinclorac and orthosulfamuron plus quinclorac LPOST. Florpyrauxifen-benzyl or triclopyr were required for volunteer soybean control > 63% 14 DA-LPOST.

To optimize barnyardgrass control and rice yield, penoxsulam plus triclopyr and orthosulfamuron plus quinclorac should not be mixed with quizalofop. Differences in control among auxinic herbicide mixtures with quizalofop varied by treatment; however, control of all four species was optimized following quizalofop plus florpyrauxifen-benzyl. Rice was tolerant to quizalofop plus the auxinic herbicides evaluated. Quizalofop mixtures with auxinic herbicides are safe and effective for grass and broadleaf weed control, and choice of mixture could be adjusted based on weed spectrum.

RICE RESPONSE TO COMMON PREPLANT HERBICIDES. B. Lawrence*[1], J.A. Bond[2], H.M. Edwards[1], B.R. Golden[2], T.L. Sanders[3], N.G. Corban[1], J.D. Peeples Jr.[4]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University: Delta Research & Extension Center, Stoneville, MS, [4]Delta Research and Extension Center, Stoneville,, MS (214)

ABSTRACT

Glyphosate-resistant (GR) Palmer amaranth is the most troublesome weeds in corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), and soybean [*Glycine max* (L.) Merr] in Mississippi. Gramoxone SL applied prior to planting in mixture with residual herbicides representing multiple MOA is a foundation treatment for GR Palmer amaranth control in Mississippi. Rice is often grown in proximity to corn, cotton, and soybean. Consequently, in recent years, incidents of off-target Gramoxone SL movement to rice fields from neighboring corn, cotton, and soybean fields have increased. Extent of rice injury following exposure to off-target Gramoxone SL movement is difficult to verify due to inclusion of multiple herbicide MOA in Gramoxone SL applications. Therefore, research was conducted to evaluate which rice growth stages are most susceptible to a sub-lethal rate of Gramoxone SL and how rice responds to Gramoxone SL applied in mixture with common residual herbicides utilized for corn, cotton, and soybean.

Two studies were conducted from 2015 to 2018 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to characterize rice performance following exposure to a sub-lethal rate of Gramoxone SL at different growth stages and to characterize rice response to sub-lethal rates of Gramoxone SL in combination with common residual herbicides. Experimental design for both studies was a randomized complete block with four replications. In the Timing Study, Gramoxone SL was applied at 0.075 lb ai A^{-1} at the spiking to one-leaf (VEPOST), two- to three-leaf (EPOST), three- to four-leaf (MPOST), 7 d postflood (7 d PTFLD), and panicle differentiation (PD) rice stages. In the Herbicide Mixture Study, herbicide treatments were Gramoxone SL applied alone and in mixture with Authority MTZ, Boundary, Canopy, Corvus, Cotoran, Envive, Fierce, Lexar EZ, Prefix, or Sonic. Herbicides in both studies were applied at 10% of the rates recommended for application in Mississippi. Treatments in the Herbicide Mixture Study were applied EPOST. A nontreated control was included for comparison in both studies. Visual estimates of rice injury were recorded 14 and 28 d after treatment (DAT). The number of days to 50% heading was recorded as an indication of rice maturity and converted to d delay in rice maturity compared to the nontreated. Rough rice yields were collected at maturity. Seed germination percentage was determined in the Timing Study based on number of germinated seed out 100 seed after 48 h exposure to 14 h photoperiod at 95 F. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with $\alpha = 0.05$.

Injury 14 DAT was least following Gramoxone SL applied VEPOST and PD; however, by 28 DAT, injury was greatest following MPOST and comparable to that from EPOST and 7 d PTFLD treatments. Regardless of growth stage at time of exposure, injury to rice from Gramoxone SL was ≥38 % 28 DAT. Rice yields following exposure to Gramoxone SL applied

VEPOST were comparable to the nontreated, but maturity was delayed 6 d. However, Gramoxone SL applied during early reproductive growth stages delayed maturity ≥14 d, reduced yield to 13 bu/A, and reduced germination to 80%.

Regardless of residual herbicide treatment, rice injury was ≥50% 28 DAT and delays in rice maturity were ≥9 d. Rough rice yield was ≤125 bu/A regardless of herbicide application compared to 160 bu A where no herbicide treatment was applied. Lexar EZ reduced rough rice yields to 99 bu/A; however, this treatment was comparable to Authority MTZ, Boundary, Corvus, Cotoran, and Canopy.

These data indicate that delays in rice maturity following exposure to Gramoxone SL increased as application timings were delayed. Rice yield was negatively affected following exposure to Gramoxone SL applied any time after VEPOST. However, applications of Gramoxone SL to rice in early reproductive growth reduced rough rice yield 61% and reduced seed germination 14%. Early-season injury to rice following exposure to Gramoxone SL had less effect on rice yield compared with injury occurring at later developmental stages. However, harvest efficiency could be affected regardless of growth stage at which exposure occurred. Additionally, fields devoted to seed rice production are at risk for reduced seed germination if exposed to a sub-lethal paraquat rate during early reproductive growth stages. Regardless of residual herbicide in mixture with paraquat, injury to rice was ≥50%, delayed maturity ≥9 d, and yield reduced ≥21%. Rice exposure to Gramoxone SL negatively affected rice growth and development regardless of timing of exposure or mixture; therefore, caution should be exercised when applying Gramoxone SL in proximity to emerged rice.

GRAMOXONE MAGNUM: A NEW OPTION FOR BURNDOWN AND RESIDUAL WEED CONTROL.

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ABSTRACT

Gramoxone Magnum herbicide is a new product for burndown and residual control of grass and broadleaf weeds in corn, legume vegetables, sorghum, soybeans, and sunflower. Gramoxone Magnum is a combination of paraquat (Group 22) and s-metolachlor (Group 15). Upon EPA approval, it will provide two alternative sites of action to glyphosate (Group 9) and has tank mix flexibility for multiple cropping systems.

PERMEATE: A NEW NPE-FREE NONIONIC SURFACTANT. J.A. Gillilan[1], R.J. Edwards*[2], T.A. Hayden[3], L.C. Magidow[4], A.D. Makepeace[4], J.V. Gednalske[4]; [1]Winfield United, Springfield, TN, [2]WinField Solutions, River Falls, WI, [3]Winfield United, Owensboro, KY, [4]Winfield United, River Falls, WI (216)

ABSTRACT

Introducing Permeate™ (NPE free surfactant-based adjuvant) from Winfield® United. Permeate™ adjuvant is a next generation non-ionic surfactant that will help optimize application coverage. Permeate™ has been shown maximizes pesticide performance by improving droplet spreading through decreased contact angles with minimal expected crop injury. Permeate™ also provides patented UV protection, which protects herbicides, insecticides and fungicides from photo degradation. Permeate™ can be applied whenever a pesticide label allows for the addition of a non-ionic surfactant.

NOZZLE TYPE AND TIME OF APPLICATION EFFECTS ON WEED CONTROL IN MISSISSIPPI COTTON. J. Ferguson*[1], P.H. Urach Ferreira[1], M.T. Wesley Jr.[2], L.H. Merritt[1], Z.R. Treadway[1], K.L. Broster[3], N. Fleitz[4]; [1]Mississippi State University, Mississippi State, MS, [2]MIssissippi State University, Mississippi State, MS, [3]Mississippi State University, Starkville, MS, [4]Pentair-Hypro, New Brighton, MN (217)

