Proceedings of the Southern Weed Science Society 71st Annual Meeting

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Dedication Statement

With the highest level of respect, the 2018 Southern Weed Science Society Proceedings are dedicated to life and career of Dr. Timothy R. Murphy, Professor Emeritus and Extension Agronomist- Weed Science with the University of Georgia at the Griffin Campus. Dr. Murphy died on 13 April 2018 at the age of 66.

Dr. Murphy 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.

Dr. Murphy served as a technical specialist for weed science programs in turfgrasses, forages, roadsides, and non-cropland in Georgia. Dr. Murphy was the first extension specialist to be housed at the Griffin Campus and quickly established a stellar reputation of service to county agents, golf course managers, homeowners, farmers, ranchers, and various agencies responsible for roadside maintenance. An area of personal interest and excellence was weed identification. Dr. Murphy was among the best in plant identification and universally considered to be the in-house expert. This interest led to him co-authoring several superb weed identification reference books that were the classic example of successful multi-institutional collaborations among several land-grant universities. One such publication, Weeds of Southern Turfgrasses, is the all-time best seller in U. S. Extension Service history.

Dr. Murphy was instrumental in the implementation of in-service training sessions for Georgia County agents. These training sessions were conducted throughout the state on a recurring basis and featured quality weed science instruction in many different settings; agronomic crops, horticultural crops, aquatics, turfgrass, non-cropland, and weed identification where his weed ID quizzes were legendary. Dr. Murphy was part of the team of Georgia weed scientists who hosted the 1993 Southern Weed Science Society Weed Contest.

The highest award for a University of Georgia extension service faculty member in the College of Agricultural and Environmental Sciences is the D. W. Brooks Award for Excellence in Extension, which Dr. Murphy received in 1995. Dr. Murphy’s stature and impact as a weed scientist were recognized by the Weed Science Society of America (WSSA) in 1999 by him receiving the Outstanding Extension Award. Dr. Murphy was elected to serve on the Southern Weed Science Society (SWSS) Board of Directors as WSSA representative in 2002. His long-term service to the SWSS and the weed science discipline were recognized by the SWSS in 2009 by him receiving the Distinguished Service Award, which is now considered to be the Fellow Award. As recently as November 2017, Dr. Murphy received the Lifetime Achievement Award.
from the Georgia Crop Production Alliance. Dr. Murphy clearly made a difference in the weed science discipline and many aspects of agriculture benefited from his service.

Dr. Murphy was always approachable, even when the demands of his career consumed every single minute of the work day. His service, availability, selflessness, and humility continued long after he retired from the University of Georgia. For many years, he worked as a volunteer in maintenance of the physical plant at First Baptist Church of Griffin. Additionally, he volunteered as carpenter in the construction of houses built by Habitat for Humanity in the Griffin area.

While Dr. Murphy was an accomplished agricultural professional, he was first and foremost a family man. He 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.
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   C.H. Tingle, G.L. Steele and J.M. Chandler; Department of Soil and Crop Sciences, Texas A&M University, College Station, TX 77843.

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Outstanding Young Weed Scientist- Academia

Ramon Leon

Dr. Ramon Leon was born in San Jose, Costa Rica. He grew up in the capital, but because of his summers visits to his grandfather’s farm in the northern part of the country, he became interested in agriculture. He attended the University of Costa Rica where he majored in Crop Production. In 1997, he was hired as a Research Technician in the Weed Science Program of the same institution, mainly conducting research on red rice management in paddy rice fields and integrated weed management in sugarcane. After obtaining his B.S. (2000), Dr. Leon went to Iowa State University to work on his master’s (2003) and Ph.D. (2005) on Crop Production and Physiology with emphasis in Weed Science under the mentoring of Dr. Micheal D.K. Owen. There, he also obtained a Ph.D. (2005) in Genetics under the guidance of Dr. Diane Bassham. After completing his graduate studies, Dr. Leon was appointed Assistant Professor-Weed Science at the Horticulture and Crop Science Department, California Polytechnic State University in San Luis Obispo. In 2007, he had the opportunity to return to Costa Rica, where he became a Weed Science Professor at EARTH University, an international agricultural college training students from over 30 countries in agriculture, natural resource management, and sustainable development. While at EARTH University, Dr. Leon worked on multiple agronomic and horticultural crops and was involved in teaching, development and research projects throughout Latin America, Africa, and Europe. In 2012, Dr. Leon and his family decided to return to USA, so he could devote more time to conduct research on weed biology and management. He moved to the West Florida Research and Education Center, Jay, FL of the University of Florida as an Assistant Professor- Weed Science Extension Specialist working on weed management in row crops and turfgrass. In 2017, he was promoted to Associate Professor and given tenure. Because of his passion to study weed behavior in agricultural systems, he recently accepted a faculty position at the Department of Crop and Soil Sciences, North Carolina State University as an Assistant Professor of Weed Biology and Ecology, where he is studying weed population dynamics and weed adaptations to cropping systems. Dr. Leon has authored and coauthored 59 peer-reviewed scientific articles, 3 book chapters, over 100 abstracts, 37 refereed extension publications and over 27 articles in newsletters and popular press. He has mentored 6 M.Sc. and 3 Ph.D. students. He currently lives in Raleigh, NC with his wife Rocio and sons Ignacio and Tomas. During his limited free time, he enjoys reading and hiking.
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<td>2012</td>
<td>Cody Gray</td>
<td>United Phosphorus Inc.</td>
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<td>2013</td>
<td>Greg Armel</td>
<td>BASF Company</td>
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<td>2013</td>
<td>Shawn Askew</td>
<td>Virginia Tech</td>
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<td>2014</td>
<td>Jason Ferrell</td>
<td>University of Florida</td>
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<td>2014</td>
<td>Vinod Shivrain</td>
<td>Syngenta</td>
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<td>2015</td>
<td>Jim Brosnan</td>
<td>University of Tennessee</td>
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<td>2016</td>
<td>Daniel Stephenson, IV</td>
<td>LSU-Ag Center</td>
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<td>2016</td>
<td>Drew Ellis</td>
<td>Dow AgroSciences</td>
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<td>2017</td>
<td>Wes Everman</td>
<td>North Carolina State Unviersity</td>
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<tr>
<td>2017</td>
<td>Hunter Perry</td>
<td>Dow AgroSciences</td>
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</table>
Outstanding Educator Award

Stanley Culpepper

Stanley Culpepper is a Professor in the Crop and Soil Science Department at The University of Georgia. A native of North Carolina, he grew up on a bicentennial family farm producing corn, cotton, peanut, soybean, and wheat. He received his BS in Agronomy from N. C. State University. His MS and PhD were also obtained at N. C. State in weed science under the direction of Dr. Alan York. Stanley began his professional career at The University of Georgia as a cotton, vegetable, and small grain weed scientist in 1999, and continues with those responsibilities today. Stanley’s ultimate goal is to develop and share sound science with family farms improving their sustainability.

Because of Stanley’s efforts, he has been an invited speaker at 277 functions across 25 states and several countries. In Georgia, he has presented timely information to growers at 583 county meetings and 118 field days while also training extension agents during 116 in-service or regional meetings. He has authored or co-authored 97 refereed journal articles, 4 book chapters, 363 abstracts for presentations at professional meetings, 213 extension publications and 171 newsletters/blogs.

Additionally, Stanley has authored 16 successful Section 18 packages and critical use nomination packages as well as co-authoring 33 Section 24(c) state herbicide labels bringing new weed management tools to Georgia growers. Stanley has been honored to win numerous awards including the EPA’s Montreal Protocol International Award for assisting in the preservation of the ozone layer and the Southern Region Excellence in Extension Award provided by the Extension Committee on Organization and Policy and the USDA National Institute of Food and Agriculture. Stanley was also honored with an invitation to serve as a member of the Agricultural Science Committee of the U.S. Environmental Protection Agency’s Science Advisory Board.
### Previous Winners of the Outstanding Educator Award

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<td>James L. Griffin</td>
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<td>Thomas F. Peeper</td>
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<td>Don S. Murray</td>
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<td>James M. Chandler</td>
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<td>Peter Dotray</td>
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<td>2012</td>
<td>Gregory Mac Donald</td>
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<td>2013</td>
<td>Tim Grey</td>
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<tr>
<td>2014</td>
<td>Scott Senseman</td>
<td>University of Tennessee</td>
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<td>2015</td>
<td>Nilda Roma-Burgos</td>
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<td>Katie Jennings</td>
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<td>2017</td>
<td>Jason Norsworthy</td>
<td>University of Arkansas</td>
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Outstanding Graduate Student Award (MS)

Zachary Lancaster

Zachary grew up on a rice and soybean farm in northeast Arkansas, where his father and grandfather instilled in him a love for agriculture. He graduated *Cum Laude* from Arkansas State University in 2013 with a B.S. in agronomy. Zachary completed his M.S. in Weed Science from the University of Arkansas in 2017 and is currently working on his Ph.D. under the advisement of Dr. Jason Norsworthy. His thesis research evaluated quizalofop-resistant rice for Arkansas rice production systems. During his time at the University of Arkansas, Zachary has placed 1st individual at the 2015 WSSA Weed Olympics competition, and 9th and 2nd overall individual at the 2016 and 2017 SWSS Weed Contest, respectively. Zachary has also been successful in presenting his research by winning speaking contests at the 2015 SWSS Annual Meeting, the 2015 Arkansas Crop Protection Conference, and the 2016 Beltwide Cotton Conference. Zachary has been recognized for his academic and extracurricular achievements with awards such as the 2016 Department of Crop, Soil, and Environmental Sciences Outstanding M.S. Student Award, the Ron and Alice Talbert Distinguished Weed Science Scholarship, and the University of Arkansas Doctorial Academy Fellowship. Zachary’s Ph.D. research will evaluate thiencarbazone-methyl for use in Midsouth soybean production.
## Previous Winners of the Outstanding Graduate Student Award (MS)

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<td>Walter E. Thomas</td>
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<td>Whitney Barker</td>
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<td>2006</td>
<td>Christopher L. Main</td>
<td>University of Florida</td>
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<td>2009</td>
<td>Ryan Pekarek</td>
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<td>2010</td>
<td>Robin Bond</td>
<td>Mississippi State University</td>
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<tr>
<td>2011</td>
<td>George S. (Trey) Cutts, III</td>
<td>University of Georgia</td>
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<td>2012</td>
<td>Josh Wilson</td>
<td>University of Arkansas</td>
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<td>2013</td>
<td>Bob Cross</td>
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<td>2014</td>
<td>Brent Johnson</td>
<td>University of Arkansas</td>
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<td>2015</td>
<td>Garret Montgomery</td>
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<td>2016</td>
<td>Chris Meyer</td>
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<td>2017</td>
<td>John Buol</td>
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Outstanding Graduate Student Award (PhD)

Sandeep Rana

Sandeep Rana currently serves as an Agronomic Research Manager with Monsanto Company in Galena, MD. In this role, he leads and manages field research programs aimed at testing and advancing Monsanto’s novel chemistries and biotechnology traits to support the Global Breeding team. Sandeep is a native of India, where he grew up on a campus of an agricultural university - CCS Haryana Agricultural University (CCS HAU) located at Hisar in the Indian State of Haryana (Northwestern India). Born in a family of agricultural researchers and administrators, service to the field of agriculture runs deep in his family. Sandeep developed a strong passion for agricultural sciences from a very young age that motivated him to pursue higher studies in this field.

Sandeep received his B.S. degree in Agriculture (Honors) and M.S. degree in Horticulture/Biotechnology (partial completion) from CCS HAU. He then moved to the USA to pursue his M.S. degree in Weed Science under the direction of Dr. Jason Norsworthy at University of Arkansas. His thesis research focused on evaluating soybean response to drift and carryover of imazosulfuron from rice. Sandeep then moved to Virginia Tech, where he pursued a Ph.D. degree in Turfgrass Weed Science under the guidance of Dr. Shawn Askew. His Ph.D. research focused on evaluating golf green’s canopy anomaly influence on putt kinematics and designing long-term control programs for weedy Poa species in golf turf. Prior to joining Monsanto, Sandeep also spent a small but fruitful period at North Carolina State University working as Postdoctoral Research Scholar with Dr. Wesley Everman.

To date, Sandeep’s efforts have contributed to 7 peer-reviewed papers with several more in preparation, 59 abstracts from scientific presentations, and over 30 extension and outreach publications and talks. He has reviewed scientific papers for journals of Weed Technology, Weed Science, Crop Science, Crop, Forage, and Turfgrass Management, Applied Turfgrass Science, and International Turfgrass Society Research Journal. Sandeep has been actively involved in the SWSS, NEWSS, NCWSS, and WSSA. During his Ph.D., he served as the President of the SWSS GSO and Secretary of the WSSA GSO. Sandeep has also led several other student organizations at departmental and university levels. He actively volunteers to judge student papers/posters and organize weed contests, and presently serves as section chair/co-chair and/or committee member across all the aforementioned weed science societies. For his contributions, Sandeep has won several prestigious awards, including SWSS Endowment Fellowship, WSSA Travel Grant, USGA Green Section Internship, NC State University Graduate School Industry Immersion Program, etc. Sandeep also has won 6 paper or poster presentation awards at scientific meetings. He competed in 3 SWSS and 2 NEWSS weed contests, where both he and his team always scored top 3 positions, including 1st place individual and team at the 2011 SWSS contest and 1st place team at 2014 and 2015 NEWSS weed contests. Sandeep’s long-term goal is to leverage his research and leadership skills to contribute to cutting-edge research that addresses critical needs of productivity and sustainability of global agriculture. Sandeep plans to continue to extend his services to the SWSS and help the society in successfully achieving its true north objectives.

Sandeep is happily married to his college sweetheart, Trisha Sanwal, for over 5 years. In his free time, Sandeep loves to spend time with his family and friends and doing almost anything that brings him outdoors and closer to mountains and water bodies.
## Previous Winners of the Outstanding Graduate Student Award (PhD)

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<td>William A. Bailey</td>
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<td>2005</td>
<td>Ian Burke</td>
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<td>2006</td>
<td>Marcos J. Oliveria</td>
<td>Clemson University</td>
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<td>2007</td>
<td>Wesley Everman</td>
<td>North Carolina State University</td>
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<td>2008</td>
<td>Darrin Dodds</td>
<td>Mississippi State University</td>
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<td>2009</td>
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<td>Kelly Barnett</td>
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<td>James McCurdy</td>
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<td>2016</td>
<td>Reiofeli Algodon Salas</td>
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<td>2017</td>
<td>Misha Manuchehri</td>
<td>Texas Tech University</td>
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Fellow Award

Scott Senseman

Scott Senseman graduated from Wilmington College of Ohio in 1986 with a B.S. in Agricultural Business. He attended the University of Arkansas where he completed his M.S. in Agronomy-Weed Science in 1990 and his Ph.D. in Agronomy-Pesticide Residue in 1994. He served on that faculty in the Department of Soil and Crop Sciences at Texas A&M University for more than 18 years starting in October 1994. He is currently Professor and Head of the Department of Plant Sciences at the University of Tennessee where he has been employed since July, 2013. Dr. Senseman’s research program has concentrated on several aspects of herbicide chemistry including the effectiveness of grass buffer strips on removal of herbicides from runoff water, herbicide dissipation and carryover, herbicide absorption and translocation, herbicide effects on soil microbial activity, extraction method development for soil and water, and weed management in rice. He has authored or coauthored 106 peer-reviewed journal articles, 229 abstracts of poster and oral presentations, 8 technical reports, two magazine articles, and one encyclopedia entry. In 2007, he finished his service as the editor for the Weed Science Society of America’s Ninth Edition of the Herbicide Handbook. In 2014, he served as President for the Southern Weed Science Society. In 2016, he was elected to serve on the Board of Directors of the Weed Science Society of America serving as Vice President, President-Elect (2017), and President (2018). Dr. Senseman helped develop and teach the beginning course in agronomy (SCSC 101 Introduction to Agronomy), two undergraduate courses related to the evolution, role, and fate of agricultural chemicals in row crop production (SCSC 435 Ecology of Agrochemicals and SCSC 446 Weed Management and Ecology), a graduate and distance course related to herbicide mode of action and environmental fate (SCSC 650 Mode of Action and Environmental Fate of Herbicides) as well as an analytical course related to instrumentation used in environmental aspects of agronomy (SCSC 618 Methods of Plant, Soil, and Water Analysis in Environmental Systems). He also co-developed and co-taught PLSC 456/556 Turfgrass Weed Science at the University of Tennessee. Dr. Senseman has served as major advisor or co-advisor for 22 graduate students and has served on 66 other graduate student committees and four international undergraduate internships during his tenure at Texas A&M and the University of Tennessee.
Fellow Award