ABSTRACT

A field study was conducted at the Blackbelt Research Station in Brooksville, MS to understand the effect of nozzle type and herbicide application timing on weed control in cotton. The study also compared applications made with an eight nozzle tractor sprayer compared to a four nozzle backpack sprayer. For the tractor study, five nozzle types: Ultra-Low Drift (ULD) 12004, Guardian Air (GA) 11004, Guardian Air Twin (GAT) 11004, 3D 10004, and High Flow (HF) 14008 were compared. For the backpack study, four nozzle types: Ultra-Low Drift (ULD) 12002, Guardian Air (GA) 11002, Guardian Air Twin (GAT) 11002, 3D 10002 were assessed. Applications were made at 140 L ha^{-1} (15 gal ac^{-1}). Spray pressure for the 04 nozzles was 276 kPa (40 psi) and 138 kPa (20 psi) for the HF 08 nozzle. Herbicide applications were made at four different timings: preemergence (PRE), early post (EPost), early-mid post (EMpost), and late post (LPost) corresponding to the preemergent, 2-3 leaf, 5-6 leaf, and match head square stages respectively. Programs selected were: PRE fb EPost fb LPost; EM Post only; EPost fb LPost. Treatments included a standard herbicide treatment applied at each growth stage, with the nozzle type as the variable by each timing. Results showed no difference between sprayer type or nozzle type for weed control, where all programs resulted in control at or above 90%. For yield results, neither nozzle type nor sprayer type was significant so data were pooled across those factors. Yield results showed that the EMpost program resulted in the best yield (2600 lbs seed cotton / acre) compared to the other two programs respectively (2312 and 2340 lbs seed cotton / acre). The results are less indicative of pursuing a one-time application only, but rather reflects a need to further examine glufosinate tolerance among cotton varieties. Given that weed control results were all optimal, the difference in yield appears to be more a factor of cotton sensitivity to a late season glufosinate application than due to yield loss from weed control. The study is to be replicated in 2019, which should provide greater information to better understand results from the 2018 data.

EVALUATION OF BENZOBICYCLON-CONTAINING PROGRAMS FOR WEEDY RICE CONTROL IN PROVISIA RICE. J.A. Patterson*, J.K. Norsworthy, Z.D. Lancaster, J.T. Richburg, M.C. Castner; University of Arkansas, Fayetteville, AR (218)

ABSTRACT

Weedy rice (*Oryza sativa*) is particularly difficult to control in rice cropping systems due to its highly competitive nature and the large risk for evolution of resistance to herbicides. With further developing herbicide resistance, the need for new modes of action (MOA) in rice production is imperative. Gowan Company is currently pursuing registration of benzobicyclon, a Group 27 (HPPD) herbicide, as a post-flood option in rice. It will be the first HPPD herbicide commercially available in U.S. rice production. In 2018, a field research trial was conducted at the Pine Tree Research Station near Colt, AR. The trial was implemented as a randomized complete block design with four replications. The objective of the trial was to evaluate benzobicyclon-containing weedy rice control programs, most of which contain Provisia™, in Midsouth rice compared to currently used programs. The herbicides used in the trial included Prowl H20 (pendimethalin), Bolero (thiobencarb), Warrant (acetochlor), pethoxamid, Provisia (quizalofop), and Rogue (benzobicyclon). The herbicides were applied in various combinations and timings, except all benzobicyclon applications were made post-flood. At two weeks after the post-flood application, >80% weedy rice control was observed for treatments sprayed at the 4-leaf stage with Provisia followed by a post-flood application of benzobicyclon. At four weeks after the post-flood application, the same treatment improved to >90% weedy rice control. No more than 9% injury was observed from treatments containing Provisia followed by benzobicyclon, and yield from these treatments were 3645 Kg/ha^{-1} higher than treatments containing Provisia followed by Provisia. All other evaluated treatments severely injured rice or were noneffective. Therefore, the use of benzobicyclon in Provisia rice systems could be a viable rice weed control option moving forward but additional years of research are needed to validate this conclusion.

TAKING EFFECTIVE SCIENTIFIC PHOTOGRAPHS AND ANALYZING DIGITAL IMAGES AND VIDEOS IN WEED SCIENCE RESEARCH. S. Askew*; Virginia Tech, Blacksburg, VA (219)

ABSTRACT

When using photographs to produce scientific data, poor image quality results in experimental error. Problems associated with exposure, depth of field, shake or vibration, and subject isolation are the most common errors that curtail image quality. Controlling the scene by using midtone backgrounds instead of white or black or adjusting on-camera settings for exposure compensation will solve most exposure-related problems. If the scene's dynamic range exceeds the camera's capabilities, using automatic exposure bracketing and high dynamic range image merging software will be needed. Increased depth of field can be achieved by setting the camera to aperture mode and choosing a larger F ratio, such as F11 to F32. For macro photography, focus stacking is a new technology that allows the photographer to take several images at different focus depths and merge them through post-image processing software. Camera shake can be reduced by mounting the camera on a tripod or light box, setting the mirror-lock function, and taking images with a wired or wireless remote. Where possible, scientific photographers should look for ways to control the scene by isolating the subject. Backdrops of uniform color that are nonreflective are one approach and using a small F ratio and orienting the subject at distance from any background elements is another. The most common data collected from images in weed science is cover associated with pixels that meet a range of hue and saturation values. To do this, the user will iteratively adjust hue and saturation range levels until the selection of pixels is visually-estimated to match expected outcomes (e.g., all green leaves are selected but other objects are not). Once the hue and saturation range is set for preliminary test images, this range is used to select pixels of all images for all experimental units. The ratio of selected pixels to the total number of pixels in the area of interest is then used to estimate cover. Video tracking software enables scientist to identify objects in a video stream of images and determine the coordinates of the object as it moves. These data are then graphically illustrated or tabulated for further statistical analysis. In addition to reducing errors associate with photography discussed above, the scientist must also be concerned about the perspective of the video camera to the direction of the moving object. Any vertical or horizontal trends associated with camera perspective can be removed by regression techniques.

IMAGE-BASED DETECTION OF PLASTICULTURE ROW-MIDDLE VEGETATION USING A CONVOLUTIONAL NEURAL NETWORK. S.M. Sharpe*[1], A.W. Schumann[2], J.J. Yu[3], N. Boyd[1]; [1]University of Florida, Wimauma, FL, [2]University of Florida, Lake Alfred, FL, [3]University of Florida, Riverview, FL (220)

ABSTRACT

Herbicides are the primary means to control weeds between the rows in Florida vegetable plasticulture production. Due to the patchy nature of weeds, it may not be necessary to broadcast apply postemergence herbicides. Developing smart sprayers to apply herbicides only to where weeds occur may reduce input costs. The study objective was to test the latest implementation of the object detection convolutional neural network You Only Look Once 3 (YOLOV3) to detect both the presence of any vegetation as a single class, and to discriminate between three classes of vegetation commonly encountered in Florida vegetable row middles. The three classes of vegetation were broadleaves, grasses, and sedges. The 3-class network (Fscore = 0.95) capability for detecting plants exceeded the 1-class network (Fscore=0.93). It appeared that any benefit from increased sample size by pooling classes vegetation into a single class was negated by the associated increased variability. The individual Fscores for the 3-class model were 0.96, 0.96, and 0.93 for sedges, grasses, and broadleaves, respectively. For all three classes, recall was the limiting factor, reducing Fscores. For the extent to which plants were detected (broadleaves and grasses), the 3-class network (Fscore = 0.93) exceeded that of the 1-class network (Fscore = 0.79). The 1-class network limitation was detection of grass weeds (recall = 0.59). YOLOV3 appears a feasible option for incorporation into smart spraying applications within row middles for Florida vegetable production.

WHAT'S NEW FROM SYNGENTA: NEW PRODUCT INTRODUCTIONS AND CURRENT PRODUCT UPDATES. D. Black*; Syngenta Crop Protection, Searcy, AR (221)

ABSTRACT

Tavium® Plus VaporGrip® Technology herbicide is a premix of *S*-metolachlor, dicamba, and VaporGrip Technology® that is under regulatory review for registration by the U.S. Environmental Protection Agency (EPA). Upon EPA approval, it will control key broadleaf weeds and grasses in Roundup Ready 2 Xtend® Soybeans or Bollgard II® XtendFlex® Cotton.

Gramoxone Magnum™ is a premix of paraquat and *S*-metolahclor also under regulatory review awaiting EPA approval. Upon registration, Gramoxone Magnum™ will provide fast, reliable control of emerged weeds and residual control of broadleaf weeds and grasses. It is expected to be registered for use in corn, cotton, legume vegetables, sorghum, soybean, sunflower, and post-harvest weed management.

Axial® Bold is a new cereals herbicide from Syngenta that contains the active ingredients pinoxaden and fenoxaprop. This combination delivers improved consistency and broad-spectrum post-emergence control of troublesome grasses such as wild oat, foxtail species, Italian ryegrass, and barnyardgrass. Enhanced flexibility makes it a convenient tank mix partner with broadleaf herbicides like Talinor® for broad-spectrum control of both grasses and broadleaf weeds.

Tavium® Plus VaporGrip® Technology and Gramoxone Magnum™ are not yet registered for sale or use in the United States and are not being offered for sale. Upon registration, Tavium and Gramoxone Magnum will be Restricted Use Pesticides. Gramoxone SL and Gramoxone SL 2.0 are Restricted Use Pesticides.

INTRODUCING PROVISTA ST. AUGUSTINE GRASS, THE NEXT GENERATION OF SUSTAINABLE LAWN GRASSES. S. Kelly*[1], C.A. Yurisic[1], L. Freshour[2], M. Koch[2], C. Baldwin[2], R.D. Baker[2]; [1]The Scotts Company, Apopka, FL, [2]The Scotts Company, Marysville, OH (222)

ABSTRACT

The Scotts Company has developed a novel line of St. Augustinegrass (*Stenotaphrum secondatum*) that addresses two of the most troublesome management issues facing landscape managers: frequent mowing and lack of weed control options. This novel grass has been modified so that mowing is reduced as much as 50% and is tolerant to glyphosate. Both internal and external trials have demonstrated glyphosate tolerance up to 6 lb ae/A with no visible injury other than slight stunting. Mowing studies have shown 35% and greater reduction in mowing compared to 'Floratam', the predominant variety in Florida landscapes. Shade studies indicate that these transformed events are more tolerant to reduced light conditions than 'Floratam' and better than or equal to 'Palmetto' and 'Seville'. These events are also equally tolerant to commonly used herbicides such as Avenue South, Manor, Manage, Celsius, Asulam, atrazine, and Basagran. Given the issue of glyphosate resistance that is prevalent in both production agriculture and turf situations, we recommend that landscape managers and sod producers continue to use conventional herbicide programs in conjunction with glyphosate applications for difficult-to-control weeds to minimize development of additional glyphosate resistant weed species. Removal or control of unwanted ProVista St. Augustinegrass can be achieved with applications of Finale (6 qt/A) or Finale + Fusilade (6 qt + 24 oz/A +0.25% NIS). The development of ProVista St. Augustinegrasses will be a benefit to the turf industry in the form of reduced labor and fuel, and more efficient weed control and improved sod production. ProVista will allow sod producers an opportunity to control or manage weeds such as tropical signalgrass (*Urochloa subquadripara*), annual grass escapes, bermudagrass (*Cynodon dactylon*) and torpedograss (*Panicum repens*), leading to higher yields and cleaner sod for the end user.

PALMER AMARANTH (AMARANTHUS PALMERI) CONTROL USING VARIOUS DROPLET SIZES OF ACIFLUORFEN AND LACTOFEN. L.X. Franca*[1], D. Dodds[1], C. Samples[1], G. Kruger[2], T.R. Butts[2]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska-Lincoln, North Platte, NE (223)

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 of Palmer amaranth populations resistant to PPO-inhibiting herbicides across the Midwestern and Southern United States. Palmer amaranth populations resistant to PPO-inhibiting herbicides have been reported in Arkansas, Tennessee, Illinois, and Mississippi. Therefore, efficacious and cost effective means of application are needed to maximize lactofen and acifluorfen effectiveness.

Experiments were conducted in 2016, 2017, and 2018 across three locations in Mississippi and Nebraska to evaluate the influence of droplet size on lactofen and acifluorfen effectiveness for Palmer amaranth control. Lactofen (Cobra®, Valent U.S.A., Walnut Creek, CA 94596-8025) was applied at 0.21 kg ai ha^{-1} + crop oil concentrate (Agri-Dex®, Helena Chemical Company, Collierville, TN 38017) at 1% v/v and acifluorfen (Ultra Blazer®, United Phosphorus Inc., King of Prussia, PA 19406) at 0.42 kg ai ha^{-1} + crop oil concentrate (Agri-Dex®, Helena Chemical Company, Collierville, TN 38017) at 1% v/v using the following droplet sizes: 150, 300, 450, 600, 750, 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 15 cm Palmer amaranth using a tractor mounted sprayer equipped with a CAPSTAN® AG Pulse Modulated Sprayer (Capstan Ag Systems, Inc., Topeka, KS) and Wilger Precision Spray Technology Tips (Wilger Inc., Lexington, TN 38351-6538) at 4.8 km per hour using a spray volume of 140 L ha^{-1}. Visual Palmer amaranth control was evaluated at 7, 14, 21, and 28 days after application. Ten plants per plot were tagged prior initiation of the experiment and used for dry biomass determination at the end of the experiment. Data were subjected to analysis of variance using PROC MIXED procedure in SAS® v. 9.4 (SAS Institute Inc., Cary, NC 27513-2414) and means were separated using Fischer's Protected LSD at α=0.05. In addition, a generalized additive modelling (GAM) analysis was conducted for optimal droplet size determination to maximize herbicide efficacy and mitigate spray drift.

Palmer amaranth control did not differ with respect to droplet size using lactofen, regardless of rating period. Acifluorfen applied using 300 µm droplets resulted in the greatest Palmer amaranth control, regardless of rating period. Lactofen applied at all droplet sizes resulted in significant dry biomass reduction. Additionally, GAM analysis suggests that the greatest control level using acifluorfen could be achieved with 250 µm droplets, and droplets ranging from 180 µm to 310 µm could be used to maintain 90% level of maximum weed control.

INTERSPECIFIC AND INTRASPECIFIC INTERFERENCE OF PALMER AMARANTH (AMARANTHUS PALMERI) AND LARGE CRABGRASS (DIGITARIA SANGUINALIS) IN SWEETPOTATO. N.T. Basinger*[1], K.M. Jennings[2], D. Monks[2], D. Jordan[2], W. Everman[2], E.L. Hestir[3], M.D. Waldschmidt[2], S.C. Smith[2], C. Brownie[2]; [1]The University of Georgia, Athens, GA, [2]North Carolina State University, Raleigh, NC, [3]Universirty of California, Merced, Merced, CA (224)

ABSTRACT

Field studies were conducted in 2016 and 2017 in Clinton, NC to determine the interspecific and intraspecific interference of Palmer amaranth (*Amaranthus palmeri* S. Wats.) or large crabgrass [*Digitaria sanguinalis* (L.) Scop.] in 'Covington' sweetpotato. Palmer amaranth and large crabgrass were established 1 d after sweetpotato transplanting and maintained season-long at 0, 1, 2, 4, 8 and 0, 1, 2, 4, 16 plants m^{-1} of row, respectively in the presence and absence of sweetpotato. Predicted yield loss for sweetpotato was 35 to 76% for large crabgrass at 1 to 16 plants m^{-1} of row and 50 to 79% for Palmer amaranth at 1 to 8 plants m^{-1} of row. Weed dry biomass m^{-1} row increased linearly with increasing weed density. Individual dry biomass of Palmer amaranth and large crabgrass decreased, although minimally, as weed density increased when grown in the presence of sweetpotato. When grown without sweetpotato individual weed dry biomass decreased linearly from 1 to 4 plants and 1 to 3 plants m^{-1} row for Palmer amaranth and large crabgrass, respectively. Individual weed dry biomass was not affected above 3 and 4 plants m^{-1} row to the highest density of 8 and 16 plants m^{-1} row for Palmer amaranth and large crabgrass, respectively.

CUCURBIT RESPONSE TO RESIDUAL GLYPHOSATE ACTIVITY FROM A PREPLANT APPLICATION. K.J. Goodman*[1], T.M. Randell[1], L.C. Hand[1], J.C. Vance[1], A.S. Culpepper[2]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Tifton, GA (225)

ABSTRACT

Glyphosate is one of the most important weed management tools available for a produce grower helping to ensure weeds are not present at planting. Glyphosate labels suggest the herbicide provides no residual soil activity thereby eliminating plant back or rotational concerns. Although glyphosate is marginally effective in controlling nutsedge (the most problematic weed), labels do suggest a glyphosate use rate of 2.2 lb ae/A with sequential applications can be effective.