Jerry Wells

Jerry Wells was raised in south-east Texas, east of Houston. He received a B.S. in agronomy in 1979 from Texas A&M University where he developed an interest in weed science from Dr. Morris Merkle. After graduation, he worked for 6 months as a field development intern for Eli Lilly and Company at their regional office in Dallas, Texas. He then continued his education receiving a M.S. in Crop Science in 1982 working in Dr. Phil Banks' weed science program and in 1985 a Ph.D. in Agriculture from Texas Tech University working under Dr. John Abernathy and Dr. Jack Gipson. Jerry accepted a position with Sandoz Crop Protection (then operating as Zoecon Corp. in the U.S.) as a field development representative in Lincoln, Nebraska with responsibilities in ND, SD, NE, KS, MN, IA and MO. In 1986 he moved to Louisiana to take responsibility for product development activities in the state for Sandoz. In 1997 he relocated to Greensboro, NC to work as a technical brand manager for Novartis Crop Protection and later in various regulatory roles at Syngenta Crop Protection until his retirement in 2017. Jerry benefited greatly from the SWSS as a student and during his career in industry, participating in student contest presentations and the annual weed competitions. He served as student contest judge, on various committees, as president of the society and as section chair or symposia coordinator for regulatory sessions at SWSS and WSSA. He and his wife Janet have two children, Natalie and Sam and currently live in Oak Ridge, NC.
# Previous Winners of the Distinguished Service Award

*(Renamed Fellow Award in 2015)*

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<td>Don E. Davis</td>
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<td>V. Shorty Searcy</td>
<td>Ciba-Geigy</td>
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<td>Allen F. Wiese</td>
<td>Texas Agric. Expt. Station</td>
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<td>Russel F. Richards</td>
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<td>Robert E. Frans</td>
<td>University of Arkansas</td>
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<td>George H. Sistrunck</td>
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<td>Ellis W. Hauser</td>
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<td>John E. Gallagher</td>
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<td>Paul W. Santelmann</td>
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<td>Turney Hernandez</td>
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<td>Cleston G. Parris</td>
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<td>Gene D. Wills</td>
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<td>Claude W. Derting</td>
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<td>Jerome B. Weber</td>
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<td>R. Larry Rogers</td>
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<td>James R. Bone</td>
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<td>Lawrence R. Oliver</td>
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<td>Roy J. Smith, Jr.</td>
<td>USDA, ARS Stuttgart</td>
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<td>Harold D. Coble</td>
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<td>Aithel McMahon</td>
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<td>1998</td>
<td>Stephen O. Duke</td>
<td>USDA, ARS Stoneville</td>
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<td>Phillip A. Banks</td>
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<td>Laura L. Whatley</td>
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<td>William W. Witt</td>
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<td>Randall L. Ratliff</td>
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<td>E.I. DuPont</td>
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<td>2008</td>
<td>Gregory Stapleton</td>
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<td>Tim R. Murphy</td>
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<td>Bobby Walls</td>
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<td>John Harden</td>
<td>BASF Corporation</td>
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<tr>
<td>2017</td>
<td>James Holloway</td>
<td>Syngenta</td>
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Previous Winners of the Weed Scientist of the Year Award

(Renamed Fellow Award in 2015)

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<thead>
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<th>Year</th>
<th>Name</th>
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<tr>
<td>1984</td>
<td>Chester L. Foy</td>
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<tr>
<td>1985</td>
<td>Jerome B. Weber</td>
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<td>1986</td>
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<tr>
<td>1987</td>
<td>Robert E. Frans</td>
<td>University of Arkansas</td>
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<tr>
<td>1988</td>
<td>Donald E. Moreland</td>
<td>USDA, ARS, North Carolina</td>
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<td>1989</td>
<td>Roy J. Smith, Jr.</td>
<td>USDA, ARS, North Arkansas</td>
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<tr>
<td>1990</td>
<td>Chester McWhorter</td>
<td>USDA, ARS, Mississippi</td>
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<tr>
<td>1991</td>
<td>Ronald E. Talbert</td>
<td>University of Arkansas</td>
</tr>
<tr>
<td>1992</td>
<td>Thomas J. Monaco</td>
<td>North Carolina State University</td>
</tr>
<tr>
<td>1993</td>
<td>A. Douglas Worsham</td>
<td>North Carolina State University</td>
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<td>1994</td>
<td>Stephen O. Duke</td>
<td>USDA, ARS, Mississippi</td>
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<td>1995</td>
<td>Lawrence R. Oliver</td>
<td>University of Arkansas</td>
</tr>
<tr>
<td>1996</td>
<td>William L. Barrentine</td>
<td>Mississippi State University</td>
</tr>
<tr>
<td>1997</td>
<td>Kriton K. Hatzios</td>
<td>VPI &amp; SU</td>
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<tr>
<td>1998</td>
<td>G. Euel Coats</td>
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<td>1998</td>
<td>Robert E. Hoagland</td>
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<td>Gene D. Wills</td>
<td>Mississippi State University</td>
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<td>2005</td>
<td>R. M. Hayes</td>
<td>University of Tennessee</td>
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<td>2006</td>
<td>James L. Griffin</td>
<td>Louisiana State University</td>
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<tr>
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<td>Alan C. York</td>
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<td>Wayne Keeling</td>
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<td></td>
<td>W. Carroll Johnson, III</td>
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<td>2010</td>
<td>Krishna Reddy</td>
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<td>Barry Brecke</td>
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<td>2017</td>
<td>James Holloway</td>
<td>Syngenta</td>
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</tbody>
</table>
Excellence in Regulatory Stewardship 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 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 and his wife Becky were named as co-winners of the Outstanding Alumnus Award from the College of Agriculture and Life Sciences at North Carolina State University. Neil and Becky (also a Weed Scientist) reside in Maryville where they enjoy woodworking, fishing, swimming, and singing in church choir.
Excellence in Regulatory Stewardship Award

Trevor Israel

Trevor grew up in North Carolina and worked in the family nursery and garden center business. He received his BS in Environmental Science from NC State University. While working as an aquatic weed technician, he met Dr. Rob Richardson and pursued an MS degree in Weed Science also from NC State University. Trevor then worked as an Extension Assistant at the University of Tennessee and completed his PhD in Weed Science under the direction of Dr. Neil Rhodes. During his membership in the SWSS, he has served as a Section Chair and Graduate Student Organization President and has placed in Student Paper, Poster, and Summer Weed Contests. He has authored/co-authored articles in Weed Science and Weed Technology and numerous Extension publications. Currently, Trevor is a Field Market Development Specialist with Valent USA and handles product development and technical service responsibilities in MN, ND, and SD. He is active in the NCWSS, serving on the Strategic Planning Committee and as a student paper judge. Trevor and his wife Rhiannon reside in Sioux Falls, SD.
Past Presidents of the Southern Weed Science Society

1948-49 C.A. Brown 1982-83 J.E. Gallagher
1949-50 E.C. Tullis 1983-84 C.G. McWhorter
1950-51 O.E. Sell 1984-85 W.S. McIntire
1951-52 G.M. Shear 1985-86 R.E. Talbert
1952-53 D.A. Hinkle 1986-87 H.M. LeBaron
1953-54 W.B. Ennis, Jr. 1987-88 R.L. Rogers
1955-56 G.C. Klingman 1989-90 L.R. Oliver
1956-57 W.B. Albert 1990-91 J.R. Bone
1959-60 V.S. Searcy 1993-94 A.D. Worsham
1960-61 R.A. Darrow 1994-95 P.A. Banks
1962-63 J.T. Holstun, Jr. 1996-97 B.D. Sims
1963-64 R.F. Richards 1997-98 R.M. Hayes
1965-66 D.E. Wolf 1999-00 D.S. Murray
1966-67 D.E. Davis 2000-01 L.L. Whatley
1967-68 R.A. Mann 2001-02 J.E. Street
1968-69 W.L. Lett, Jr. 2002-03 J.W. Wells
1971-72 J.R. Orsenigo 2005-06 D.R. Shaw
1972-73 T.J. Hernandez 2006-07 J.A. Driver
1973-74 A.F. Wiese 2007-08 D.W. Monks
1974-75 W.G. Westmoreland 2008-09 A.M. Thurston
1975-76 P.W. Santlemann 2009-10 D.B. Reynolds
1976-77 A.J. Becon 2010-11 T.J. Holt
1977-78 G.A. Buchanan 2011-12 B.J. Brecke
1978-79 C.G. Parris 2012-13 T.C. Mueller
1979-80 M.G. Merkle 2014-15 S.A. Senseman
1980-81 C.E. Moore 2015-16 B. Minton
1981-82 J.B. Weber 2016-17 P. Dotray
1982-83 J.E. Gallagher
1983-84 C.G. McWhorter
1984-85 W.S. McIntire
1985-86 R.E. Talbert
1986-87 H.M. LeBaron
1987-88 R.L. Rogers
1988-89 L.B. Gillham
1989-90 L.R. Oliver
1990-91 J.R. Bone
1991-92 J.M. Chandler
1992-93 J.L. Barrentine
1993-94 A.D. Worsham
1994-95 P.A. Banks
1995-96 S.O. Duke
1996-97 B.D. Sims
1997-98 R.M. Hayes
1998-99 R.L. Ratliff
1999-00 D.S. Murray
2000-01 L.L. Whatley
2001-02 J.E. Street
2002-03 J.W. Wells
2003-04 W.W. Witt
2004-05 J.S. Harden
2005-06 D.R. Shaw
2006-07 J.A. Driver
2007-08 D.W. Monks
2008-09 A.M. Thurston
2009-10 D.B. Reynolds
2010-11 T.J. Holt
2011-12 B.J. Brecke
2012-13 T.C. Mueller
2014-15 S.A. Senseman
2015-16 B. Minton
2016-17 P. Dotray
2017-18 G. Schwarzlose
# Dedication of the Proceedings of the SWSS

<table>
<thead>
<tr>
<th>Year</th>
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<th>University or Company</th>
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<td>Hoyt A. Nation</td>
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<td>Dennis Elmore</td>
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<td>2018</td>
<td>Timothy R. Murphy</td>
<td>University of Georgia</td>
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List of SWSS Committee Members

January 31, 2018 - January 31, 2019

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

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Year</th>
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<tbody>
<tr>
<td>President</td>
<td>Bob Scott</td>
<td>2019</td>
</tr>
<tr>
<td>President Elect</td>
<td>James Holloway</td>
<td>2020</td>
</tr>
<tr>
<td>Vice-President</td>
<td>Eric Webster</td>
<td>2021</td>
</tr>
<tr>
<td>Secretary-Treasurer</td>
<td>Jim Brosnan</td>
<td>2020</td>
</tr>
<tr>
<td>Editor</td>
<td>Muthu Bagavathiannan</td>
<td>2020</td>
</tr>
<tr>
<td>Immediate Past President</td>
<td>Gary Schwarzlose</td>
<td>2019</td>
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100b. ADDITIONAL EXECUTIVE BOARD MEMBERS

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Year</th>
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<tbody>
<tr>
<td>Member-at-Large - Academia</td>
<td>Jason Bond</td>
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<tr>
<td>Member-at-Large - Industry</td>
<td>Greg Stapleton</td>
<td>2020</td>
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<tr>
<td>Member-at-Large - Ac</td>
<td>Todd Baughman</td>
<td>2021</td>
</tr>
<tr>
<td>Member-at-Large- Industry</td>
<td>Eric Castner</td>
<td>2021</td>
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<tr>
<td>Representative to WSSA</td>
<td>John Byrd</td>
<td>2020</td>
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100c. EX-OFFICIO BOARD MEMBERS

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<th>Position</th>
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<tbody>
<tr>
<td>Constitution and Operating Procedures</td>
<td>Carroll Johnson</td>
<td>2019</td>
</tr>
<tr>
<td>SWSS Business Manager</td>
<td>Kelley Mazur</td>
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</tr>
<tr>
<td>Student Representative</td>
<td>Zachary Lancaster</td>
<td>2019</td>
</tr>
<tr>
<td>Web Master</td>
<td>David Kruger</td>
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<tr>
<td>Newsletter Editor</td>
<td>Susan Scott</td>
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101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

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<tr>
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<tr>
<td>President</td>
<td>Darrin Dodds</td>
<td>2019</td>
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<tr>
<td>Secretary</td>
<td>Donnie Miller</td>
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<tr>
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<td>Hunter Perry</td>
<td>2021</td>
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101b. BOARD OF TRUSTEES - EX-OFFICIO

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Brent Sellers</td>
<td>Past President of Endowment Foundation Board of Trustees</td>
</tr>
<tr>
<td>Kelley Mazur</td>
<td>SWSS Business Manager</td>
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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.

<table>
<thead>
<tr>
<th>Chair</th>
<th>Year</th>
<th>Chairperson</th>
<th>Award Subcommittees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gary Schwarzlose*</td>
<td>2019</td>
<td>Joyce Tredaway</td>
<td>2019 Ken Smith 2019</td>
</tr>
<tr>
<td>Charlie Cahoon</td>
<td>2019</td>
<td>Jay Ferrell</td>
<td>2019 David Shaw 2019</td>
</tr>
<tr>
<td>Doug Worsham</td>
<td>2019</td>
<td>Renee Keese</td>
<td>2020 Brad Minton 2021</td>
</tr>
<tr>
<td>Ken Smith*</td>
<td>2019</td>
<td>Barry Brecke</td>
<td>2020 Scott Senseman 2021</td>
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<tr>
<td>Jim Brosnan</td>
<td>2019</td>
<td>Tom Mueller</td>
<td>2020 Peter Dotray 2021</td>
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<tr>
<td>Jay Ferrell*</td>
<td>2019</td>
<td>Drew Ellis</td>
<td>2020 Ramon Leon 2021</td>
</tr>
<tr>
<td>Todd Baughman</td>
<td>2019</td>
<td>Daniel Stephenson</td>
<td>2020 Hunter Perry 2021</td>
</tr>
<tr>
<td>Joyce Tredaway*</td>
<td>2019</td>
<td>Jay McCurdy</td>
<td>2020 Sandeep Rana 2021</td>
</tr>
<tr>
<td>Matt Goddard</td>
<td>2019</td>
<td>Stanley Culpepper</td>
<td>2020 Muthu Bagavathiannan 2021</td>
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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

<table>
<thead>
<tr>
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<th>Year</th>
<th>Chairperson</th>
<th>Award Subcommittees</th>
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</thead>
<tbody>
<tr>
<td>Ken Smith*</td>
<td>2019</td>
<td>Barry Brecke</td>
<td>2020 Scott Senseman 2021</td>
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<tr>
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<td>2019</td>
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102b. Outstanding Educator Award Subcommittee

<table>
<thead>
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<th>Year</th>
<th>Chairperson</th>
<th>Award Subcommittees</th>
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</thead>
<tbody>
<tr>
<td>Charlie Cahoon*</td>
<td>2019</td>
<td>Jason Norsworthy</td>
<td>2020 Nilda Burgos 2021</td>
</tr>
<tr>
<td>Jim Brosnan</td>
<td>2019</td>
<td>Tom Mueller</td>
<td>2020 Peter Dotray 2021</td>
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102c. Outstanding Young Weed Scientist Award Subcommittee

<table>
<thead>
<tr>
<th>Chair</th>
<th>Year</th>
<th>Chairperson</th>
<th>Award Subcommittees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jay Ferrell*</td>
<td>2019</td>
<td>Drew Ellis</td>
<td>2020 Ramon Leon 2021</td>
</tr>
<tr>
<td>Todd Baughman</td>
<td>2019</td>
<td>Daniel Stephenson</td>
<td>2020 Hunter Perry 2021</td>
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102d. Outstanding Graduate Student Award Subcommittee

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<tr>
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<th>Year</th>
<th>Chairperson</th>
<th>Award Subcommittees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joyce Tredaway*</td>
<td>2019</td>
<td>Jay McCurdy</td>
<td>2020 Sandeep Rana 2021</td>
</tr>
<tr>
<td>Matt Goddard</td>
<td>2019</td>
<td>Stanley Culpepper</td>
<td>2020 Muthu Bagavathiannan 2021</td>
</tr>
</tbody>
</table>
102e. Excellence in Regulatory Stewardship Award Subcommittee

<table>
<thead>
<tr>
<th>Member</th>
<th>Year</th>
<th>Member</th>
<th>Year</th>
<th>Member</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Shaw</td>
<td>2019</td>
<td>J. D. Green</td>
<td>2020</td>
<td>David Jordan</td>
<td>2021</td>
</tr>
<tr>
<td>Matt Goddard</td>
<td>2019</td>
<td>Larry Walton</td>
<td>2020</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