Three experiments were conducted to determine the impact of glyphosate applied prior to transplanting watermelon, cucumber, or squash. In each experiment, common cultivars were transplanted into bareground production after applying glyphosate. Each crop was grown following standard production practices with each treatment replicated four times. Soils were over 90% sand with less than 0.5% organic matter.

Seedless Watermelon: During the spring of 2018, glyphosate at 0 or 2.2 lb/A was applied 1 d prior to planting with herbicide treatments either receiving no irrigation or 0.5 inch of irrigation after spraying but before planting. Maximum watermelon injury was 5% with irrigation and 30% without irrigation, respectively. Glyphosate preplant without irrigation reduced runner lengths 27% at 41 DAT, preharvest plant biomass 56%, and pounds of fruit harvested 25% when compared to no glyphosate. The addition of irrigation was beneficial but glyphosate still reduced runner lengths by 12 % and pounds of fruit harvested 16%.

Cucumber: An experiment with a factorial treatment design of glyphosate rate (1.1, 2.2, or 3.3 lb ae/A) and interval between planting (7, 4, or 1 d) plus a non-treated control was conducted during the spring and fall of 2018. Pooled over locations, maximum injury ranged from 5 to 8, 14 to 31, and 27 to 52% with 1.1, 2.2 or 3.3 lb/A, respectively, with higher injury levels noted with applications closer to planting. At 32 DAT, glyphosate at 1.1 lb/A applied 7, 4, or 1 d preplant were the only treatments not reducing runner length compared to the control. Preharvest plant biomass noted values similar to the control with only 1.1 lb/A applied 7 d preplant. After harvesting 11 to 13 times, pounds of marketable fruit were reduced by all glyphosate applications except for 1.1 lb/A applied 7, 4, or 1 d preplant and with 2.2 lb/A applied 7 d preplant.

Squash: The experimental design was identical to that for cucumber with a single location conducted in the fall of 2018. Maximum injury ranged from 0 to 13, 3 to 22, and 13 to 48% with glyphosate at 1.1, 2.2 or 3.3 lb/A, respectively, with higher injury levels noted with applications closer to planting. Glyphosate reduced plant heights (25 DAT), preharvest biomass, and pounds of marketable fruit (16 harvests) except when glyphosate was applied at 1.1 lb/A at 7 or 4 d prior to planting.

EVALUATING PUMPKIN TOLERANCE TO ACETOCHLOR. J.H. Ferebee*[1], C.W. Cahoon[1], T. Besancon[2], H.B. Blake[1], T.H. Hines[1]; [1]Virginia Tech, Painter, VA, [2]Rutgers University, Chatsworth, NJ (226)

ABSTRACT

Direct-seeded pumpkin production places greater dependence on residual weed control than when the crop is grown in a plasticulture system. Preemergence herbicides are routinely used to control troublesome weeds in pumpkin production. Fluridone and acetochlor, group 12 and 15 herbicides, respectively, provide broad spectrum weed control when applied preemergence. Field research was conducted in Virginia and New Jersey to evaluate pumpkin tolerance and weed control to preemergence herbicides. Pumpkin were planted into conventionally prepared soil and treatments were applied immediately after planting using a CO_2-pressurized backpack sprayer. Treatments consisted of fomesafen at 210, fomesafen at 280, ethalfluralin at 631, clomazone at 289, halosulfuron at 39, fluridone at 168, *S*-metolachlor at 1068, acetochlor emulsifiable concentrate (EC) at 1264, and acetochlor microencapsulated (ME) at 1262 g ai ha^{-1}. A nontreated check was included for comparison. Pumpkin stand was collected 14 days after planting (DAP). Visual estimates of pumpkin tolerance and weed control were collected 14, 28, 42, and 56 DAP. Pumpkins were harvested and weighed at the end of the season to determine total fruit number and yield. A separate study specifically evaluated fluridone applied preemergence at 42, 84, 126, 168, 252, 336, and 672 g ai ha^{-1}. Fluridone, acetochlor EC, acetochlor ME, and halosulfuron injured pumpkin 81, 39, 34, and 35% 14 DAP when 0.7 and 2.6 cm of rain fell 2 and 3 DAP compared to 40, 8, 19, and 33% when 1.5 cm of rain fell 4 DAP. Fluridone controlled ivyleaf morningglory and common ragweed 91 and 100% 28 DAP, respectively. Acetochlor EC controlled redroot pigweed 100%. Pumpkin treated with *S*-metolachlor yielded the greatest (10764 fruit ha^{-1}) despite broadcasting over the planted row; labeling requires a directed application to row-middles. Fluridone resulted in pumpkin injury >95% at rates 168 g ai ha^{-1} and greater; significant yield loss were noted when the herbicide was applied at rates greater than 42 g ai ha^{-1}. This research demonstrated that fluridone and acetochlor formulations are unacceptable candidates for pumpkin production.

EVALUATION OF CHELATED FE AND PLANT HORMONES AS HERBICIDE SAFENERS IN SWEETPOTATO. M.A. Cutulle*[1], H.T. Campbell[1], P.A. Wadl[2], D. Jeffris[1]; [1]Clemson University, Charleston, SC, [2]USDA-ARS, Charleston, SC (227)

ABSTRACT

Weed control is challenging in sweetpotato production, as there are limited herbicide available for use in the crop. Safening a herbicide that controls nutsedge in sweetpotato would be beneficial for the industry. Research was conducted to evaluate the effect of chelated Fe, melatonin, and a brassinosteroid (Vitazym) product on safening bentazon in sweetpotato. Greenhouse studies were conducted to evaluate the impact of bentazon (0, 1000 or 2000 g ai/ha), potential safener treatments (Vitazyme, melatonin, or chelated Fe) on multiple sweetpotato varieties. There was a variable response of 15 Sweetpotato varieties to chelated Fe. Experimental line USDA 06-001 was the most tolerant to bentazon without chelated Fe with only 7% injury at a 2X field rate. All the other varieties were injured greater than 10% when bentazon was applied without chealted Fe. When chelated Fe was mixed with the 2X rate of bentazon 5 varieties had injury ratings of 10% or less 7 days after treatment. Vitazyme significantly reduced bentazon injury in both Covington and Bayou Belle varieties. Injury in Covington was reduced from about 20% injury to 10% when vitazyme was tank mixed with bentazon while injury in Bayou Belle was reduced from 12% to 2.5% when vitazyme was mixed with bentazon. Preliminary studies showed that melatonin did not appear to safen bentazon in sweetpotato.

EFFECTS OF LOW-DOSE APPLICATIONS OF 2,4-D AND DICAMBA ON CUCUMBER AND CANTALOUPE. L.C. Hand*[1], A.S. Culpepper[2], T. Gray[3], J. Shugart[3]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Tifton, GA, [3]Georgia Department of Agriculture, Atlanta, GA (228)

ABSTRACT

Crops engineered with resistance to 2,4-D or dicamba have been commercialized to combat problematic weeds. Due to this, spatiotemporal use of these herbicides is increasing, leading to increased potential for off-target damage to sensitive crops. Two cucumber (2014, 2015) and two cantaloupe (2014, 2016) studies were conducted to describe how auxinic herbicide, herbicide rate, and application timing influenced cucumber and cantaloupe injury, yield, and herbicide residues in marketable fruit. An augmented factorial treatment design included 2 herbicides, 2 herbicides rates, 3 application timings, and a non-treated control. Herbicide rates of 1/75 and 1/250 field use for 2,4-D (1,120 g ai ha^{-1}) and dicamba (560 g ai ha^{-1}) were examined. For cucumber, application dates were 26, 16, and 7 DBH (days before harvest). For cantaloupe, application dates were 54, 31, and 18 DBH. Treatments were arranged in a RCBD and replicated four times. Generally, greater visual injury was observed with applications that occurred during earlier vegetative growth stages for both crops. For each herbicide, the 1/75 rate was more injurious than the 1/250 rate. For cucumber, dicamba was more injurious than 2,4-D during one of two years, while cantaloupe responded similarly to both herbicides. When pooled over herbicide, the 1/75 rate applied 26 DBH reduced cucumber fruit weight in both years by 15-22%. For cantaloupe when pooled over herbicides, the 1/75 rate applied 54 DBH reduced cantaloupe fruit weight by 16 and 30% in 2014 and 2016, respectively. A loss in yield of 18% was noted with a 31 DBH application with both herbicides in 2016, however this was only at the 1/75 rate. Yield loss was not influenced with any application made 18 DBH. Herbicide residues were detected in cucumber fruit that were treated with dicamba 7 DBH with both rates in both years (0.0073-0.0523 ppm). For cantaloupe in 2014, dicamba residues were detected in fruit that were treated with the 1/75 rate 31 and 18 DBH (0.015-0.0253 ppm). In 2016, herbicide residues were detected at both rates of 2,4-D (0.00025-0.004 ppm) and dicamba (0.00025-0.00825 ppm) applied 31 and 18 DBH. For both crops, no residues were detected in the nontreated control. Nor was dicamba detected in samples treated with 2,4-D and vice versa.