103. COMPUTER APPLICATION COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>Member</th>
<th>Year</th>
<th>Member</th>
<th>Year</th>
<th>Member</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shawn Askew</td>
<td>2019</td>
<td>Jim Brosnan</td>
<td>2020</td>
<td>Shandrea Stallworth</td>
<td>2020</td>
</tr>
<tr>
<td>Dan Reynolds</td>
<td>2019</td>
<td>Matt Goddard</td>
<td>2020</td>
<td>Kelley Mazur</td>
<td></td>
</tr>
</tbody>
</table>

104. CONSTITUTION AND OPERATING PROCEDURES COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>Member</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. Carroll Johnson</td>
<td>2019</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Member</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eric Webster</td>
<td>2020</td>
</tr>
<tr>
<td>James Holloway</td>
<td>2019</td>
</tr>
<tr>
<td>Jacob Reed</td>
<td>2019</td>
</tr>
<tr>
<td>Larry Steckel</td>
<td>2019</td>
</tr>
<tr>
<td>Jim Brosnan</td>
<td>2020</td>
</tr>
<tr>
<td>Muthu Bagavathiannan</td>
<td>2020</td>
</tr>
<tr>
<td>Phil Banks</td>
<td>2020</td>
</tr>
<tr>
<td>John Schultz</td>
<td>2021</td>
</tr>
<tr>
<td>Tom Barber</td>
<td>2021</td>
</tr>
<tr>
<td>Kelley Mazur – SWSS Business Manager</td>
<td></td>
</tr>
</tbody>
</table>

106. GRADUATE STUDENT ORGANIZATION

<table>
<thead>
<tr>
<th>Position</th>
<th>Member</th>
<th>College</th>
</tr>
</thead>
<tbody>
<tr>
<td>President</td>
<td>Zachary Lancaster</td>
<td>Arkansas</td>
</tr>
<tr>
<td>Vice President</td>
<td>Jordan Craft</td>
<td>Virginia Tech</td>
</tr>
<tr>
<td>Secretary</td>
<td>Harrison Ferebee</td>
<td>Virginia Tech</td>
</tr>
<tr>
<td>Weed Resistance &amp; Technology Committee</td>
<td>Blake Young</td>
<td>Texas A&amp;M</td>
</tr>
<tr>
<td>Endowment Committee</td>
<td>Maria Zaccaro</td>
<td>Arkansas</td>
</tr>
<tr>
<td>Social Chair/Student Program Committee</td>
<td>Seth Abugho</td>
<td>Texas A&amp;M</td>
</tr>
</tbody>
</table>
107. WEED RESISTANCE AND TECHNOLOGY STEWARDSHIP (STANDING)

<table>
<thead>
<tr>
<th>State</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>J. Tredaway</td>
</tr>
<tr>
<td>Arkansas</td>
<td>N. French, J. Norsworthy, T. Baughman</td>
</tr>
<tr>
<td>Florida</td>
<td>B. Brecke, W. Robles</td>
</tr>
<tr>
<td>Georgia</td>
<td>E. Prostko, C. Johnson, M. Cutulle</td>
</tr>
<tr>
<td>Kentucky</td>
<td>J. Green, J. Holloway, L. Steckel, A. Mills</td>
</tr>
<tr>
<td>Louisiana</td>
<td>D. Stephenson, P. Dotray</td>
</tr>
<tr>
<td>Mississippi</td>
<td>H. Perry, F. Carey, J. Bond, S. Askew</td>
</tr>
<tr>
<td>Missouri</td>
<td>M. Horak, B. Young</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

108. HISTORICAL COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>Member</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Byrd</td>
<td>2021</td>
</tr>
<tr>
<td>Andy Kendig</td>
<td>2019</td>
</tr>
</tbody>
</table>

109. LEGISLATIVE AND REGULATORY COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>Member</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angela Post</td>
<td>Chair</td>
</tr>
<tr>
<td>Lee Van Wychen</td>
<td>(ad hoc) WSSA Science Policy Director</td>
</tr>
<tr>
<td>Donn Shilling</td>
<td>(ad hoc) Chair of the WSSA Science Policy</td>
</tr>
<tr>
<td>Greg Kruger</td>
<td>(ad hoc), EPA liaison</td>
</tr>
<tr>
<td>Jason Bond</td>
<td>Member-at-Large - Academia</td>
</tr>
<tr>
<td>Greg Stapleton</td>
<td>Member-at-Large - Industry</td>
</tr>
<tr>
<td>Todd Baughman</td>
<td>Member-at-Large – Academia</td>
</tr>
<tr>
<td>Eric Castner</td>
<td>Member-at-Large - Industry</td>
</tr>
<tr>
<td>Gary Schwarzlose</td>
<td>Past President</td>
</tr>
</tbody>
</table>

110. LOCAL ARRANGEMENTS COMMITTEE - (STANDING)

<table>
<thead>
<tr>
<th>Member</th>
<th>Year</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Todd Baughman</td>
<td>2019</td>
<td>Oklahoma City, OK (SW)</td>
</tr>
<tr>
<td>Darin Dodds</td>
<td>2020</td>
<td>Biloxi, MS (MS)</td>
</tr>
<tr>
<td>Jim Brosnan</td>
<td>2021</td>
<td>(SE)</td>
</tr>
</tbody>
</table>
111. **LONG-RANGE PLANNING COMMITTEE (STANDING)** –
Shall consist of the Past-Past President (chair), Past-President, President, and President-Elect.

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter Dotray</td>
<td>2019</td>
</tr>
<tr>
<td>Gary Schwarzlose</td>
<td>2020</td>
</tr>
<tr>
<td>Bob Scott</td>
<td>2021</td>
</tr>
<tr>
<td>James Holloway</td>
<td>2022</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Name and Geographical Area</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eric Webster (SW)</td>
<td>2019</td>
</tr>
<tr>
<td>Angela Post (SE)</td>
<td>2021</td>
</tr>
<tr>
<td>Andrew Price (MS)</td>
<td>2023</td>
</tr>
<tr>
<td>James Holloway</td>
<td>2020</td>
</tr>
<tr>
<td>Luke Etheredge (SW)</td>
<td>2022</td>
</tr>
<tr>
<td>Jim Brosnan (SE)</td>
<td>2024</td>
</tr>
<tr>
<td>Kelley Mazur – SWSS Business Manager</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gary Schwarzlose</td>
<td>2019</td>
</tr>
</tbody>
</table>

114. **PROGRAM COMMITTEE - 2019 MEETING (STANDING)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>James Holloway</td>
<td>2019</td>
</tr>
<tr>
<td>Eric Webster</td>
<td>2020</td>
</tr>
</tbody>
</table>

115. **PROGRAM COMMITTEE - 2020 MEETING (STANDING)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eric Webster</td>
<td>2020</td>
</tr>
<tr>
<td>Elected VP (in-coming)</td>
<td>2021</td>
</tr>
</tbody>
</table>
116. RESEARCH COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>State</th>
<th>Representative</th>
<th>State</th>
<th>Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>J. Tredaway</td>
<td>North Carolina</td>
<td>W. Everman</td>
</tr>
<tr>
<td>Arkansas</td>
<td>N. Burgos</td>
<td>Oklahoma</td>
<td>T. Baughman</td>
</tr>
<tr>
<td>Florida</td>
<td>P. Dittmar</td>
<td>Puerto Rico</td>
<td>W. Robles</td>
</tr>
<tr>
<td>Georgia</td>
<td>E. Prostko</td>
<td>South Carolina</td>
<td>M. Marshall</td>
</tr>
<tr>
<td>Kentucky</td>
<td></td>
<td>Tennessee</td>
<td>L. Steckel</td>
</tr>
<tr>
<td>Louisiana</td>
<td>D. Miller</td>
<td>Texas</td>
<td>P. Dotray</td>
</tr>
<tr>
<td>Mississippi</td>
<td>J. Byrd</td>
<td>Virginia</td>
<td>S. Askew</td>
</tr>
<tr>
<td>Missouri</td>
<td>K. Bradley</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

117. RESOLUTIONS AND NECROLOGY COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>Representative</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Black</td>
<td>2021</td>
</tr>
<tr>
<td>Ryan Edwards</td>
<td>2020</td>
</tr>
<tr>
<td>Michael Flessner</td>
<td>2019</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>State</th>
<th>Representative</th>
<th>State</th>
<th>Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippi</td>
<td>D. Dodds **</td>
<td>Missouri</td>
<td>J. Heiser</td>
</tr>
<tr>
<td>Alabama</td>
<td>J. Tredaway</td>
<td>North Carolina</td>
<td>W. Everman</td>
</tr>
<tr>
<td>Arkansas</td>
<td>N. Burgos</td>
<td>Oklahoma</td>
<td>T. Baughman</td>
</tr>
<tr>
<td>Florida</td>
<td>G. MacDonald</td>
<td>South Carolina</td>
<td>M. Cuttlle</td>
</tr>
<tr>
<td>Georgia</td>
<td>W. Vencill</td>
<td>T. Mueller</td>
<td>D. Ellis</td>
</tr>
<tr>
<td>Kentucky</td>
<td></td>
<td>Texas</td>
<td>P. Dotray</td>
</tr>
<tr>
<td>Louisiana</td>
<td>E. Webster</td>
<td>Virginia</td>
<td>S. Askew</td>
</tr>
<tr>
<td>Mississippi</td>
<td>D. Reynolds</td>
<td>Puerto Rico</td>
<td>W. Robles</td>
</tr>
<tr>
<td>Ad Hoc – Current</td>
<td>Bruce Kirksey</td>
<td>Ad Hoc – Previous</td>
<td>Cheryl Dunne</td>
</tr>
</tbody>
</table>

119. STUDENT PROGRAM COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>Representative</th>
<th>Year</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlie Cahoon</td>
<td>2019</td>
<td>**</td>
</tr>
<tr>
<td>Seth Abugho</td>
<td>2019</td>
<td>Graduate Student Organization Rep. – Ex-officio</td>
</tr>
<tr>
<td>Kelly Backscheider</td>
<td>2020</td>
<td></td>
</tr>
<tr>
<td>Peter Eure</td>
<td>2021</td>
<td></td>
</tr>
</tbody>
</table>
120. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Name</th>
<th>Year</th>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacob Reed *</td>
<td>2019</td>
<td>Kelly Backscheider</td>
<td>2020</td>
<td>Bob Scott</td>
<td>2021</td>
</tr>
<tr>
<td>Peter Eure</td>
<td>2019</td>
<td>Tom Barber</td>
<td>2020</td>
<td>Peter Dotray</td>
<td>2021</td>
</tr>
</tbody>
</table>

121. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

<table>
<thead>
<tr>
<th>State</th>
<th>Name</th>
<th>Year</th>
<th>State</th>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>Steve Li</td>
<td>2019</td>
<td>NC</td>
<td>Bobby Walls</td>
<td>2019</td>
</tr>
<tr>
<td>AR</td>
<td>Tom Barber</td>
<td>2019</td>
<td>NC</td>
<td>Katie Jennings</td>
<td>2019</td>
</tr>
<tr>
<td>FL</td>
<td>Calvin Odero</td>
<td>2019</td>
<td>OK</td>
<td>Todd Baughman</td>
<td>2019</td>
</tr>
<tr>
<td>GA</td>
<td>Scott Tubbs</td>
<td>2019</td>
<td>SC</td>
<td>Alan Estes *</td>
<td>2019</td>
</tr>
<tr>
<td>KY</td>
<td>Mike Harrell</td>
<td>2019</td>
<td>TN</td>
<td>Drew Ellis</td>
<td>2019</td>
</tr>
<tr>
<td>LA</td>
<td>Jeff Ellis</td>
<td>2019</td>
<td>TX</td>
<td>Jacob Reed</td>
<td>2019</td>
</tr>
<tr>
<td>MS</td>
<td>Te-Ming Paul Tseng</td>
<td>2019</td>
<td>VA</td>
<td>Shawn Askew</td>
<td>2019</td>
</tr>
</tbody>
</table>
Minutes

SWSS Board of Directors Meeting
Sunday, January 21, 2018
Hyatt Regency, Atlanta, GA
5:00-6:00pm

Meeting called to order by Gary Schwarzlose at 5:04 PM, January 21, 2018

Those in attendance included:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tom Mueller</td>
<td>Acting secretary</td>
<td><a href="mailto:tmueller@utk.edu">tmueller@utk.edu</a></td>
</tr>
<tr>
<td>Bob Scott</td>
<td>President-Elect</td>
<td><a href="mailto:bscott@uaex.edu">bscott@uaex.edu</a></td>
</tr>
<tr>
<td>Greg Stapleton</td>
<td>Member at Large, Industry</td>
<td><a href="mailto:Gregory.stapleton@basf.com">Gregory.stapleton@basf.com</a></td>
</tr>
<tr>
<td>Jason Bond</td>
<td>Member at Large, Academia</td>
<td><a href="mailto:jbond@drec.msstate.edu">jbond@drec.msstate.edu</a></td>
</tr>
<tr>
<td>Peter Dotray</td>
<td>Past President</td>
<td><a href="mailto:peter.dotray@ttu.edu">peter.dotray@ttu.edu</a></td>
</tr>
<tr>
<td>Henry McLean</td>
<td>Local Arrangements Chair</td>
<td><a href="mailto:henry.mclean@syngenta.com">henry.mclean@syngenta.com</a></td>
</tr>
<tr>
<td>John Byrd</td>
<td>WSSA representative</td>
<td><a href="mailto:jbyrd@pss.msstate.edu">jbyrd@pss.msstate.edu</a></td>
</tr>
<tr>
<td>Janis McFarland</td>
<td>WSSA President</td>
<td><a href="mailto:Janis.mcfarland@syngenta.com">Janis.mcfarland@syngenta.com</a></td>
</tr>
<tr>
<td>Matt Goddard</td>
<td>Member at large, Industry</td>
<td><a href="mailto:mjgodd@monsanto.com">mjgodd@monsanto.com</a></td>
</tr>
<tr>
<td>Angela R Post</td>
<td>Member at large, academia</td>
<td><a href="mailto:angela_post@ncsu.edu">angela_post@ncsu.edu</a></td>
</tr>
<tr>
<td>(underscore in email)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee Van Wychen</td>
<td>WSSA Science Policy</td>
<td><a href="mailto:Lee.VanWychen@wssa.net">Lee.VanWychen@wssa.net</a></td>
</tr>
<tr>
<td>Tara Steinke</td>
<td>Business Manager</td>
<td><a href="mailto:tara@imigroup.org">tara@imigroup.org</a></td>
</tr>
<tr>
<td>James Holloway</td>
<td>Vice President</td>
<td><a href="mailto:james.holloway@syngenta.com">james.holloway@syngenta.com</a></td>
</tr>
<tr>
<td>Gary Schwarzlose</td>
<td>President</td>
<td><a href="mailto:gary.schwarzlose@bayer.com">gary.schwarzlose@bayer.com</a></td>
</tr>
</tbody>
</table>

Written copy of agenda distributed by Schwarzlose. Goddard moved, Bond seconded to approve agenda. Motion passed (MP).

Minutes were previously sent out to all BOD members for review. Scott moved, Dotray seconded to approve minutes. MP.

Financial summary made by Mueller (based on report submitted by Brosnan). No appreciable change in net worth of SWSS as of May 31, 2017 fiscal year end. Holloway moved, Goddard seconded to approve. MP
Steinke provided specifics of financial report for SWSS, including specifics of this meeting and other financial aspects. She requested guidance on how to proceed with inventory of SWSS weed ID DVDs, and Bob Scott and Jason Bond expressed interest in buying “boxes” of them for their use. Scott moved, Byrd seconded to accept report. MP

Local arrangements report by McLean. Listed all the members of his committee (Schwarzlose requested complete list for his use during business meeting). Total hotel bill will be ~63K. All arrangements for meeting appear to be ready. Some BOD members encourage some signs/staff to direct members to meeting locations. Holloway moved, Dotray seconded to accept report. MP

Program report by Scott. He shared specifics of 2018 program, including some issues related to administration of title and abstract submission site. He shared with the group the challenge of learning the entire program building process, and some BOD suggested the vice president be more involved in the program development to aid in the learning process. Byrd moved, Post seconded to approve report. MP

WSSA report by Van Wychen and McFarland. Mike Barrett stepped down as WSSA-EPA liaison and new person in same position is Greg Kruger (University of Nebraska). Donn Shilling stepping down as USDA-NIFA fellow. No successor yet chosen. Van Wychen requested SWSS to provide a SWSS representative to the WSSA public awareness committee. New WSSA CAST liaison is Dallas Peterson. Van Wychen also shared various updates on federal issues (provided written report). He emphasized the importance of the annual weed survey. Schwarzlose expressed need for the SWSS to conduct this activity. Scott moved, Stapleton seconded to approve report. MP

WSSA rep Byrd updated BOD including upcoming WSSA meeting next week. Future meeting locations include New Orleans (2019), and Hawaii/west coast (2020). Dotray moved, Goddard seconded to approve. MP

Schwarzlose moved old and new business to Monday AM BOD meeting to allow members to attend a portion of the SWSS mixer/training occurring at that time.

Holloway moved, Bond seconded to adjourn meeting at ~6:15 PM. MP
SWSS Board of Directors Meeting

Monday, January 22, 2018
Hyatt Regency. Atlanta, GA
11:00am – 12:00pm

Attendees:
Jim Brosnan (Secretary); Muthu Bagavathiannan (Editor); John Brewer (Grad Student Representative); James Holloway (Vice President); John Byrd (WSSA Representative); Gary Schwarzlose (President); Tara Steinke (Business Manager); Bob Scott (President-Elect); Greg Stapleton (Member at Large – Industry); John Richburg (Sustaining Membership); Pete Dotray (Past President); Jason Bond (Member at Large – Academia); Matt Goddard (Member at Large-Industry); Angela Post (Member at Large – Academia); Janis McFarland (WSSA President); Brent Sellers (Endowment Committee)

Schwarzlose called meeting to order at 11:01 am

Sunday Evening Report – B. Scott

Scott gave report on graduate student mixer from Sunday evening. Commented that 26 students attended and overall event went well. Recommendation made by Scott to continue with this event moving forward. Scott suggested several speakers for next year. Brosnan suggested an event with the Super Bowl given that meeting is a week later and overlaps with the game.

Proceedings Update – M. Bagavathiannan

Bagavathiannan reported that the 2017 proceedings document is online now, dedicated to Dr. Dennis Elmore. Document totaled 425 pages with 295 abstracts. This is down from 2016 (by 200 abstracts), likely because 2016 was a joint meeting with WSSA. Communicated thanks for chance to serve SWSS and will expedite process for this year.

Endowment Committee Update - B. Sellers

The SWSS Endowment Foundation Board met at 8:00 AM on Monday, January 22. The golf tournament was held the previous day, with a net income of $7000. Only 15 of the 29 participants that signed up for the event actually participated. The Foundation Enrichment Scholarship winners provided their summaries of their experiences during the general session. Applications for the 2018 Enrichment Scholarship will be due on April 6, 2018, and winners should be notified by the end of April. A special note on the scholarship is that a donation by Gylling Data Management will be utilized for 1 of the 3 annual scholarship awards for the next several years. The number of awards may increase, but will be dependent upon the number of applicants and will be at the discretion of the Foundation Board. We also voted on a change to our MOPs, which basically helped clarify what the Endowment Foundations actually funds within the society.
Legislative Committee Update - A. Post

Eight attendees at committee meeting this morning. Talked about a survey about what success looks like for dicamba in 2018 – group decided that this wouldn’t be the best direction for SWSS to go in. Deferred this activity to new WSSA committee on off-target movement (led by Kevin Bradley). Recommend that all regions be represented on that committee.

WSSA Recommendations for 2018 Farm Bill Discussed – mainly #3. All other points seemed easy to support but there was debate over #3 (extending exclusivity if stewardship practices are upheld), debate regarding how this would affect large vs. small companies.

EPA released risk assessment documents that glyphosate is not likely to be carcinogenic and included studies not included in prior reports from other health associations. A 60-day public comment period will be coming and SWSS will be asked to sign on in support.

Sustaining Membership Update- John Richburg

Those attending the committee meeting consisting of John Richburg (Chair-rotating off), Jacob Reed (New-Chair) and Tom Barber on January 22th, 2018. One key item of business discussed included status of 2018 Sustaining Members’ dues (21 of 26 have paid) and efforts to make sure those who have not paid are contacted. Overall support for additional activities of SWSS remained strong and the committee recommended the same “master invoice” approach going forward. In addition, the committee discussed new potential Sustaining Member companies and came up with the following list.

SePRO – contact Kyle Briscoe – kyleb@sepro.com

Nichino – Scott Ludwig – sludwig@nichino.net

West Central – jrose@wcdst.com

Old Business

None to report – Student Contest Report deferred to Annual Meeting

New Business

McFarland suggested that SWSS begin discussing the 2019 WeedOlympics. WSSA also working on metrics for strategic plan and would like a contact from SWSS to work with on this project.

Schwarzlose adjourns meeting at 11:54 am.
Meeting Called to Order by G. Schwarzlose at 5:00pm

Motion to approve agenda made by Schwarzlose. Seconded by J. Byrd. Motion passes unanimously.
Business Manager’s Report for the 2018 SWSS Meeting

Report submitted by: T. Steinke

All tax forms and bills were paid on time during the past year. The attached financial statements show that SWSS is in good financial order. Our current (as of January 19, 2018) financial status is attached. We have a total of $415,529.11 on hand (this includes 672.00 worth of Weed DVD’s, which has been reduced from $4236.00 on last years financials). I will send the Finance Committee the financials and provide detailed investment information for when we meet.

Currently, 341 SWSS members have registered for the Annual Meeting (95 students registered). Of the 95 students 55 have signed up for the Sunday Evening Symposia. There are 4 spouse/friend registrations. We filled 86% of the room block at the hotel, so we will receive all of the concessions listed in the contract. The SWSS Endowment Golf Tournament has 22 golfers registered (up from 17 last year). Award plaques and the Awards Program were printed and shipped to the meeting. The Local Arrangements Chair, Henry McLean and his committee have done an outstanding job of getting the particulars of the meeting organizes.

I will work with the Site Selection Committee to choose a location for our 2021 meeting. It should be in the Southeast part of our region (Florida, Georgia, North Carolina, South Carolina, Virginia or Puerto Rico). The committee will have a recommendation at the summer Board Meeting. The next Annual Meeting will be held in Oklahoma City, OK at the Renaissance Oklahoma City Convention Center Hotel. The dates for the 2019 Annual Meeting are February 3-7, 2019.

Crowd Compass is the Mobile Meeting App that we chose to use for the 2018 meeting. It has come together nicely. I appreciate the ease of recognizing our Sustaining Members. Gary Schwarzlose has been a big help on completing the Meeting App.
Local Arrangements Committee Report

Report submitted by: Henry McLean

Schwarzlose recognizes entire committee for efforts on 2018 Program. Applauded by all attendees.
2018 SWSS Program Report

Report submitted by: Bob Scott

I want to thank Joyce Lancaster, Tara Steinke, President Gary Schwarzlose and Henry Mclean for all their assistance with the 2018 Program. I would also like to thank all the section chairs and student contest chair Darin Dodds for their input. The program contains 293 presentations, 119 of which are posters. We have 83 students entered into the contests. I am very pleased that this year we will be hosting three symposia. The topics are Dicamba Issues in the Mid-South, Metabolic Herbicide Resistance and a turf weed control workshop. In addition, the student program includes a special speaker on Sunday night titled “Getting past the earbuds” by John Montuori. This talk deals with working across generational divides. This year’s program will be the first available to attendees as a digital version only, this version is supported by the Attendee-Hub app. New efforts to condense the number of user identities created on the wssa abstracts website were successful and I believe greatly aided in the production of the Program. There are still a few bugs and multiple name listings that need to be sorted out. One problem that has been identified is that co-authors who have not updated their status or membership information in a while might have been listed as an affiliate of a former University or employer. A lot of work has gone into this year’s program and we sincerely hope that you all enjoy it.
Director of Science Policy Report

Report submitted by: Dr. Lee Van Wychen, Jan 15, 2018

**WSSA-EPA Liaison:** Mike Barrett has served as WSSA-EPA Liaison for the past 4 years and made his last visit to EPA in December. I cannot express enough my sincere thanks and appreciation for his incredible service to WSSA in this role! Thank you Mike! Greg Kruger has hit the ground running and already made two visits to EPA, which overlapped with Mike. There is no shortage of weed science issues to deal with and I have complete confidence that Greg will pick things up where Mike left off.

**WSSA-NIFA Fellow:** Donn Shilling has served as WSSA’s first USDA-NIFA Fellow for nearly 3 years now working to increase NIFA’s understanding of weed science issues and vice-versa. Donn feels the time is right to step down in this role and allow the next NIFA Fellow to build on his efforts. Thank you Donn for your service!

**FY 2018 Federal Budget:** The government is running on a continuing resolution (CR) until Jan. 19. It is unlikely that the House and Senate will reach a budget agreement by then and there is talk they will pass another CR funding the government through Feb. 19 and possibly for the remainder of the 2018 fiscal year. The House and Senate have passed individual FY 2018 spending bills, but none have gone to conference to iron out differences because Congress still needs to pass a budget resolution that would waive sequestration caps. In addition there are other high profile issues (i.e. dreamers, border wall, debt ceiling, federal disaster aid) that could further complicate this. The ag approps numbers are in pretty good shape, provided we don’t have to deal with sequestration caps.

**Many Agency Leadership Positions Still Vacant:** Typically, more than a year after the Presidential election, the senior appointees of most agencies are in place. However, this Administration, for whatever reasons, has been exceedingly slow in selecting, moving, and confirming subcabinet positions while excessive media scrutiny and a slim Senate majority has derailed a number of nominees. EPA still doesn’t have a Deputy Administrator (Andrew Wheeler has been nominated), nor an Assistant Administrator for the Office of Chemical Safety and Pollution Prevention (OCSPP) which oversees the Office of Pesticide Programs (OPP).

About half of the Senate confirmed leadership positions at both USDA and Dept. of Interior still remain unfilled. There is an effort to get Rich Bonanno, Associate Dean and head of NC State Extension, nominated for the USDA Under Secretary for Research, Education and Economics, which is USDA’s “Chief Scientist” that oversees USDA-ARS, NIFA, ERS, and NASS. Bill Northey, former Iowa Secretary of Ag who spoke at the 2016 NCWSS meeting, has been approved by the Senate Ag Committee for USDA Under Secretary for Farm Production and Conservation. However, his final confirmation by the full Senate has been put on hold by Sen. Ted Cruz (TX) due to Cruz’s concerns about ethanol and the Renewable Fuel Standard.

**USDA Leadership Positions Confirmed:** USDA Secretary- Sonny Perdue (GA); Deputy Secretary- Steve Censky (MN); Under Secretary for Trade and Foreign Agriculture- Ted McKinney (IN); and Under Secretary for Marketing and Regulatory Programs- Greg Ibach (NE).
**Divisive Dicamba:** Without a question, the most divisive issue I have faced in my 12+ years as Director of Science Policy. EPA announced label changes for Extendimax, Engenia, and Fexapan on Oct. 13, 2017. EPA’s objective is to minimize the number of off-target incidents in 2018, while also recognizing the utility of the technology in weed resistance management. During the PPDC meeting at EPA in November, EPA made it clear that a repeat of 2017 is unacceptable and posed the question “What does success look like in 2018?” A common theme in all the dicamba related meetings I’ve participated in is EPA’s need for more research and information on 1) physical drift, 2) contamination, 3) temperature inversions, 4) volatility, and 5) misuse. There is also a massive dicamba education and training effort underway that many of our members are involved with. I’ve heard some concerns that all the focus on dicamba is draining resources from other pesticide stewardship activities.

**Glyphosate Not Carcinogenic:** The International Agency for Research on Cancer’s (IARC) witch hunt on glyphosate, unfortunately, has been one of best public misinformation and fear mongering campaigns ever conducted. WSSA is on record stating that “the IARC review process for glyphosate was flawed and represents a case of gross scientific negligence”. In November, updated results from the “gold standard” Agricultural Health Study (AHS) that follows the health outcomes of 44,932 glyphosate applicators showed that glyphosate was not statistically significantly associated with cancer at any site. IARC omitted the AHS in its analysis.

On December 19, 2017, EPA released its human health draft risk assessment and supporting documents that concludes that glyphosate is not likely to be carcinogenic to humans and found no other meaningful risks to human health when the product is used according to the label. EPA will be opening a 60-day public comment period in early 2018 that will be posted in glyphosate’s registration review docket EPA-HQ-OPP-2009-0361 on www.regulations.gov.

**2018 Farm Bill Recommendations:** Congress will begin work on a new Farm Bill in 2018. Some of the recommendations the science policy committee has been exploring include: 1) promote Areawide IPM programs and funding within USDA-NIFA; 2) incentivize cover crop use and crop insurance programs for weed resistance management; 3) extend data exclusivity period for herbicide registrants in exchange for implementing resistance management stewardship practices; 4) require a National Program Leader for Weed Science in both USDA-ARS and USDA-NIFA; 5) continue support for the Foundation for Food and Agricultural Research (FFAR) and add “invasive species” to its list of priorities; and 6) increasing research funding for weed genomics and “intelligent” weed removal technologies (i.e. precision spraying, self-learning weed removal robots, CO₂ lasers, etc.).

**EPA Finalizes Herbicide Resistance Management Guidance:** Referred to as PRN 2017-2, this applies to all herbicide uses, except for those applied in residential settings (i.e. lawns). Weed resistance management labels will be required on any new herbicide products as well as existing herbicides that go through registration review. Most of the resistance management “elements” will be addressed via the herbicide label, which will include the following:

1. Listing the herbicide mechanism-of-action (MOA), according to the WSSA MOA classification scheme.
• Clearly expressing application parameters and full-labeled use rates
• Recommendations to scout the treatment area both before and after application
• How to identify suspected resistance
• How to report lack of performance and proactively take action before escaped weeds become widespread
• A list of herbicide resistance BMP’s using WSSA and HRAC guidance
• Information to help make growers and applicators aware of herbicide resistant weeds found in their local area

The registrants will also be responsible for reporting new cases of suspected and confirmed resistance to EPA and users, and in certain circumstances, may be required to follow additional guidance such as “apply only with another MOA”.

The last major part of PRN-2017-2 will be dependent upon the weed management stakeholder community to provide educational and training materials for applicators and users at the local level. Further guidance for developing resistance management plans and remedial action plans are provided in Appendix 1 of PRN 2017-2.

**USDA Will Re-engage Stakeholders on Revisions to Biotechnology Regulations:** APHIS withdrew its proposed rule on biotechnology regulations revisions in November and will re-engage with stakeholders to determine the most effective, science-based approach for regulating the products of modern biotechnology while protecting plant health. The National and Regional Weed Science Societies submitted comments on the proposal in June. While we complimented APHIS on the many positive aspects of the proposal, we encouraged APHIS to re-propose a rule that minimizes regulatory uncertainty related to their weed risk assessment model.

**Weed-Free Certification Programs:** What is the role of the weed science societies in promoting weed-free certification programs such as the North American Weed Free Forage Program that was developed by the North American Invasive Weed Management Association (NAISMA).

**Monarchs and Milkweed:** Excellent monarch numbers were reported in the Upper Midwest in July 2017 (the highest in 25 years at some sites), but Hurricane Harvey may have decimated the monarchs on their fall migration back through Texas. The U.S. Fish and Wildlife Service (FWS) is working to assess the effectiveness of monarch conservation efforts. JUNE 2019- anticipated timeframe for when FWS will make a decision on whether the monarch butterfly should be listed under the Endangered Species Act.

**Proposal Would Delay WOTUS “Effective Date” Until 2020:** EPA and the Army Corps of Engineers have proposed to delay the effective date of the 2015 Waters of the United States (WOTUS) rule in order to provide regulatory certainty and prevent any confusion from a potential Supreme Court decision in early 2018. This action is separate from the President’s Executive Order on WOTUS issued in Feb. 2017.

EPA and the Corp are expected to finalize the delay in the effective date of the 2015 WOTUS rule in early 2018, which means that the 2015 WOTUS rule would not be effective until
sometime in 2020, thus providing EPA another two years to rescind the rule and promulgate a replacement rule.

**NPDES Fix Legislation:** There is a renewed effort on the Senate side to pass a NPDES fix bill, S. 340, which is the companion bill to H.R. 953 on the House side that was passed on May 24, 2017. The bills amend FIFRA and the Clean Water Act to prohibit the EPA from requiring duplicative permitting under the National Pollutant Discharge Elimination System (NPDES) for a discharge of a pesticide from a point source into navigable waters if the pesticide is already approved for aquatic use under FIFRA. The six national and regional weed science societies endorsed letters of support to both the House on H.R. 953 and the Senate on S. 340 and recently endorsed a letter urging the House Ag Committee to include the NPDES-fix language in the 2018 Farm Bill.