CROP TOLERANCE AND WEED CONTROL OF CLOMAZONE + ETHALFLURALIN POSTTRANSPLANT IN CUCURBIT CROPS. P.J. Dittmar*[1], A.S. Culpepper[2], R.B. Batts[3]; [1]University of Florida, Gainesville, FL, [2]University of Georgia, Tifton, GA, [3]NCSU IR-4 Field Research Center, Raleigh, NC (229)

ABSTRACT

Clomazone + ethalfluralin preplant is a common practice in transplanted cucurbit crops. The objective was evaluate cucurbit crop tolerance and weed control of clomazone + ethalfluralin applied posttransplant. Research was conducted at the Plant Science Research Education Unit in Citra, FL. The crops included were muskmelon 'Athena', cucumber 'Dasher II" and squash 'Lioness'. The crops were transplanted into bareground raised bed with drip irrigation buried 1 in. deep in the center of the bed. Herbicide treatments included clomazone + ethalfluralin at 0.2 + 0.6, 0.3 + 1, 0.6 + 2.0 lb./A applied at 1 or 5 day after transplant. Also, included were clomazone + ethalfluralin at 0.2 + 0.6 lb./A preplant and a nontreated. Weed control was similar across all crops and were combined. Grass control at 4 wk after planting (WAP) was similar among all herbicide treatments and was greater than 87%. Broadleaf weed control at 4 WAP was 35-42% for all herbicide treatments. Injury was different among the crops. Muskmelon was the most tolerant; at 2 WAP, POST and PRE treatments had similar crop injury (6-14%) and at 4 WAP the POST treatments had greater crop injury (8-10%) than the PRE and nontreated (2 and 0%, respectively). Cucumber had the greatest injury; at 2 WAP, the POST treatments had 47-62% and at 4 WAP the injury was 22-15%. At both rating dates in cucumber, the POST treatments were similar to the PRE treatment. Similar treatments were applied to squash in GA; the crop was irrigated with overhead irrigation had a greater amount of crop injury and death. Clomazone + ethalfluralin POST in muskmelon has excellent crop tolerance, but cucumber and squash may not be suitable. Further research is necessary to examine the impact of cultural practice on crop tolerance.

PUMPKIN VARIETY TOLERANCE TO FOMESAFEN. N.R. Burgos*[1], M. Machado Noguera[1], L. Benedetti[1], P.C. Lima[1], F.C. Caratti[2], S. Eaton[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Fayeteville, AR, [3]University of Arkansas, Fayetteville, Fayetteville, AR (230)

ABSTRACT

Pumpkin production is a significant specialty crops industry in the US. In 2017, 680 million kg of pumpkins were produced in the US. Weed control for pumpkin is a major constraint because it is a long-season crop for which there is no mechanical nor chemical tools for weed management after the crop starts to vine. The options for residual herbicides are few and the expense for handweeding is high. Pumpkins are sensitive to many residual herbicides. Special labels have been obtained for S-metolachlor and fomesafen in some states, but crop tolerance data are needed for the mid-south, i.e. Arkansas. An experiment was conducted at the Vegetable Research Station, Kibler, Arkansas to test the tolerance of five pumpkin varieties to preemergence application of S-metolachlor and fomesafen in comparison to the standard commercial herbicide, Strategy, which is a premix of ethalfuralin and clomazone. The varieties were Big Max, Connecticut Fields, Dickenson, Jarrahdale, and Jack-O-Lantern. Fomesafen was tested at 0.28 and 0.42 kg/ha, S-metolachlor at 1.02 kg/ha, a mixture of fomesafen (0.28kg) and S-metolachlor (1.02 kg), and the standard herbicide treatment at 0.125 kg clomazone + 0.45 kg ethalfluralin. The experimental units were arranged in a strip plot design with three replications. The pumpkins were direct-seeded on June 28 in 6.1-meter-long plots on 3.6-m centers. Seedlings were thinned to 6 per plot after stand counts were recorded. Supplemental hoeing was done to eliminate weed competition. The crop was managed according to commercial standard practices and harvested on October 4. The varieties responded differently to each herbicide. Big Max yield 1.62X more with fomesafen (0.28 kg/ha) than with Strategy; treatments with S-metolachlor were comparable to Strategy. Connecticut fields yielded about 0.40X to 0.70X times less with fomesafen or S-metolachlor than with Strategy, with the low rate of fomesafen producing equivalent yield to Strategy. The alternative herbicides, except fomesafen at 0.28 kg/ha, reduced the yield of Dickenson 20-40%. The yields of Jarrahdale and Jack-O-Lantern were similar between the fomesafen or S-metolachlor treatments and Strategy. Therefore, all varieties were tolerant to fomesafen at 0.25 kg/ha applied preemergence. Jarrahdale and Jack-O-Lantern are tolerant to S-metolachlor while the other varieties will incur some yield loss with this herbicide. We need more site-years to assemble a robust crop response database.

HYDROGELS AS HERBICIDE CARRIERS IN VEGETABLE PLASTICULTURE. R. Kanissery*[1], C. McAvoy[2]; [1]University of Florida - IFAS, Immokalee, FL, [2]University of Florida - SWFREC, Immokalee, FL (231)

ABSTRACT

Weed management is a fundamental step in the successful production of vegetable crops in Florida under commercial plasticulture production system. Herbicide applications under plastic mulch are severely limited due to the potential for crop phytotoxicity. Hence, a tremendous interest that has developed recently in adopting techniques that protect vegetable crops from herbicide injury while providing adequate weed control. One concept that has surfaced is the use of 'hydrogels,' also known as superabsorbent polymers, as slow release carriers for herbicide application. A study was conducted at the Southwest Florida Research and Education Center (SWFREC) in Immokalee, to evaluate the improvement in efficacy and crop safety of pre-emergent herbicides in vegetable plasticulture, utilizing hydrogels. This preliminary study demonstrated the potential of the hydrogel as slow release carriers for pre-emergent herbicides (e.g., s-metolachlor) in vegetable plasticulture production. The observations show 98% control of nutsedge (*Cyperus* spp.), two months after application, within the raised beds under bell pepper production. Moreover, utilizing hydrogel as a carrier for s-metolachlor provided the much-needed crop safety from herbicide injury to transplants as observed from the plant vigor and yield measurements.

POSTEMERGE JAPANESE STILTGRASS CONTROL. N. Gambrell*; Clemson University, Clemson, SC (232)

ABSTRACT

Japanese stiltgrass (*Microstegium vimineum*) is an invasive annual found throughout the east coast, from New York to Florida, and west through Texas and Arkansas. Japanese stiltgrass is found in floodplains, woodlands, deep shade, and disturbed fertile soils. Limited data has been published in southeast on Japanese Stiltgrass. Therefore, purpose of this study was identify POST herbicides for control. Two field studies were conducted in Clemson, SC at Walker Golf Course in summer of 2018. Several herbicide treatments provided control.