**National Invasive Species Awareness Week (NISAW): February 26 – March 2, 2018**
We are working with House Invasive Species Caucus co-chairs Rep. Elise Stefanik (NY) and Mike Thompson (CA) to host a luncheon seminar each day on an invasive species topic as well as a webinar in the afternoon. A Congressional Reception and Federal Agency Fair is scheduled for Wednesday, Feb. 28 beginning at 4:30 p.m. We are also trying to coordinate events with the Invasive Species Advisory Committee (ISAC) who will be meeting that week in DC. Activities will be posted on www.nisaw.org as they become available. If you are interested in getting involved with NISAW or would like to sponsor events during the week, please contact me or Rick Otis with the Reduce Risks from Invasive Species Coalition (RRISC) at rick.otis@rrisc.org.

**Survey of Most Common and Troublesome Weeds:** See http://wssa.net/wssa/weed/surveys/ for 2017 results summary for weeds in grass crops, pasture and turf. The 2018 survey will focus on weeds in the following non-crop areas: 1) aquatic – irrigation & flood control, 2) aquatic – lakes, rivers, reservoirs, 3) aquatic – ponds, 4) forestry, 5) natural areas – parks, wildlife refuges, 6) ornamentals – landscape, field, and 7) right-of-ways – rail, road, utility. I’ll be sending out a survey to all national and regional weed science members in the U.S. and Canada within the next month.
WSSA Representative Report

Report submitted by: J. Byrd

WSSA Officers and Board of Directors
President, Janis McFarland, 336-632-2354, janis.mcfarland@syngenta.com President-Elect, Scott Senseman, 865-974-8033, ssensema@utk.edu
Vice-President, Larry Steckel, 731-424-1643, lsteckel@utk.edu
Past-President, Kevin Bradley, 573-882-4039, bradleyke@missouri.edu Constitution/MOPs, Mark Bernards, 309-298-1569, ML-Bernards@wiu.edu Secretary, Hilary Sandler, 508-295-2212, hsandler@umass.edu
Treasurer, Rick Boydston, 509-786-9267, rick.boydston@ars.usda.gov
Dir. of Science Policy, Lee Van Wychen, 202-746-4686, Lee.VanWychen@wssa.net
Dir. of Publications, Sarah Ward, 970-491-2102, sarah.ward@colostate.edu
Member-at-Large, Andrew Kniss, 307-766-3949, akniss@uwyo.edu
Member-at-Large, Bryan Young, 765-496-1646, BryanYoung@purdue.edu
APMS Representative, Rob Richardson, 919-515-5653, rob_richardson@ncsu.edu
CWSS Representative, Eric Page, 519-738-1229, eric.page@agr.gc.ca
NCWSS Representative, Reid Smeda, 573-882-1329, smedaR@missouri.edu
NEWSS Representative, Mike Fidanza, 610-396-6330, maf100@psu.edu
SWSS Representative, John Byrd, 662-325-4537, jdb4@msstate.edu
WSWS Representative, Marty Schraer, 208-250-0937, marty.schraer@syngenta.com
Grad Student Representative, Chase Samples, 662-587-0290, cs572@msstate.edu

Newly elected officers are Bill Curran, Vice-President, Phil Banks Treasurer, Dawn Refsell Member-at-Large, Greg Elmore NCWSS Representative; Secretary TBD.

2018 WSSA meeting will be January 29 through February 1, Crystal City Marriott, Arlington, VA. This year the $650 registration fee to attend the meeting will include 1 year WSSA membership. There will be six symposia: Grade Report for New Dicamba Technology in 2017, Herbicide Metabolism in Crops and Weeds: A Revisit, Current Understanding, and New Insights, Learning by Listening: Herbicide Resistance Listening Sessions, Pesticide Registration in the U.S. and How the WSSA Can Inform the Process, Fostering Sustainable Programs to Improve Pesticide Applications and Promote Resistance Management, and The State of the Weed Control Industry in 2018, plus a teaching workshop. WSSA will use Guidebook as the mobile app for the 2018 meeting. Tours to the Botany Department of the Natural History Museum, Botanic Garden, breakfast for Women in Weed Science, a graduate
student luncheon, workshop, and presentation competitions are planned. WSSA will use Guidebook as the mobile app for the 2018 meeting.

Eric Gustafson with IMI Group is the new Executive Secretary. The transition to Cambridge University Press to handle journals was completed the summer of 2017. Anna Hofvander is the Publishing Editor [(212) 337-5080, ahafvander@cambridge.org] for WSSA. WSSA should receive funding from Cambridge University Press to fund graduate student awards.

Lee Van Wychen is summarizing surveys of most common and most troublesome weeds of various crops. Focus for 2017 was grass crops, corn, sorghum, small grains, rice, turf, and pasture, rangeland, and hay. The focus for 2018 will be aquatic – irrigation & flood control, aquatic – lakes, rivers, reservoirs, aquatic – ponds, forestry, natural areas – parks, wildlife refuges, ornamentals, and right-of-ways – rail, road, utility

A graduate student Enrichment program like that of SWSS will start in 2018 and be funded by industry. One student from each region and Canada will be selected to participate. Selected students must choose an enrichment opportunity outside their home region.

Greg Kruger is the new EPA liaison, replacing Mike Barrett. Donn Shilling is completing his 3 year term as the first NIFA representative; WSSA will look for replacement after the 2018 meeting (WSSA NIFA Fellow webpage: http://wssa.net/society/wssa-nifa-fellow/). Dallas Peterson will be the new CAST representative; Carl Libbey (225 S. 10th Street, Mount Vernon, WA 98274, newsletter@wssa.net, Phone: (360) 708-5543) the Newsletter Editor.

**Future meetings**

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

Possible joint conference with WSWS in 2020? Proposals have been received from Hyatt Regency, Maui, HI, January 3-10; Hilton Waikoloa Village, Waikoloa, HI, February 7-15; Sheraton Waikiki, Oahu, HI, January 31-February 7 or February 21-28, and Hilton Doubletree, San Diego, CA, January 30-February 7.
Endowment Committee Report

Monday January 23, 2017
Hyatt Regency-The Wynfrey Hotel; Avon Room, Birmingham, Alabama

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

Absent: Renee Keese

ENDEWMENT BOARD:

James Holloway (2017), President  Brent Sellers (2018), Secretary
Hunter Perry (2021)    Gary Schwarzlose (2022); newly elected

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

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

Old Business

1. 2016 SWSS Student Enrichment Scholarship

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

2. Financials

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

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lxxiii
Security Value Change 1,443.75
TOTAL INFLOWS 24,050.90

OUTFLOWS
Account Fee 1,495.15  RBC fees
Annual Fee 10.00
Expense For Golf Tournament 5,703.31
Scholarship 4,500.00  three $1500 scholarships
Student Paper Contest 2,400.00  Held at annual meeting
Supplies 0.00
Tax Charge 15
Tax Preparation 460.33
TOTAL OUTFLOWS 14,583.79

OVERALL TOTAL 9,467.11

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

New Business

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

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

3. Nominees to the Endowment Board for election
Two names were motioned by Donnie and seconded by Darrin, Larry Steckel, UT and Josh Copes, LSU. Passed.

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

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

Meeting adjourned at 8:54 am.

Respectfully submitted,

Brent A. Sellers, Secretary
Southern Weed Contest Committee Report

Report submitted by: Darrin Dodds

The 2017 SWSS weed contest was held at the Syngenta Research Farm in Vero Beach, FL on August 1st and 2nd. 64 students from nine universities participated in the 2017 contest which represented 13 graduate teams and 3 undergraduate teams. The contest ran very smoothly thanks to the diligent efforts of Rakesh Jain, Cheryl Dunne, Joe Wuerfel, Ethan Parker, James Holloway, Eric Rawls, and many others.

The 2018 contest will be held August 8th at the Memphis AgriCenter and will be hosted by Bruce Kirksey. The 2019 Weed Olympics will be held in Champaign, IL and will be co-hosted by Valent Corp. and BASF. The SWSS Weed Contest Committee voted in favor of participating in the 2019 Weed Olympics.

The SWSS Weed Contest Committee also voted in favor of the following: returning the entire scoresheet to each participating team with names of participants from other universities sanitized for privacy purposes; develop and utilize and standard scoresheet to be used to each host each year; limit the crop/weed problem solving portion of the contest to 6 crops; limit unknown herbicide ID to 25 herbicides; and limit the number of weeds on the weed list to 100. In addition, the rules and accompanying weed list, herbicide list, crops, etc. should be distributed to the SWSS membership by March 1 of each year.
Secretary Treasurer’s Report

Report submitted by: Jim Brosnan

Secretarial

Minutes are included in the 2017 proceedings posted on the website. No changes were noted.

Minutes from the June 2017 summer Board meeting, as well as results of electronic voting from June – Dec 2017 were approved by the Board and will be available later this year.

Financial

SWSS Total Assets (as of May 31 2017) = $335,886.32 with no liabilities
(increase of $3,306 – Weed DVDs now included in assets)

Distribution of funds is as follows:

- Five individual CDs valued at $20,080 to $20,260
- Money market account valued at $36,751 (increase ~$75)
- RBC account valued at $111,527 (increase ~$2077)
- SWSS checking valued at $46,731 (down ~$3741 from May 2016, due to brief overlap in management fees when Marathon Ag and IMI were committed to SWSS)
- Wells Fargo Savings valued at $36,028 (increase $541 from May 2016)

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<td>Total Assets on May 31 2015</td>
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<td>Total Assets on May 31 2016</td>
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<td>Total Assets on May 31 2017</td>
<td>335,886</td>
<td>3,306</td>
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Income during the 2016-2017 SWSS year was $128,678 from the following primary sources:

- Annual meeting registration ($83,501)
- Sustaining member dues ($22,800)
- Golf tournament ($4275)
- Annual meeting support ($4,000)
- DVD and Book Sales ($5105)

Expenses during the 2016-2017 SWSS year was $129,228 from the following primary sources:

- Annual meeting expenses ($44,015)
- Management fee ($30,332)
- Endowment funds transferred ($25,070)
- Website host ($4,000)
- Director of science policy ($7,223)
• Awards ($3,400)
• Merchant account ($5,729)
• Summer BOD meeting ($2517)

Overall loss of $550 during the 2016-2017 SWSS year
Student Program Committee Report

Report submitted by: Darrin Dodds

81 students presented oral or poster presentations at the 2018 SWSS annual meeting. Three sections of oral presentations were held for by M.S. and Ph.D. students. In addition, one section held for Ph.D. posters and two sections for M.S. posters. 53 people volunteered to judge – many of which on the first call for judges.

Student contest for 2019 will be Charlie Cahoon with co-chairs Kelly BackScheider and Pete Eure. Jim Brosnan has begun the process of developing an electronic scoresheet for the SWSS student contest.
Graduate Student Organization

Report submitted by: J. Brewer

Eight students involved in golf tournament.

26 students at Sunday night event. Talk by John Montouri was well received. Hope that this event continues.

Wednesday will be grad student luncheon. New officers will be elected.
Awards Committee Report

Report submitted by: Pete Dotray

The Awards committee received a total of 19 nomination packets this year. Winners were announced at the SWSS Awards Banquet on Wednesday, January 24, 2018 at the Hyatt Regency Atlanta. The 2018 SWSS Award Winners were:

Outstanding Educator Award (OEA): Dr. Stanley Culpepper, University of Georgia
Outstanding Young Weed Scientist (OYWSA) – Academia: Dr. Ramon Leon
Outstanding Young Weed Scientist (OYWSA) – Industry: no packets were submitted
Outstanding Graduate Student Award (MS) – Zachary Lancaster
Outstanding Graduate Student Award (PhD) – Dr. Sandeep Rana
Excellence in Regulatory Stewardship Award – Drs. Neil Rhodes and Trevor Israel
Fellow Awards: Dr. Scott Senseman and Dr. Jerry Wells

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 2019.
Endowment Foundation Committee Update

Report submitted by: Brent Sellers

Golf tournament – 30 signup, 15 attended. Made $7000 profit

Enrichment scholarship – Applications due on April 6th, 2018. Will be sent via Darrin Dodds or Tara Steinke

$10,000 from Gylling Data Management for Enrichment Scholarship – Two scholarships funded as normal from the Endowment Fund and one funded by Gylling monies. Name change will be made to recognize Gylling.

Monday, January 22, 2018

The SWSS Endowment Foundation Board met at 8:00 AM on Monday, January 22. The golf tournament was held the previous day, with a net income of $7000. Only 15 of the 29 participants that signed up for the event actually participated. The Foundation Enrichment Scholarship winners provided their summaries of their experiences during the general session. Applications for the 2018 Enrichment Scholarship will be due on April 6, 2018, and winners should be notified by the end of April. A special note on the scholarship is that a donation by Gylling Data Management will be utilized for 1 of the 3 annual scholarship awards for the next several years. The number of awards may increase, but will be dependent upon the number of applicants and will be at the discretion of the Foundation Board. We also voted on a change to our MOPs, which basically helped clarify what the Endowment Foundations actually funds within the society.

Respectfully submitted,

Brent A. Sellers, President
SWSS Endowment Foundation
Proceedings Editor Report

Report submitted by: Muthu Bagavathiannan

Proceedings Editor’s Report of the 2017 Meeting

The 2017 meeting was held at Hyatt Regency-The Wynfrey Hotel, Birmingham, AL during Jan 23-26, 2017. The 2017 Proceedings of the Southern Weed Science Society contained 425 pages, including 229 abstracts (118 posters, 107 oral presentations, and 4 symposium abstracts). By comparison, 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.

The 2017 Proceedings was dedicated to Dr. Dennis Elmore who was born on April 3, 1940 in Clay County Mississippi to Clarence and Nadine (Berry) Elmore. Dennis received a B.S. degree at Mississippi State University in 1962, M.S. degree from the University of Arizona in 1966 and a Ph.D. from the University of Illinois Urbana-Champaign in 1970. After completion of his Ph.D., Dennis moved to Leland, Mississippi where he began a 32-year career as a Plant Physiologist at the Jamie Whitten Delta States Research Center (USDA-ARS). His efforts resulted in the development of a guide that contained high quality images and descriptions of 350 weeds. His effort toward this project was recognized by him receiving the highest honor bestowed by the SWSS, the Distinguished Service Award in 1993.

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 2017.
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Objectives for Next Year: complete the 2018 proceedings in a timely fashion

Finances (if any) Requested: None

Respectively submitted,
Muthu Bagavathiannan, Proceedings Editor

End of report
Constitution and Operating Procedures Report

Report submitted by: Carroll Johnson

The SWSS Constitution and Bylaws Committee conducted a comprehensive review of both documents. It was determined that corrections were needed to authorize electronic voting by the general membership and Board of Directors when appropriate. Additional minor changes were needed to reflect the current method of the SWSS conducting routine business.

This is a summary of the revisions:

Revision of the Constitution. In accordance with Article VIII, Section 3 of the SWSS Constitution: The following updates in the Constitution were proposed:

1. **Article III, Sections 2, 5, and 6**: Revised the wording to reflect that all active members voting for leadership positions (officers and elected board positions) use an electronic ballot, accessed and submitted through the SWSS website.

2. **Article VIII, Sections 2 and 3**: Revised wording to reflect that all active members may vote on changes to the Constitution by electronic ballot or in-person at the SWSS Business Meeting, depending on when the called vote is scheduled.

Revision of the SWSS Bylaws. In accordance with Section VI – Amendments, Section 1 of the SWSS Bylaws: the following updates in the Bylaws were proposed:

1. **Section 5, Subsection a**: This is a description of Editor duties. Presently, it is stated that proceedings are published ‘in the form of compact discs’. This was revised to ‘be published on the SWSS website and downloaded as needed.’

2. **Section 8, Subsection b**: This is a description of Business Manager duties, specifically ‘mailings’. Revised to include the use of email and notices posted on the SWSS website.

3. **Amendments, Sections 1 and 2**: Updated to allow use of electronic ballots and voting accessed through the SWSS website or by vote at a called Business Meeting.

The proposed revisions were announced in the August SWSS Newsletter and unanimously approved by vote of the membership present at the Business Meeting, 22 January 2018. An updated copy of the SWSS Constitution and Bylaws were posted on the website after the annual conference.

Johnson motions that members approve changes. Second by Senseman. Motion passes unanimously.
Nominating Committee Report

Report submitted by: Pete Dotray

There were four (4) SWSS Board of Directors positions that needed to be filled at the conclusion of the 2018 annual meeting. Two (2) candidates for each position were approved by the Board at the 2017 summer board meeting in Atlanta. 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 27. The new officers were announced in the December 2017 SWSS Newsletter and are given below:

**Vice-President**
Eric Webster, LSU

**Endowment Foundation Board**
Mike Lovelace, Dow AgroScience

**Member-At-Large Academia**
Todd Baughman, Oklahoma State University

**Member-At-Large Industry**
Eric Castner, DuPont
Legislative and Regulatory Committee Report

Report submitted by: Angela Post

Eight attendees at committee meeting this morning. Talked about a survey about what success looks like for dicamba in 2018 – group decided that this wouldn’t be the best direction for SWSS to go in. Deferred this activity to new WSSA committee on off-target movement (led by Kevin Bradley). Recommend that all regions be represented on that committee.

WSSA Recommendations for 2018 Farm Bill Discussed – mainly #3. All other points seemed easy to support but there was debate over #3 (extending exclusivity if stewardship practices are upheld), debate regarding how this would affect large vs. small companies.

EPA released risk assessment documents that glyphosate is not likely to be carcinogenic and included studies not included in prior reports from health associations. A 60-day public comment period will be coming and SWSS will be asked to sign on in support. Post encouraged all SWSS members to sign as individual scientists as well.
SWSS Board of Directors Meeting

Thursday, January 25, 2018
Hyatt Regency. Atlanta, GA

7:00 – 10:00 am

Attendees: Jim Brosnan (Secretary), Bob Scott (President), Carroll Johnson (Constitution & Bylaws); Eric Castner (Industry at Large); Darrin Dodds; Tara Steinke (Business Manager); Eric Webster (President-Elect); Angela Post (Academia-at-Large); Matt Goddard (Industry at Large); Gary Schwarzlose (Past-President); Greg Stapleton (Industry at Large); Zach Lancaster (Graduate Student Representative); Jason Bond (Academia-at Large); Todd Baughman (Academia-at-Large)

Bob Scott called meeting to order at 7:10 am

Motion to approve agenda made by Bond, second by Johnson. MP.

Introductions

Graduate Student Update- Z. Lancaster

Speaker on planning for retirement at graduate student session was well received. Association wants to approve attendance at golf tournament. Talked about changing their MOP to change the Endowment Committee representative to a two-year position, currently listed as one. New officers elected:

Blake Young, TAMU; Seth Abugo, TAMU ; Harrison Feherety, VT; Maria Zacharo, Arkansas; Jordan Craft, VT

Worked through a questionnaire on how to improve graduate student activities at the meeting and summer weed contest. On the meeting, desire for more social activities to network with industry. Some wanted to move the Sunday night event to Monday; Scott explained that the Sunday event is to justify student attendance to the meeting on Sunday (in lieu of golf only) and expressed that the event will grow with time. On the summer contest, students wanted to move calibration (written) to the day before the main event.

Graduate Student Contest and Weed Contest – D. Dodds

81 students in contest (two no-shows)—everything went smoothly all in all. A total of 53 judges for the contest. There were 37 score sheets with substantial errors. Will explore digital options for scoring next year via Adobe or Google Forms. Dodds will be rotating off this committee. Charlie Calhoun will be the new chair of the committee; Kelly Backscheider will be the co-chair next year. Brosnan suggested that a demonstration of digital scoring be made at the summer BOD meeting. Stapleton suggested leaving winning posters up at the mixer. Webster mentioned that it may help other students learn by seeing what posters won.
Weed Contest – Dodds commented that Syngenta team at Vero did a great job in hosting. 13 graduate teams and 3 undergraduate teams. Desire to encourage more undergraduates to participate. 2018 contest will be at the AgriCenter in Memphis. In 2019, Valent and BASF will host the WeedOlympics and the committee voted that SWSS will participate.

Committee wants to have same farmer problems for all participants rather than having multiple problems assigned at random. Discussion about continuing to have farmer problems that don’t involve herbicide damage. Consensus was to continue with these types of questions as it is valuable experience for the students, as well as giving hosts flexibility to design problems that meet their site. Dodds communicated that scores will be provided to all coaches with student names removed to allow for performance comparisons among teams. Goal is to have everything out to participants by March 1st, 2018.

Webster suggested moving the Student Contest Committee meeting to Monday evening, after the SWSS Annual Meeting to prevent conflicts with other committee meetings. Scott suggested this be communicated to James Holloway for the 2019 Meeting.

2018 Meeting Review – T. Steinke

341 pre-register, 35 walk in – total of 376, up 20 people from Birmingham

Turf symposium had 18 pre-register, 19 walk-in: 37 total attendees— extra profit of $3700 for SWSS

Hotel performed exceptionally well by all accounts.

Motion to accept report made by Baughman, Second by Johnson. MP

Program Committee Update – B. Scott

Slide upload was the only major issue. Scott suggested that we offer directions about how to name files for proper uploading. Many did not adhere to the slide uploading deadline posted on the website. Suggestion made to adhere to older setup with Shawn Askew’s crew available for uploading – Post commented that while effective, it handcuffs that team to uploading and not attending the meeting. Brosnan suggested having a lightning round session without slides.

Webster commented this could be a fit for Wednesday afternoon. Scott suggested this be a “Symposium” for 2019. Brosnan commented that this might be useful for students in that it would teach them to give a summary of their work in a concise format (elevator speech style).

Johnson suggested summarizing the website/abstract glitches and relaying that information to the web-master for how to improve functionality.

Bond suggested potentially moving the Awards Banquet to lunch to increase attendance. Discussion about how this would affect attendance, both positively and negatively, ensued.

2018 Local Arrangements Review – H. McLean

Comments about not having hot tea were relayed to H. McLean. Others commented that coffee was too strong. McLean commented that students helped a great deal, suggested bringing a few
more students to avoid conflicts with having to give presentations. McLean commented on need to have start/end times and room seating needs relayed among the program chair, local arrangements chair, and hotel earlier than was done in 2018. Suggested more time in the summer BOD meeting outlining details of sessions for January. McLean suggested that 2020 chair shadow Todd Baughman to learn the process. McLean also suggested that section chairs communicate needs for 2019 to new local arrangements chair before the summer BOD meeting. Brosnan suggested having a new committee meeting at the 2019 conference for section chairs to learn how projectors/lights in each room work.

Todd Baughman will be local arrangements chair for 2019.
Constitution and Operating Procedures Update

Report submitted by: C. Johnson

At the Savannah meeting, SWSS passed policy that retired members who are fellows have registration fees waived. Suggested that this be publicized more in newsletters/email and be added to the registration form.

Scott and Brosnan commented that many were upset about Endowment Committee changing the name of the Enrichment Scholarship to reflect Gylling donation. Others have donated far more money and have not had awards named after them. Bob Scott will reach out to Darrin Dodds (new chair) about specifics of the donation/name change and clarification.

Schwarzlose suggested adding the Vice President to the Program Committee. Also suggested more documentation from SWSS regarding what arms of the Society pay for what activities. Johnson mentioned need for SWSS to develop a year-to-year budget.

**Old Business – B. Scott** - None to report

**New Business – B Scott**

Summer Board meeting will be June 28-29th (first option), June 25-26th (second option), June 18-22nd (third option). Steinke will inquire with hotel and report back to BOD.

Schwarzlose suggested that Scott get together with other society presidents about ways to improve the WSSA abstracts website for next year’s series of meetings.

Schwarzlose commented that SWSS needs to decide on whether or not to renew contract with CrowdCompass. Brosnan suggested the need for SWSS to continue with the app given the 241 users that downloaded the app by the end of the meeting. Brosnan suggested having CrowdCompass staff attend the summer BOD meeting to address improvements to the app for the 2019 SWSS Meeting.

Motion by Baughman to get out of CrowdCompass contract if they will not give SWSS a no-cost extension. Amendment made by Brosnan that CrowdCompass be contacted about addressing issues regarding app improvement (e.g., search functionality, program display, etc.) with justification that if these can’t be fixed, SWSS wouldn't want an extension/renewal regardless. Seconded by Post. Motion passes. Steinke suggested that SWSS Computer Applications Committee (Askew, Reynolds, Goddard, Brosnan, Shandrea Stallworth) engage with CrowdCompass via Conference Call after WSSA.

Post addressed Pesticide Registration Improvement Act (PRIA) letter to be sent to Congress, asking for support from all Weed Science Society Presidents. Baughman motioned that SWSS support the letter being signed by Scott. Seconded by Goddard. MP Scott will send electronic signature to Lee Van Wychen. Post will circulate letter to all BOD.

Scott adjourned meeting at 9:30am.
SWSS Constitution and Bylaws Committee Report

The SWSS Constitution and Bylaws Committee conducted a comprehensive review of both documents. It was determined that corrections were needed to authorize electronic voting by the general membership and Board of Directors when appropriate. Additional minor changes were needed to reflect the current method of the SWSS conducting routine business.

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Respectively Submitted;

W. C. Johnson, III
Chairman – Constitution and Bylaws Committee
2018 SWSS Program Update

Report by: Bob Scott

I want to thank Joyce Lancaster, Tara Steinke, President Gary Schwarzlose and Henry Mclean for all their assistance with the 2018 Program. I would also like to thank all the section chairs and student contest chair Darin Dodds for their input. The program contains 293 presentations, 119 of which are posters. We had 81 students enter into the contests. I am very pleased with this year’s symposia. The topics were Dicamba Issues in the Mid-South, Metabolic Herbicide Resistance and a turf weed control workshop. In addition, the student program included a special speaker on Sunday night titled “Getting past the earbuds” by John Montuori. This talk deals with working across generational divides. This year’s program was be the first available to attendees as a digital version only option, this version was supported by the Attendee-Hub app. New efforts to condense the number of user identities created on the WSSA abstracts website were successful and I believe greatly aided in the production of the Program. There are still a few bugs and multiple name listings that need to be sorted out. One problem that has been identified is that co-authors who have not updated their status or membership information in a while might have been listed as an affiliate of a former University or employer.

Respectfully submitted by,

Bob Scott
2018 Program Chair and President Elect
Graduate Student Organization Report

71st SWSS Annual Meeting
GSO Student Luncheon
Hyatt Regency-Atlanta Downtown Hotel
Atlanta, GA
January 22-25, 2018

Luncheon Begins at 12:00 PM
Welcome by President John Brewer

12:00-1:22 PM Graduate Student Symposium


- Budget Workshop
- Plan finances early, utilize 401(k)
  - Up to $18,500 per year can be deposited→ tax deferred (no tax until you withdraw)
  - Take advantage of company matching
  - Allows you to lower taxable income
- IRA’s→ Roth vs Traditional
  - $5,500 contribution limit in 2018 to either, depending on eligibility
  - Roth: Taxed on input
  - Traditional: Taxed on Withdrawal
- Q&A session, parting advice

Old Business:

I. Introductions and Officer Reports
   a. John Brewer (President): Golf tournament was fun, attendance was slightly up but could do better. Sunday night event was successful, nearly 30 graduate students attended. Will have a cash bar mixer tonight followed by the awards banquet (5-6/6-8pm). May need to introduce a position on the board for maintaining the annual meeting App.
   b. Vice President Report (Zach Lancaster): Endowment Committee/VP positions are very worthwhile. 2-year position. Allows good networking with and learning from some of the most notable scientists in our field (pun intended). Help handle the
endowment enrichment scholarships as well as society finances. April 6 2018 there will be an announcement for the endowment fellowship application.

c. Savana Davis (Herbicide Committee Chair): There will be an updated list of herbicide-resistant weeds made accessible on the herbicide-resistance website.


e. Dr. Schwarzlose remarks: The Sunday mixer and speaker was a big success, next year we are trying for Mike Gundy from OKState or a wrestling coach. The GSO and graduate students are the backbone of the society, so feel free to reach out to the GSO board and the SWSS board if you have any questions or concerns.

New Business:

President- Zach Lancaster, University of Arkansas

a. Future Meetings
   a. 2019- Oklahoma City, OK; Feb. 3-7
   b. 2020- Biloxi, MS: Jan 26-30th
b. 2018 SWSS Weed contest
   a. Memphis TN Agricenter
   b. August 8

c. 2019 SWSS/WSSA National Weed Olympics
   a. Champaign, IL

Election of new officers

b. Herbicide committee chair
   a. Nominations
      1. John Buol Mississippi State
      2. DJ Mahoney NC State
      3. Blake Young Texas AM
      4. Lucas VA Tech

   Blake Young Texas AM (blake.young@tamu.edu)

c. Social Chair/Student Event Committee:
   a. Nominations
      1. Seth Caputo- Texas AM
      2. Mason Caster- Arkansas

   Seth Abugho- Texas AM (seabugho@tamu.edu)
d. Secretary
   Nominations:
   Hannah Wright- Arkansas
   Harrison Ferrebee- Virginia Tech

   Harrison Ferrebee- Va Tech (hferebee@vt.edu)

e. Endowment Committee Chair (2-Year appointment)
   a. Nominations
      1. Maria Zaccaro- PhD Arkansas
      2. Sean Beam- PhD VaTech
      3. Runjit R.- PhD Florida

      Maria Zaccaro – Arkansas (mzaccaro@uark.edu)

f. Vice-President
   a. Nominations
      1. Jordan Craft- PhD VA Tech
      2. Spencer Samuelson- Texas A&M
      3. DJ Mahoney-NC State

   Jordan Craft- VA Tech (jcraft1@vt.edu)

II. University Rep Nominations:
   a. University of Arkansas: Wyatt Kauffman
   b. Virginia Tech- John Brewer?
   c. Mississippi State- Nelson Corbin
   d. Auburn- Bradley Greer
   e. Georgia- Kaylee Easton
   f. NC State- DJ Mahoney
   g. Texas A&M- Seth Cabughio
   h. University of Tennessee-Knoxville- Drake Copeland
   i. Florida- ?
   j. LSU-N/A
   k. Tennessee- N/A
   l. Clemson-N/A

Meeting is adjourned at 1:59 PM
Meeting Site Selection Committee Update

Report submitted by: Tim Grey

The Site Selection Committee for the SWSS met Monday January 22nd, 2018 at the Hyatt Regency Hotel in Atlanta Georgia. Timothy Grey, Eric Webster, James Halloway, Angela Post, Gary Schwarzlos, Tara Steinke, and Jim Brosnan were in attendance, other committee members including Luke Etheredge and Andrew Price.

The site for the February 3rd to 6th 2019 meeting in Oklahoma City, OK at the Renaissance Oklahoma City Convention Center Hotel and Spa had been previously selected in 2017.

For the 2020 site selection, the committee met via email with notifications of 4 potential sites in the mid-west region for the 2020 SWSS meeting. These include 2 sites in in Lexington KY, as well as sites in Biloxi MS, and Pt. Clear AL. After site visits by committee members, it was recommended that the Beau Rivage Resort and Casino in Biloxi MS for January 26th to 30th 2020 be recommended to the SWSS Board.

At the Atlanta meeting, a discussion about the 2021 SWSS site selection per the MoP moves back to the Eastern Region including the states of Florida, Georgia, South Carolina, North Carolina, Puerto Rico, and Virginia. Knoxville TN was also mentioned as a potential location. Tara will request quotes for hotels from these cities to establish potential sites for the 2021 meeting and communicate with the committee to establish a recommendation for the 2018 annual summer board meeting.
Three necrology reports were submitted, Dr. Eddie Basler Jr., Turney John Hernandez, Dr. Avean Wayne Cole.

Dr. Eddie Basler Jr., 93, died on August 30, 2017. He was born on March 25th, 1924 in the Bridgecreek area of Grady County Oklahoma. Upon graduating from Bridgecreek High School Eddie attended Oklahoma State University Institute of Technology where he learned to weld. This trade took him to Seattle, WA where he worked on battleships. After returning to his family farm, he entered the Army Infantry and served as the radio operator for the 106th Infantry.

Following WWII, Eddie returned to Bridgecreek and enrolled at the University of Oklahoma where he earned his BS and MS degrees in Plant Physiology. Upon graduating from OU, Eddie was accepted as a doctoral student at Washington University in Saint Louis, MO. While in St. Louis Eddie met Ruby Nell Norman, whom he married in 1956.

In 1957, Dr. Basler accepted the position of Plant Physiologist at Oklahoma State University where he retired in 1990. While at OSU, he was a mentor for many students and published many papers on translocation of herbicides. He was president of the OSU Sigma XI chapter and was the faculty council.

Eddie is survived by his wife Ruby Nell; daughter Susan Tomlinson (Tommy); sons, Steven Basler (Peggy); Mike Basler (Zoila), Barry Basler (Ruth Ann); Brothers Jerry and Dee Basler; nine grandchildren and one great-grandchild.