Initial treatments were applied on July 30, 2018 and August 13, 2018. Treatments included: Drive XLR8 1.5L @ 64 oz/ac, Metsulfuron 60DF @ 0.5 oz/ac, MSMA 6L @ 22 oz/ac, MSMA 6L @ 22 oz/ac + Sencor 75DF @ 0.33 lb/ac, Manuscript 0.42EC @ 9.6 oz/ac fb Manuscript 0.42EC @ 9.6 oz/ac two weeks after initial (WAIT), Tribute Total 61WDG @ 3.2 oz/ac, Dismiss 4L @ 8 oz/ac, Xonerate 70WDG @ 4 oz/ac, Plateau 2L @ 2 oz/ac, and Segment 1L @ 32 oz/ac. In the first study, all treatments provided < 20% control @ 2 WAIT. Two treatments provided > 90% control @ 4 WAIT. These included MSMA 6L @ 22 oz/ac and Segment 1L @ 32 oz/ac. Two treatments provided 100% control @ 4 WAIT. These included MSMA 6L @ 22oz/ac + Sencor 75DF @ 0.33 lb/ac and Xonerate 70WDG @ 4 oz/ac. Four treatments provided 100% control @ 8 WAIT. These treatments included: MSMA 6L @ 22 oz/ac, MSMA 6L @ 22 oz/ac + Sencor 75DF @ 0.33 lb/ac, Xonerate 70WDG @ 4 oz/ac, and Segment 1L @ 32 oz/ac. In the second study, all treatments provided < 50% control @ 2 WAIT. Four treatments provided 100% control @ 4 WAIT and 8 WAIT. These treatments included: MSMA 6L @ 22 oz/ac, MSMA 6L @ 22 oz/ac + Sencor 75DF @ 0.33 lb/ac, Xonerate 70WDG @ 4 oz/ac, and Segment 1L @ 32 oz/ac.

Research will continue investigating japanese stiltgrass control with additional POST herbicides with and without PRE herbicides to determine additional options for control.

ZOYSIAGRASS AND BROADLEAF WEED RESPONSE TO HERBICIDES APPLIED DURING SPRING GREEN UP. J.M. Craft*, S. Askew; Virginia Tech, Blacksburg, VA (233)

ABSTRACT

Winter annual broadleaf weeds begin to germinate as zoysiagrass enters dormancy in the fall. Dense infestation of winter annual weeds can severely slow zoysiagrass green-up in the spring due to competition for sunlight, moisture and nutrients. Numerous herbicides are available for post emergent control of winter annual broadleaf weeds. However, little published literature has examined zoysiagrass response to these herbicides during spring green-up. Three field trials were conducted to evaluate numerous herbicides for weed control and zoysiagrass tolerance. All studies were established at the Virginia Tech Turfgrass Research Center in Blacksburg, VA. On March 27, 2017, one broadleaf weed control study was established and was repeated on March 17, 2018. On the same date in 2018, a tolerance site was established on fairway height 'Meyer' zoysiagrass that was beginning to green-up. On average, all plots had between 2 to 4% green zoysiagrass cover at treatment application. The experimental design was a randomized complete block with four replicates and plots were 1.7 m^2. All trials were sprayed with a CO_2-powered backpack sprayer calibrated to apply 280 L/ha. Herbicide treatments included, Glyphosate at 700 g ai ha^{-1}, Reward at 560 g ai ha^{-1} Glufosinate at 1680 g ai ha^{-1}, Specticle Flo at 32.7 g ai ha^{-1}, SpeedZone at 1230 g ai ha^{-1}, SpeedZone Southern at 455 g ai ha^{-1}, MSM Turf at 21 g ai ha^{-1}, Blindside at 460 g ai ha^{-1}, Dismiss Turf at 280 g ai ha^{-1}, Revolver 28.3 at g ai ha^{-1}, Tribute Total 85 at g ai ha^{-1}, Princep at 2240 g ai ha^{-1} + Glyphosate at 700 g ai ha^{-1}, Cool Power at 1770 g ai ha^{-1}, Escalade 2 at 2100 g ai ha^{-1}, Princep at 2240 g ai ha^{-1} + Specticle Flo at 32.7 g ai ha^{-1}, and an untreated check was included for comparison.

In both years Glyphosate, Glufosinate, Glyphosate + Princep, Specticle + Princep and Tribute Total were the only treatments that controlled persian speedwell (*Veronica persica*) and common chickweed *(Stellaria media*) greater than 80%. Common 3-way and 4-way broadleaf herbicides such as SpeedZone, SpeedZone Southern, Cool Power, and Escalade 2 did not effectively control persian speedwell. However, these products had excellent control of common chickweed and common dandelion (*Taraxacum officinale*) in both year without injuring the zoysiagrass. MSM Turf and Blindside effectively controlled common dandelion and common chickweed in both years. Blindside controlled persian speedwell 78% while MSM Turf control was only 59%. These products also caused commercially unacceptable zoysiagrass injury of approximately 50% 6 week after initial treatment (WAIT) but was fully recovered by the conclusion of the trial. Glufosinate had the best overall broadleaf control compared to other treatments but severally injured the zoysiagrass greater than 95%. All Glyphosate containing treatments injured zoysiagrass on average 55% at 6 WAIT but had fully recovered by the conclusion of the trial. Results indicated Princep + Specticle and Tribute Total were the only two treatments that controlled persian speedwell, common chickweed and common dandelion without causing any commercially unacceptable zoysiagrass injury.

POTENTIAL TURFGRASS HERBICIDE SAFENERS. S.A. Ledford*, B. McCarty, B. Kerr; Clemson University, Clemson, SC (234)

ABSTRACT

In this experiment multiple additives were combined with the herbicides tompramezone and metribuzin to control goosegrass (*Eleusine indica*) in bermudagrass turf. Visual ratings were made to determine turfgrass injury (0 being no injury, and 100 being dead grass) and goosegrass control (0 being no control, and 100 being total control). None of the additives consistently reduced turfgrass injury. A chelated iron additive was the most effective method to reduce turfgrass injury, and this interaction has been observed previously with MSMA. When turfgrass injury was reduced, typically goosegrass control was also reduced. These products were unable to produce desirable intended effects for reducing turfgrass injury and improving weed control.

POST EMERGENCE CONTROL OF SOUTHERN WATERGRASS AND TORPEDOGRASS - FINAL UPDATES. P.J. Brown*, B. McCarty, B. Cross, B. Kerr, N. Gambrell; Clemson University, Clemson, SC (235)

ABSTRACT

Many aquatic weeds are capable of invading terrestrial areas, especially in the presence of high water content. Certain grassy aquatic weeds can escape and establish themselves in managed turfgrass stands adjacent to aquatic environments. Two such species, torpedograss and Southern watergrass, are very difficult to selectively control when in desirable turfgrass stands. The purpose of this study was to evaluate selective control of torpedograss and Southern watergrass in bermudagrass turf. Greater than 86% control of torpedograss was observed 4 wk after sequential treatment (WAST) with quinclorac, trifloxysulfuron-sodium, quinclorac and trifloxysulfuron-sodium, sulfentrazone + imazethapyr and quinclorac and trifloxysulfuron-sodium, and quinclorac and trifloxysulfuron-sodium fb glyphosate. However, by 8 WAST, control was reduced to <36% for all treatments. Greatest Southern watergrass control was achieved 4 WAST with trifloxysulfuron-sodium (83%), and thiencarbazone-methyl + foramsulfuron + halosulfuron-methyl (75%). Limited control (<30%) was observed with other treatments. By 8 WAST, Southern watergrass control was <12% for all treatments. This study suggests short term control/suppression of these two species is possible; however, long-term control is limited with single year programs. These weeds will likely require multiple applications in successive years to reduce infestations. Future research should continue to screen other herbicides, combinations, and timings for control of these and other perennial grass weeds.

EVALUATION OF NEWLY ESTABLISHED BUFFALOGRASS FOR TOLERANCE TO GLYPHOSATE. M.B. Bertucci*, D. Karcher, D. OBrien, M. Richardson; University of Arkansas, Fayetteville, AR (236)

ABSTRACT

Buffalograss (*Buchloë dactyloides*) is a warm-season grass native to the US Great Plains and exhibits many desirable characteristics as a turf for home lawns or moderately trafficked areas. Buffalograss is ideal for low maintenance environments due to its reduced irrigation and fertility requirements and slower growth rate. Observations during herbicide screenings revealed a degree of tolerance and a recuperative ability of mature buffalograss following application with glyphosate. Because glyphosate is an inexpensive, general-use herbicide, it would be useful in low input systems where buffalograss is currently used. However, it is not clear whether newly established buffalograss seedlings have similar tolerance to glyphosate. Thus, the present study was designed to investigate the effects of glyphosate rates and application timings in newly seeded buffalograss. 'Cody' buffalograss was seeded into prepared sites in Fayetteville, AR on June 21 and May 19 in 2017 and 2018, respectively. Six glyphosate rates were included for this study: 10, 255, 510, 1,020, and 2041 g ae ha^{-1} and one untreated control. Three glyphosate applications were timed at 1, 3, or 8 wk after emergence (WAE), relative to when 50% of buffalograss seedlings had emerged. Glyphosate rates and application timings were crossed in a factorial treatment arrangement in a randomized complete block design and replicated three times. Visual ratings of turf quality were assessed at 10 weekly intervals in each year, starting one week after initial glyphosate application. Digital images were recorded using a portable lightbox and digital camera twice per week over a 10 wk period. Subsequent image analysis calculated percent coverage and dark green color index at each rating period. In 2017, unacceptable injury was observed at all application timings when glyphosate was applied at 255 g ha^{-1} or above. Buffalograss injury was slightly reduced in 2018, and unacceptable injury was observed when glyphosate was applied at 510 g ha^{-1} or above. In 2018, early applications (1 WAE) of glyphosate at 255 g ha^{-1} rate caused unacceptable injury during initial ratings, but the buffalograss subsequently recovered to meet the minimum acceptable standard for turf quality. In 2018, glyphosate applied at 255 g ha^{-1} at 8 WAE did not result in unacceptable injury. Based on the results of the present study, buffalograss has some ability to withstand lower levels of glyphosate at specific growth stages. However, glyphosate applications at these rates and timings after emergence cause an unacceptable amount of injury to buffalograss and would not be a commercially viable option for weed management.

POSTEMERGENCE CRABGRASS (DIGITARIA SPP.) CONTROL IN BERMUDAGRASS WITH PINOXADEN. D.R. Taylor*[1], J.T. Brosnan[2], G. Breeden[3], G.M. Henry[4]; [1]University of Tennessee Knoxville, Knoxville, TN, [2]Univ. of Tennessee, Knoxville, TN, [3]University of Tennessee, Knoxville, TN, [4]University of Georgia, Athens, GA (237)

ABSTRACT

Crabgrass (*Digitaria*spp.) is a common summer annual weed of bermudagrass (*Cynodon*spp.) on golf courses, athletic fields, and lawns. Pinoxaden is a new acetyl co-A carboxylase inhibiting herbicide labeled for use in bermudagrass, St. Augustinegrass [*Stenotaphrum secundatum* (Walter) Kuntze], and zoysiagrass (*Zoysia* spp.) turf. Field research was conducted in 2018 to evaluate the efficacy and turfgrass safety of pinoxaden applications for postemergence (POST) control of crabgrass at various stages of growth.

Research was conducted at the East Tennessee AgResearch & Education Center (Knoxville, TN) on a stand of common bermudagrass (*Cynodon dactylon*L., cv. 'Yukon') naturally infested with smooth crabgrass (*Digitaria ischaemum*). Research was also conducted at the Athens Turfgrass Research & Education Center (Athens, GA) on a stand of hybrid bermudagrass (*C. dactylon* x *C. transvaalensis* Burtt-Davey, cv. 'TifTuf') naturally infested with large crabgrass (*Digitaria sanguinalis*). Mowing height in Tennessee measured 1.5 cm compared to 5 cm in Georgia. Plots at both locations measured 1.5 x 3.0 m and were arranged in randomized complete block designs with four replications. Pinoxaden was applied both singularly and sequentially at 153 g $ha^{-1}$when crabgrass averaged 2 to 3 tillers or 5 to 7 tillers. Single and sequential applications of pinoxaden at 312 g ha^{-1}were applied at the 5 to 7 tiller stage as well. All pinoxaden treatments included a methylated rapeseed oil adjuvant at 0.5% v/v. Sequential treatments were applied on a 14-day interval at both timings. Pinoxaden treatments were compared to sequential applications of quinclorac (880 g ha^{-1}) + methylated seed oil (0.5% v/v) at the 5 to 7 tiller stage. In Tennessee, smooth crabgrass control and bermudagrass injury were visually assessed using a 0 (i.e., lowest) to 100% (i.e., highest) scale 3 to 16 weeks after initial treatment (WAIT) compared to non-treated control plots in each replication. Crabgrass cover in all plots was assessed on each date that plots were assessed visually. In Georgia, large crabgrass cover was visually assessed at each rating timing and converted to percent control by comparing back to initial cover ratings for each plot at time of treatment application.All data were subjected to analysis of variance in R (v. 3.5.1) with means separated using the 'LSD.test' function of the 'agricolae' package.

At the conclusion of the Tennessee study, smooth crabgrass was controlled >90% with sequential pinoxaden applications, regardless of application rate or timing. Control was similar to quinclorac applied at the 5 to 7 tiller stage. Although single applications of pinoxaden were highly active on smooth crabgrass at both rates and timings (96 to 100% control 6 WAIT), overall control with these treatments only ranged from 48 to 74% by the end of the study. No common bermudagrass injury was observed in response to any pinoxaden applications in Tennessee. In Georgia, sequential applications of pinoxaden controlled large crabgrass >85% by the end of the study, regardless of application rate or timing. Single applications of pinoxaden failed to control large crabgrass >60%. Transient hybrid bermudagrass injury (≤ 25%) was

detected with both single and sequential applications of pinoxaden; however, all turfgrass recovered by the end of the study. This research demonstrates that sequential applications of pinoxaden can effectively control crabgrass POST in bermudagrass. However, additional research is warranted to explore differences in control among crabgrass species, as well as differences in tolerance among warm-season turfgrass species and cultivars.

SOIL MOISTURE AND APPLICATION PLACEMENT AFFECT HERBICIDE EFFICACY FOR POSTEMERGENCE GOOSEGRASS (ELEUSINE INDICA) CONTROL.

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ABSTRACT

Greenhouse research was conducted during 2018 at the University of Tennessee (Knoxville, TN) evaluating effects of various postemergence (POST) herbicides on multi-tiller goosegrass [*Eleusine indica* (L.) Gaertn] established in silt loam soil. Two separate studies were conducted, each arranged in a randomized complete block design with six replications. Study one evaluated effects of herbicide placement on efficacy of five POST herbicides labeled for goosegrass control. Three placements were evaluated including foliar-only (FO), soil-only (SO), and foliar + soil (FS) application. SOapplications were delivered to plants using a pipette to eliminate herbicide contact with leaf or stem tissue. FO and FS treatments were applied using an enclosed spray chamber calibrated to deliver 284 L ha^{-1}; however, cotton roll was placed on the soil surface when applying FO treatments to impede herbicide from contacting the soil. This cotton remained in place for 24 hours after treatment until spray solution was dry and then was discarded. Herbicides included: a mixture of carfentrazone-ethyl + 2,4-D-ester + mecoprop-p + dicamba at 28 + 857 + 269 + 78 g ha^{-1}, respectively; topramezone at 24 g ha^{-1}; fenoxaprop at 140 g ha^{-1}; foramsulfuron at 44 g ha^{-1}; and thiencarbazone-methyl + foramsulfuron + halosulfuron-methyl at 22 + 45 + 67 g ha^{-1}, respectively. Adjuvants were included with herbicides per label recommendations. Study two explored effects of soil moisture on the efficacy of the same five herbicides for POST goosegrass control. Multi-tiller goosegrass plants (minimum of three tillers) were maintained at three different volumetric soil moisture contents (VMC): < 12%, 12 to 20%, or > 20%. Non-treated controls were included in each study for comparison. In both studies, goosegrass control was visually assessed usinga 0 (i.e., lowest) to 100% (i.e., highest) scale relative to non-treated controlsat 22 and 36 days after treatment (DAT). Aboveground biomass for each treatment was quantified 44 DAT as well. All data were subjected to analysis of variance in R (v. 3.5.1) with means separated using the 'LSD.test' function of the 'agricolae' package. In study one, few differences in goosegrass control were observed among herbicide placements. However, FO application significantly reduced aboveground biomass compared to SO or FS treatment. In study two, no differences in goosegrass control were detected among herbicides when applied to plants maintained at < 12% VMC with overall control ranging from 10 to 24% 36 DAT. Control was significantly greater for all herbicides when applied to goosegrass plants maintained at higher VMC. For example, overall goosegrass control ranged from 68 to 95% 36 DAT when applied to plants maintained at > 20% VMC. Data in these experiments highlight that barriers to foliar uptake of POST herbicides may be critically important in controlling goosegrass, particularly in environments of low VMC.