WHEREAS Dr. Basler served with distinction at Oklahoma State University and,
WHEREAS Dr. Basler provided numerous contributions to weed science and the Southern Weed Science Society,

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

Dr. Avean Wayne Cole, 83, died December 6, 2017. He was born on June 23, 1934 in Smithville, Mississippi. Wayne graduated from Itawamba Junior College in Fulton, MS. Upon graduation he served in the US Marine Corp for 6 years and was selected to serve as a Marine One pilot commissioned to the White House detail during the administration of President Dwight David Eisenhower.

After his military discharge, Wayne continued to serve in the Marine Reserve and then the Army National Guard unit out of Tupelo, MS, until his military retirement. Wayne earned a degree from Mississippi State University before earning a ‘double’ Ph.D. from Iowa State University. Dr. Cole began his academic career with Wisconsin State University. Wayne later took a
position in Weed Science and Plant Pathology at Mississippi State University. Wayne was a Professor Emeritus (teaching and research) until his retirement in 1995.

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

Wayne is survived by his wife, Mary Vines Cole, two sons; Robert Allen of Redfield, AR and Michael Stuart (Yvonne) of Panama City, FL., three step children whom he inherited and welcomed into his heart and life through marriage to Mary; Susie Tucker East and Candy Tucker Brown, both of Clinton, MS, and Jonathan Tucker (Memrie) of Starkville, MS.; 12 grandchildren and 3 great grandchildren.

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

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

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

Turney John Hernandez, 94, died on January 1, 2018 at his home in Newark, Delaware. He was born in 1923 on a small family farm in the Acadian area of Lafayette, Louisiana. He graduated from Judice High School in 1939 and attended the University of Southern Louisiana before his studies were interrupted by WW II. He served in the 21st US Army Air Corps as an aerial gunner on a B-17 bomber which was shot down by an ME109 on his 18th mission. He then served as a control tower operator, and gunnery instructor for French pilots training in the US.

Following the war, he attended Louisiana State University where he received an M.S. in horticulture. After graduation, Mr. Hernandez served as Associate Professor of Horticulture at Louisiana Polytechnic Institute for several years. In 1952, Mr. Hernandez began work for the DuPont Company as a technical sales representative and product manager in the Agricultural Products department, with expertise in crop and non-crop vegetation management. This position included extensive travel throughout the Americas and non-developed countries for over 32 years.

Turney was an active member of the Weed Science Society of America and the Southern Weed Science Society, served as president of the SWSS in 1972-73, and recognized for Distinguished Service by the SWSS in 1981. He was founder and executive director of the National Roadside Vegetation Management Association from 1985 – 2004, and a member of many other academic professional organizations.

Turney is survived by his spouse of 27 years, Ann Marie Rossi of Newark, Delaware; his children, Terry Hernandez (Janet Maurer) of Austin, TX, Randall Hernandez (Lana) of Newark, DE, and Lisa Subers of Kennett Square, PA; 9 grandchildren and three great grandchildren.
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,

THEREFORE BE IT RESOLVED that the officers and membership of the Southern Weed Science Society do hereby take special note of the loss of our coworker, Turney John Hernandez, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.
2018 MEETING ABSTRACTS
VARIETY RESPONSE TO BENZOBICYCLON APPLICATION IN DRILL- AND WATER-SEEDED RICE. B. McKnight*, E.P. Webster2, G.M. Telo1, S.Y. Rustom1, M.J. Osterholt1, L.C. Webster1; 1Louisiana State University AgCenter, Baton Rouge, LA, 2Louisiana State University, Baton Rouge, LA (1)

ABSTRACT

Benzobicyclon is an HPPD inhibiting herbicide that has been labeled for use in Japan since the early 2000s and was recently labeled for use in California rice production. Typical symptoms on susceptible weeds include bleaching followed by necrosis and complete plant death. Benzobicyclon must undergo a hydrolysis reaction in order to render the active herbicide compound, benzobicyclon-hydrolysate. Past research at LSU has concluded that benzobicyclon must be applied directly into flood irrigation water for activity on weeds. Water-seeded rice accounted for approximately 35% of the planted rice hectares in Louisiana in 2017. Ducksalad and other aquatic weeds can become troublesome in water-seeded systems earlier in the growing season, compared with drill-seeded plantings. The unique water activity of benzobicyclon will have a fit in these production systems.

Two field studies were conducted in the 2017 growing season at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana. These studies were a split-plot design with whole plot consisting of herbicide treatment and subplot consisting of rice variety. Rice cultivars ‘Diamond’, ‘Cheniere’, ‘CL111’, ‘CL272’, and ‘PVL01-B’, and ‘CLXL745’ hybrid rice were evaluated in both studies. In the first study, cultivars were drill-seeded at 78 kg ha⁻¹ and the hybrid drill-seeded at 50 kg ha⁻¹ into 1.2 m wide by 5.2 m long subplots contained within an individually-leveed bay whole plot, 6 m wide by 83 m long. Herbicide treatment consisted of a pre-packaged mixture of benzobicyclon plus halosulfuron-methyl at either a 1X or 2X rate. The 1X rate was equivalent to 246 g ai ha⁻¹ benzobicyclon plus 36 g ai ha⁻¹ halosulfuron-methyl and the 2X rate was equivalent to 492 g ai ha⁻¹ benzobicyclon plus 72 g ai ha⁻¹ halosulfuron-methyl. Herbicide treatments were applied on two- to three-leaf rice 24 h following the establishment of the permanent flood. In the second study, the previously mentioned rice lines were water-seeded into subplots contained within 6m wide by 83 m long, individually-leveed whole plot bays. One bay was managed under a pinpoint flood system and the other was not permanently flooded until rice was at the three- to four-leaf growth stage. The 2X rate of herbicide was applied in each of these bays 24 h following the establishment of the permanent flood. Applications in both field studies were made by spraying the entire plot area with one pass utilizing a CO₂-pressurized backpack sprayer calibrated to deliver 93 L ha⁻¹ spray solution, and a 6 m wide, two-man, handheld spray boom equipped with 12 flat fan 11001 nozzles.

In the water-seeded field study injury of Diamond, Cheniere, and CL111 was 30, 39, and 33%, respectively, when treated 24 h after the pinpoint flood establishment. Cheniere treated 24 h after the pinpoint flood establishment was injured 46% at 35 DAT; however herbicide injury did not exceed 30% in any other rice treated in the pinpoint flood bay at this evaluation timing. Herbicide injury of Cheniere was 21% and all other varieties were injured less than 20% by 49 DAT. CL111, Diamond, Cheniere, and CLXL745 grain yield was greater than 100% of the nontreated in both, pinpoint flood and delayed flood timing. CL272 grain yield was 82% of the nontreated when treated 24 h after pinpoint flood establishment; however, grain yield was 144% of the nontreated
when the herbicide was applied at the three- to four-leaf flood timing. PVL01-B grain yield was 87% and 82% when herbicide was applied following the pinpoint flood and three-to four-leaf flood, respectively.

In the drill-seeded study, injury ratings for CLXL745 plants treated with the 1X or 2X rate were 14 and 19% at 21 DAT, respectively. Diamond, Cheniere, and CL272 treated with the 2X herbicide rate were injured 61, 63, and 55% at 21 DAT, respectively. Injury ratings for CL111 were similar at 21 DAT for plants treated with both the 1X and 2X rate with 25 and 19% visual injury, respectively. All rice treated with the 1X herbicide rate yielded greater than 90% of the nontreated check except CLXL745 which yielded 84% compared with the nontreated. The grain yield of Diamond, PVL01-B, Cheniere, CL111, CL272, and CLXL745 treated with the 2X rate was 59, 63, 104, 78, 49, and 65% of the nontreated, respectively.

These field studies indicate herbicide mixtures containing benzobicyclon have acceptable crop safety on several commonly grown commercial rice lines and one hybrid in both, drill- and water-seeded production systems. Some excessive injury can occur to drill-seeded rice when treated with a 2X rate of benzobicyclon plus halosulfuron. Careful and accurate application should be exercised by applicators in order to avoid injury to rice. Excellent control of troublesome aquatic weeds observed in previous research, along with the level of crop safety observed in this study indicates benzobicyclon will be a useful option for weed control in Louisiana rice production systems.
EXTENDING THE SHELF –LIFE OF MYROTHECIUM VERRUVARIA, A BIOHERBICIDE. R. Hoagland*,1, C. Boyette2, K. Stetina3; 1USDA-ARS, CPSRU, Stoneville, MS, 2USDA/ARS Biological of Pests, Stoneville, MS, 3USDA-ARS, BCPRU, Stoneville, MS (2)

ABSTRACT

The shelf-life of a bioherbicide product is an important factor with regard to its commercial potential. The bioherbicidal efficacy of freshly fermented *Myrothecium verrucaria* (strain IMI 368023) (MV) mycelia formulations and MV mycelia preparations that had been freeze-dried and then stored at -20°C for 8 years was compared. Two concentrations of each formulation (1.0x and 0.5x) were tested, utilizing bioassays on seedlings of the weed, hemp sesbania (*Sesbania exaltata*) under greenhouse conditions or in darkness utilizing hydroponically grown seedlings. Freeze drying of freshly prepared MV mycelium produced a light, brownish-colored powder. Efficacy tests of this reconstituted 8-year-old dried material showed that some bioherbicidal activity was lost during long-term storage, i.e., ~20% and ~60% seedling dry weight reduction at the 1.0x and 0.5x rate, respectively. Although plant mortality was greater in the fresh mycelial preparations treatments versus the freeze-dried and stored samples at all time points in the time-course, the stored material still caused >80% mortality, 15 days after treatment. Comparative disease progression ratings also showed a similar trend. Overall results show that freeze-drying MV is a useful method to reduce the bulk and cumbersomeness of storing heavy liquid fermentation product, while retaining bioherbicidal activity. These findings increase the utility of this bioherbicide and offer the potential to use the dried material in soil treatments or in a more concentrated form than attainable via the fermented product.
TOLERANCE OF PREEMERGENCE S-METOLACHLOR AND FOMESAFEN APPLICATIONS FOR FRESH MARKET PUMPKINS. C. Rouse*1, N. Roma-Burgos1, J. Lee2, J. Norsworthy1; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas Division of Agriculture, Little, Rock, AR (3)

ABSTRACT

In recent years, S-metolachlor and fomesafen have become widely used in the production of many vegetable crops in the US southern states. Currently, Arkansas recommendations for pumpkins include the use of S-metolachlor, but the use pattern for fomesafen has not been established. Given the potential differences in varietal response and the effect of soil type on crop tolerance to fomesafen, experiments were conducted to evaluate varietal response to fomesafen across different locations. Experiments were conducted at the Vegetable Research Station (VRS) in Kibler, AR in 2016 and in two locations- VRS and Southwest Research and Extension Center (SWREC) in Hope, AR in 2017. Herbicide treatments in both years at the VRS included fomesafen at 280 g ha⁻¹ and 420 g ha⁻¹, S-metolachlor at 1121 g ha⁻¹, and S-metolachlor (1121 g ha⁻¹) + fomesafen (280 g ha⁻¹). At the SWREC the treatments included fomesafen at 140 g ha⁻¹ and 280 g ha⁻¹ and S-metolachlor at 1121 g ha⁻¹. In both locations, a non-treated control of each pumpkin variety was included. In both years and locations, Jack Sprat and Gladiator pumpkin varieties were tested. In 2016 at the VRS, Magic Lantern, Orange Rave, and Spartan were tested. In 2017 at both locations, these were replaced with Dickinson, Ironman, and Jarrahdale varieties. The experiment was arranged as a RCBD with a two-factor-factorial treatment structure of herbicide (factor A) and variety (factor B) and analyzed by year and location. Visible injury in 2016 was low regardless of herbicide or variety, with ratings not exceeding 20% at any evaluation time. Yield was not impacted by the interaction between herbicide and variety; however, Gladiator yield was reduced about 20% by all herbicide treatments. In 2017, higher injuries were observed at the VRS due to high early-season rainfall. The high rate of fomesafen (420 g ha⁻¹) and fomesafen + S-metolachlor caused the greatest injury at 23% and 35%, respectively. Yield was reduced when averaged across varieties by S-metolachlor (-40%) and S-metolachlor + fomesafen (-50%). At the SWREC, injury was low (<10%), and only S-metolachlor had significantly greater injury (7%) 2 WAP. Given these results, fomesafen up to 280 g ha⁻¹ is safe for pumpkins in Arkansas, higher application rates and tank-mixtures with S-metolachlor need further evaluation.
OPTIMIZING CHLORACETAMIDE PLACEMENT AS A MANAGEMENT COMPONENT FOR PIGWEED AND KOCHIA CONTROL IN ROUNDUP READY XTEND SOYBEAN AND COTTON PRODUCTION SYSTEMS OF THE MID-SOUTH AND MIDWEST. J. Buol*1, D.B. Reynolds1, L.X. Franca1, D. Dodds1, A. Mills2, T. Butts3, G. Kruger3; 1Mississippi State University, Mississippi State, MS, 2Monsanto Company, Collierville, TN, 3University of Nebraska-Lincoln, North Platte, NE (4)

ABSTRACT

In order to avoid the fate of previous herbicides, best management practices such as mode of action diversification are necessary to properly steward new auxin herbicide technologies such as in the dicamba-resistant Xtend Weed Control System. Chloroacetamides provide good control of small-seeded broadleaf weeds and can be applied flexibly within cotton and soybean production systems utilizing this technology. A chloroacetamide type (2) x application timing (7) factorial experiment was conducted to determine the optimal application timing of s-metolachlor or acetochlor in Xtend soybean production systems at two locations in Mississippi and one in Nebraska. Control, density, and biomass of kochia and pigweed species were recorded at various timings along with crop yield and injury information. Chloroacetamide type had no effect on any parameters. However, application timing was significant as a PRE application alone led to a yield reduction of 300-500 kg ha⁻¹ and an increase in weed biomass and harvest weed density relative to all other timings except NONE and Late POST alone. Use of a chloroacetamide PRE alone resulted in a 42-50% reduction in visible weed control relative to all other timings except NONE. Significant soybean injury occurred from some POST applications but was limited to a low magnitude ranging from 2-5 percent. Results of this study suggest that the use of at least one POST chloroacetamide application as a component of a weed control system can maximize weed control and crop yield. Future research will characterize the roles of other residual herbicide families in auxin-resistant production systems.
EVALUATION OF WEED CONTROL PROGRAMS IN XTENDFLEX COTTON WITH AND WITHOUT THE ADDITION OF A PREEMERGENCE HERBICIDE. S. Davis*1, D. Dodds1, S. Garris2, B. Wilson3; 1Mississippi State University, Mississippi State, MS, 2Bayer CropScience, Bentonia, MS, 3Mississippi State, Mississippi State, MS (5)

ABSTRACT

An experiment was conducted at Hood Farms in Dundee, MS in 2017 to evaluate various weed control programs in XtendFlex® cotton with and without the addition of a PRE herbicide. The location selected for this experiment contained a natural infestation of glyphosate-resistant Palmer amaranth. Treatments were arranged in a randomized complete block design. The cotton cultivar utilized in this study was DP 1646 B2XF and was seeded on 10 May 2017. A PRE application of fluometuron at a rate of 1.1 kg ai ha⁻¹ was made to designated plots on 11 May 2017 with a CO₂ – powered backpack sprayer. Plots treated with glufosinate and dicamba as a single application received no PRE herbicide and additional applications of glufosinate or dicamba were applied throughout the growing season as needed. The initial POST application was applied when Palmer amaranth height averaged 7 – 10 cm. Herbicides used at this time include: glufosinate (0.66 kg ai ha⁻¹), dicamba (0.83 kg ai ha⁻¹), S-metolachlor (1.1 kg ai ha⁻¹), acetochlor (1.3 kg ai ha⁻¹), and glyphosate (1.1 kg ai ha⁻¹). Treatment combinations include: glufosinate, dicamba, glufosinate + S-metolachlor, glufosinate + acetochlor, glufosinate + S-metolachlor + glyphosate, glufosinate + acetochlor + glyphosate, and dicamba + acetochlor + glyphosate. A second POST application was made 14 days after the initial POST application using the same combinations of herbicides mentioned above. An untreated check was included for comparison purposes. Data collected throughout the season included visual Palmer amaranth control and seed cotton yield. These data were analyzed in SAS v9.4 using the PROC GLIMMIX procedure. Data were subjected to analysis of variance (ANOVA) and the means were separated using Fisher’s Protected LSD at a 95% significance level.