POST-EMERGENT CONTROL OPTIONS FOR POA ANNUA. B. McCarty[1], J.R. Weaver*[2], N. Gambrell[1], C. Patrick[1]; [1]Clemson University, Clemson, SC, [2]Clemson University, Pendleton, SC (239)

ABSTRACT

Annual Bluegrass (*Poa annua* L) is a cool-season, small, tufted to clumped, annual grass that grows up to 8 inches tall, and occurs throughout North America in excessively wet, compacted soil. It is a problematic weed of in SEUSA turf. Annual bluegrass has yellow-green foliage, with smooth often wavy leaf blades. Its seedhead branches with one to two light green to whitish spikelets per node, and fruits throughout its life cycle with a majority of seedheads formed during spring. This study was conducted during winter and spring 2017/2018 in Charleston, SC on a non-overseeded bermudagrass golf course rough. All herbicide treatments were applied in either November or December 2017, and January 2018. Revolver at 18 fl oz/a, Katana at 2.5 oz wt/a, Monument at 0.44 oz wt/a, Tribute Total at 3.2 oz wt/a, and Kerb at 3 lb/a were applied November 2017. Atrazine at 2 qt/a, Atrazine at 1 qt/a, Simazine at 2 qt/a, and Simazine at 1 qt/a were applied December 2017. Atrazine 1 qt/a, Simazine 1 qt/a, Roundup 24 fl oz/a, Finale at 3 qt/a, Roundup at 24 fl oz/a + Simazine at 2 qt/a, Finale at 3 qt/a, + Simazine at 2 qt/a, Reward at 1 qt/a, Sureguard at 12 oz wt/a, Xonerate at 4.2 fl oz/a, followed by Xonerate at 4.2 fl oz/a three weeks after initial treatment (WAIT), and Kerb at 0.25 lb ai/a + Revolver at 4 fl oz/a + Xonerate at 4.2 fl oz/a were applied January 2018. At 16 WAIT, ~90% control followed Revolver, Katana, Roundup, Finale, Kerb, Kerb + Revolver + Xonerate, Tribute Total, Atrazine at 2 qt/a, and Simazine at 2 qt/a. Bermudagrass greenup was ~90% in April 2018, with the exception of Kerb + Revolver + Xonerate at ~26 %; however, this treatment provided ~98% Annual Bluegrass control. Future research will continue to investigate potential control options of this troublesome weed.

EVALUATION OF PIPER AND CLETHODIM FOR ANNUAL BLUEGRASS CONTROL IN DORMANT BERMUDAGRASS . P. McCullough*; University of Georgia, Griffin, GA (240)

ABSTRACT

A field experiment was conducted on a common bermudagrass fairway in Griffin, GA to evaluate the efficacy of Envoy Plus (clethodim) at 8 or 16 oz/acre and Piper (flumioxazin + pyroxasulfone) at 10 oz/acre for annual bluegrass (*Poa annua*) control compared to Simazine 4L at 32 oz/acre, Monument (trifloxysulfuron) at 0.56 oz/acre, Sureguard (flumioxazin) at 12 oz/acre, Segment (sethoxydim) at 2.25 pt/acre, and various tank-mixtures of these products. Treatments were applied on November 20, 2017 and control was evaluated throughout spring. On April 23, 2018, Piper and both rates of Envoy Plus provided excellent control (90% or greater) of annual bluegrass. The efficacy of these treatments was comparable to simazine and Monument applied alone or in tank-mixtures. There was no benefit to tank-mixing Envoy Plus or Piper with simazine to improve control. Segment and Sureguard controlled annual bluegrass 46% and 80%, respectively, but control was excellent when these herbicides were tank-mixed with simazine. Bermudagrass release in spring was similar to the nontreated by Envoy alone; however, Piper alone and the tank-mixture of simazine with Envoy improved bermudagrass ground cover by 4 to 5-times greater than the nontreated. This likely resulted from improvements in broadleaf weed control when Envoy was tank-mixed with simazine compared to Envoy alone. Further investigations are needed to evaluate application programs that optimize safety to bermudagrass turf with Envoy and Piper treatments. Overall, Envoy and Piper may have potential for controlling annual bluegrass as alternatives to sulfonylurea or triazines for resistance management in bermudagrass turf.

NEW PRODUCTS FOR THIN PASPALUM CONTROL. **J**. Brewer*[1], S. Rana[2], S. Askew[1]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Polytechnic Institute and State University, Blacksburg, VT (241)

ABSTRACT

Throughout the United States, *Paspalum* species are some of the most difficult perennial, grassy weeds to control in both cool-and warm-season turf. In turfgrass systems, *Paspalum* species are able to tolerate low mowing heights allowing them to persist through a wide range of settings. In Virginia, thin paspalum (*Paspalum setaceum*) is one of the most prominent *Paspalum* species in the state especially in the mountainous regions. Most traditional control recommendations for *Paspalum* species revolved around multiple applications of MSMA, but this is no longer a viable option for most turf managers. At Virginia Tech between 2014 and 2015, three studies were initiated to evaluate different herbicides for thin paspalum control. The objectives for these studies included evaluating short-and long-term thin paspalum control by fluazifop, mesotrione, pinoxaden, topramezone, and trifloxysulfuron, and tall fescue and bermudagrass tolerance to these treatments.

All trials were initiated at the Pete Dye River Course in Radford, VA in a tall fescue and/or bermudagrass rough heavily infested with thin paspalum. Trials were arranged in a randomized complete block design with three replications, and the plot sized ranged from 1.7 m^2 to 3.3 m^2. One trial in 2014 evaluated different programs of pinoxaden at 35 and 70 g ha^{-1} and trifloxysulfuron at 28 g ha^{-1}. The two studies in 2015 evaluated fluazifop at 105 g ha^{-1}, mesotrione at 174 g ha^{-1}, and topramezone at 24.6 g ha^{-1} applied alone or in combination. Treatments for all three trials were applied with a CO2-powered sprayer calibrated to 280 L ha^{-1} fitted with either XR FF 11003 or TTI 11004 nozzles.

One year after the initiation of the trial in 2014, pinoxaden at 35 and 70 g ha^{-1} applied alone controlled thin paspalum between 80 and 90%, while combinations with trifloxysulfuron controlled thin paspalum greater than 95%. None of the treatments injured bermudagrass at an unacceptable level. At this time, the local standard (theincarbazone+halosulfuron+foramsulfuron) controlled thin paspalum similar to all pinoxaden treatments. During the two trials in 2015, all topramezone and fluazifop treatments controlled thin paspalum the best and greater than mesotrione applied alone. At 13 weeks after initial application, all treatments with topramezone and fluazifop controlled thin paspalum greater than 95%, but fluazifop injured tall fescue at an unacceptable level.

In conclusion, pinoxaden programs seem to be a safe and effective option to control thin paspalum in bermudagrass turf. Also both topramezone and fluazifop are effective at controlling thin paspalum, but only topramezone can be used across a wide range of cool-season turf settings. Fluazifop can be used in tall fescue to control thin paspalum, but will caused unacceptable injury.

Survey of Herbicide-Resistant Weeds in the South

Please refer to **www.herbicideresistance.org** for up-to-date information on herbicide resistant weeds in the Southern region.

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