No significant differences in visual Palmer amaranth control following the PRE application were observed between plots treated with fluometuron and those that did not receive a PRE treatment at the time of early POST application. There were also no significant differences between PRE application and no PRE application in terms of seed cotton yield. The lack of significant differences here is likely due to uneven weed densities throughout the experimental area and high levels of rainfall received early season that deactivated the PRE treatment. The use of a PRE herbicide is recommended in order to provide residual control of weed species early in the growing season. No significant differences were observed at the time of the second POST application in visual Palmer amaranth control. At this time, all treatments excluding the untreated check, resulted in greater than 93% visual control. By 28 days after the second POST application, all treatments excluding the untreated check, fluometuron (PRE) followed by (fb) glufosinate + acetochlor + glyphosate fb glufosinate + acetochlor + glyphosate (89%), and fluometuron (PRE) fb glufosinate + acetochlor fb dicamba + acetochlor + glyphosate (83%) provided greater than 90% visual control. Treatments containing only glufosinate or dicamba throughout the growing season provided similar visual Palmer amaranth control and seed cotton yield to other treatments but this practice is not recommended as not rotating herbicide MOA leads to herbicide resistance in weed species.
PROVISIA™ RICE SYSTEM FOR GRASS WEED CONTROL IN RICE. B. Guice*, 1C. Youmans2, A. Rhodes3, J. Schultz4, S. Tan5, N. Fassler6, L. Mankin6; 1BASF Corporation, Winnsboro, LA, 2BASF Corporation, Dyersburg, TN, 3BASF Corporation, Madison, MS, 4BASF, Sherwood, AR, 5BASF Corporation, Res Tri Park, NC, 6BASF Corporation, Research Triangle Park, NC (6)

ABSTRACT

The Provisia™ Rice System is composed of a rice cultivar with Non-GM ACCase gene mutation plus Provisia™ herbicide (quizalofop-P-methyl). The Provisia™ Rice System is an effective alternative red rice and weedy rice control program that fulfills grower weed management needs and complements the Clearfield® Rice System. When applied according to the label, Provisia™ herbicide has excellent crop tolerance and provides post emerge control of annual grasses, weedy rice, and red rice. Grower adherence to the stewardship program is extremely important to ensure the longevity of the Provisia™ Rice System. The Provisia™ stewardship program includes, but is not limited to, grower stewardship agreement, adherence to product label, crop rotation, and other agronomic practices.
EFFECT OF FLOODING PERIOD AND SEED BURIAL DEPTH ON PALMER AMARANTH SEED GERMINATION. L.X. Franca*, D. Dodds, M. Plumblee, S. Davis; Mississippi State University, Mississippi State, MS (7)

ABSTRACT

Palmer amaranth (Amaranthus palmeri S. Wats.) is an extremely prolific seed producer with one single female plant being capable of producing up to 600,000 seeds per plant under favorable conditions. Palmer amaranth seed production of 312,000 and 500,000 seeds per plant have 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, typically resulting on reduction of seed germination and emergence. Flooding is a common practice in most of rice (Oryza sativa L.) fields in the Lower Mississippi Alluvial Valley, where 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 burial depth on Palmer amaranth seed germination in Mississippi.

Experiments were conducted in 2016 at the R. R. Foil Plant Research Center in Starkville, MS to evaluate the effects of flooding period and seed burial depth on Palmer amaranth seed germination. Flood simulation was conducted with 26.5 L buckets containing 30 cm of soil plus 15 cm of water. 500 micron pore opening mesh bags measuring 64 cm² containing 20 grams of soil were used to store 100 viable Palmer amaranth seeds throughout experiment duration. Three soil textures were used, a leeper silty clay loam, a Dundee silty loam, and a Brooksville silty clay. Mesh bags were buried at 0 and 15.2 cm depth and subjected to six flooding periods, 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 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 was equal or longer than 1 mm. Data were subjected to analysis of variance using PROC GLM procedure in SAS® Software 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. Moreover, only 1.6 and 0.3% of damaged seeds germinated in no-flooding and flooding period treatments, respectively. Flooding significantly reduced Palmer amaranth seed germination, regardless of flooding period (P ≤ 0.0001). In addition, Palmer amaranth seed germination was reduced by 30% in flooded treatments. No significant differences were observed on Palmer amaranth seed germination when buried in silty clay loam, silt loam, and silty clay soils (P = 0.6760). Palmer amaranth seed viability was significantly greater when buried at 15.2 cm compared to 0 cm when no flood was applied (P ≤ 0.0001). However, seed burial did not affect Palmer amaranth germination under flooded conditions.
REDUCING ENDOPHYTE-INFECTED TALL FESCUE (SCHEDONORUS ARUNDINACEUS) SEEDHEAD DEVELOPMENT WITH ALS-INHIBITING HERBICIDES. D. Russell*1, J. Byrd1, M. Zaccaro2; 1Mississippi State University, Mississippi State, MS, 2University of Arkansas, Fayetteville, AR (8)

ABSTRACT

In order to evaluate alternative measures for the management of tall fescue [Schedonorus arundinaceus (Schreb.) Dumort = Lolium arundinaceum (Schreb.) Darbysh.] toxicity and prevention of endophyte-infected seed dispersal, two rates of seven sulfonylurea herbicides were evaluated for seedhead suppression. Treatments were arranged in a randomized complete block design with four replications at two locations on established endophyte-infected ‘Kentucky 31’ tall fescue. When herbicides were broadcast applied at the flag leaf growth stage at 130 L ha⁻¹, tall fescue seedheads were suppressed below 14% coverage (> 68% visual control) by nicosulfuron + metsulfuron (20 + 5 and 40 +11 g ai ha⁻¹), imazapic (26 and 53 g ai ha⁻¹), and sulfosulfuron (53 g ai ha⁻¹) at 90 DAT. At one location, visual estimates suggested imazethapyr at 70 g ai ha⁻¹ controlled seedheads as well as the low rates of imazapic and nicosulfuron + metsulfuron and quantitatively reduced seedhead coverage below 25% across both studies. In a system where infected tall fescue and clover mixtures are desirable, imazethapyr would be the treatment of choice for tall fescue seedhead suppression due to its safety on numerous legume species. Slight reductions in forage foliar heights are possible with the use of herbicides, but in these studies any injury incurred in the form of chlorosis was less than 5% by 90 DAT.
COTTON RESPONSE TO DICAMBA DRIFT AT DIFFERENT GROWTH STAGES.
K.R. Russell*1, P.A. Dotray2, G. Ritchie3, S. Byrd4, G. Morgan5, T.A. Baughman6; 1Texas Tech University, Lubbock, TX, 2Texas Tech University, Texas A&M AgriLife Research and Extension Service, Lubbock, TX, 3Texas Tech University, Texas A&M AgriLife Research, Lubbock, TX, 4Texas A&M University AgriLife Extension, Lubbock, TX, 5Texas A&M AgriLife Extension, College Station, TX, 6Oklahoma State University, Ardmore, OK (9)

ABSTRACT

The use of newly released dicamba-tolerant cotton (Gossypium hirsutum) varieties will improve options to control troublesome weeds such as glyphosate-resistant Palmer amaranth (Amaranthus palmeri S. Wats); however, there is risk of off target dicamba movement onto non-target crops because of the increased use of this active ingredient. A field study was conducted on a subsurface drip irrigated field located on the Texas Tech New Deal Research Farm in 2017 to evaluate cotton response to dicamba when applied at four crop growth stages (first square + 2 weeks (FS+2wks), first flower (FF), first flower + 2 weeks (FF+2wks), and cut-out (CO)). Dicamba (Clarity 4L) at 0.56 (1X), 0.056 (1/10X), 0.0112 (1/50X), 0.0056 (1/100X), and 0.00112 (1/500X) kg ae/ha was applied to FiberMax 1830GLT using a carrier volume of 140 L/ha 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. Average stand density was 12 plants per meter. Cotton was box mapped prior to harvest to determine boll number and distribution as affected by the different rates 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 apparent following dicamba at 1/500 and 1/100X regardless of application timing. When applications were made at FS+2wks, a shift in boll nodal position was apparent following dicamba at 1/50X; whereas reduced boll number and lack of boll production was apparent following dicamba at 1/10 and 1X, respectively. A shift in boll distribution (1/50X) and lack of boll number (1X) was apparent when applications were made at FF. When applications were made at FF+2wks, boll number was reduced following dicamba at 1X. Relative to the non-treated control, no change in boll number and boll position was apparent following any dicamba rate when applied at CO. Yield in the non-treated plots averaged 1583 kg lint/ha. Dicamba at 1/500, 1/100, 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 FS+2wks followed by FF and FF+2wks. No yield loss was observed following dicamba at 1/10X applied at CO. Dicamba at 1X reduced cotton yield at all application timings; however, greatest yield loss was observed at FS+2wks and FF.
NOZZLE, CARRIER VOLUME, AND WEED SIZE EFFECT ON GLUFOSINATE EFFICACY. B. Sperry*, D.B. Reynolds; Mississippi State University, Mississippi State, MS (10)

ABSTRACT

Field and greenhouse experiments were conducted in 2017 in Starkville, MS to investigate the effect of carrier volume and weed size on glufosinate efficacy when applied from two different drift-reduction nozzles. In the greenhouse study, TTI and TDXL nozzles were used to apply 0.66 kg ai ha⁻¹ of glufosinate at 94 or 140 L ha⁻¹ to 8 and 15 cm waterhemp plants. Likewise in the field study, TTI and TDXL nozzles at 94 and 140 L ha⁻¹, respectively, were used to apply 0.66 or 0.74 kg ai ha⁻¹ of glufosinate to 7.6 and 15.2 cm waterhemp in soybean. In the greenhouse study, common waterhemp control was consistently ~10% higher across three evaluation dates when plants were treated at 7.6 cm compared to 15.2 cm, regardless of nozzle or carrier volume. Likewise, fresh biomass of waterhemp plants harvested 21 DAT were over 6-fold higher in plants treated at 15.2 cm compared to 7.6 cm. In the field, waterhemp control was reduced by treatment of 15.2 cm waterhemp when TDXL nozzles at 140 L ha⁻¹ were used to apply 0.74 kg ai ha⁻¹ or TTI nozzles at 94 L ha⁻¹ were used to apply 0.66 kg ai ha⁻¹. Applications to 7.6 and 15.2 cm waterhemp in the field corresponded to the V4 and R2 soybean growth stages. Soybean injury to plots treated at the 7.6 cm timing was 19% which translated into a yield loss of 10%. Conversely, the 15.2 cm weed size treatment caused only 3% soybean injury and no yield loss. The soybean injury observed is likely due to higher glufosinate rates used. Therefore, these results suggest that timely glufosinate applications to small waterhemp at typical use rates are key to avoiding the need for higher rates and the possibility of soybean injury and yield loss. However, if higher rates are needed, soybean tolerance is much higher when applied at later growth stages.
SWEETPOTATO TOLERANCE TO ORYZALIN APPLICATION TIMING AND RATE.
S. Chaudhari*, K. Jennings¹, S. Meyer², D. Miller³; ¹North Carolina State University, Raleigh, NC, ²Mississippi State University, Mississippi State, MS, ³LSU AgCenter, St Joseph, LA (11)

ABSTRACT

The investigation of potential herbicides for weed control in sweetpotato is critical due to the limited number of registered herbicides and the development of populations of herbicide resistant weeds. Therefore, field studies were conducted at the Horticultural Crops Research Station, Clinton, NC and the Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc, MS to determine the effect of oryzalin rate and application timing on sweetpotato tolerance. Oryzalin at 0.6, 1.1, 2.2, 3.4, and 4.5 kg ai ha⁻¹ was applied 0 to 2 or 14 d after sweetpotato transplanting (DAT). At Pontotoc 4 wk after application (WAA), sweetpotato injury (leaf distortion) was < 6% when oryzalin was applied 0 to 2 DAT regardless of application rate. However, when oryzalin was applied at 14 DAT greater leaf distortion was reported from 3.4 and 4.5 kg ai ha⁻¹ (12 to 13%) than 0.6, 1.1, and 2.2 kg ai ha⁻¹ (4 to 6%). At Pontotoc 8 WAA, sweetpotato injury (stunting) was < 4% regardless of oryzalin application rate and timing. At Clinton 6 WAA, sweetpotato injury (leaf distortion) was < 1% and 4 to 8% when oryzalin was applied 0 to 2 and 14 DAT, respectively. Sweetpotato stunting at 6 WAA was greater with oryzalin applied at 14 DAT (13%) than 0 to 2 DAT (6%). Oryzalin rate and timing did not affect yield of no.1, jumbo, and marketable sweetpotato. Based on these results, oryzalin herbicide has potential for registration in sweetpotato.
HERBICIDE PROGRAMS FOR COMMON RAGWEED CONTROL IN SOYBEANS. S. Beam*, M. Flessner, K. Pittman, K. Bamber; Virginia Tech, Blacksburg, VA (12)

ABSTRACT

Soybean growers across Virginia and other growing regions in the country struggle to control common ragweed (Ambrosia artemisiifolia) with glyphosate-based herbicide programs leading to yield loss. Common ragweed is known to be resistant to glyphosate and ALS inhibiting herbicides in many soybean production regions across the country. Two studies were initiated in 2017 in Lawrenceville, VA to determine herbicide program options that effectively control suspected glyphosate and ALS resistant common ragweed. Roundup Ready 2 Xtend soybeans were no-till planted on May 9, 2017. Treatments in study 1 consisted of flumioxazin + metribuzin (71.4 g + 178.5 g ai ha⁻¹) or chlorimuron-ethyl + flumioxazin + thifensulfuron + metribuzin (22.5 g + 17.5 g + 7.1 g + 178.5 g ai ha⁻¹) PRE followed by (fb) either glyphosate (1260 g ae ha⁻¹), cloransulam-methyl (17.6 g ai ha⁻¹), lactofen (218.8 g ai ha⁻¹), glufosinate (593.8 g ai ha⁻¹), dicamba (558.3 g ae ha⁻¹), or 2,4-D (1120 g ae ha⁻¹); or clomazone (558.6 g ai ha⁻¹) + metribuzin at two different rates (278.3 g or 336 g ai ha⁻¹) fb glufosinate. Study 2 had treatments consisting of flumioxazin + chlorimuron-ethyl + metribuzin (71.4 g + 22.4 g + 249.3 g ai ha⁻¹), flumioxazin + chlorimuron-ethyl + thifensulfuron (71.4 g + 22.4 g + 7 g ai ha⁻¹), and metribuzin + chlorimuron-ethyl + S-metolachlor (270.1 g + 44.9 g + 1071 g ai ha⁻¹) PRE each fb glyphosate + dicamba (1260 g + 559.2 g ae ha⁻¹) with or without S-metolachlor (1071 g g ai ha⁻¹). A nontreated check was included in each study. Treatments were arranged in a randomized complete block design with 4 replications. Preemergence herbicides were applied at soybean planting and postemergence herbicides were applied when weeds were 5-10 cm in height with a handheld spray boom calibrated to deliver 140 L ha⁻¹ of spray solution. Soybean plots were 4 rows wide on 76 cm centers with whole plots measuring 3 m by 6 m. Plots were assessed for visible weed control and soybean injury on a biweekly basis for 6 wks following both PRE and POST treatments. Soybean yield was harvested in November. All data were analyzed in JMP Pro 13 using ANOVA, and when significant, means were separated using Fisher’s Protected LSD (α=0.05). The nontreated check was excluded from the statistical analysis for common ragweed control and soybean injury. The best performing preemergence herbicide treatment in study 1 was chlorimuron-ethyl + flumioxazin + thifensulfuron + metribuzin resulted in 99 and 98% common ragweed control at 4 and 6 wk after treatment (WAT), respectively. All other PRE treatments resulted in 83 and 88% common ragweed control 4 WAT and between 63 and 85% 6 WAT. All POST treatments except glyphosate following flumioxazin + metribuzin and chlorimuron-ethyl + flumioxazin + thifensulfuron + metribuzin had >98% common ragweed control 6 WAT. Soybean injury was observed in plots receiving lactofen and cloransulam-methyl at 2 and 4 WAT but was not observed by 6 WAT. In study 2 no differences in common ragweed control were found between any treatments 6 WAT, and soybean injury was observed 2 WAT but could not be observed beyond this point. These studies demonstrate that effective herbicide programs can be implemented for common ragweed control in soybean. Future research needs to look at the effectiveness of these programs on ALS resistant populations of common ragweed and other weed species.
AVAILABLE OPTIONS FOR CONTROL OF MULTIPLE-RESISTANT PALMER AMARANTH IN TENNESSEE. S. Steckel*1, J. Copeland2, L. Steckel2; 1University of TN, Jackson, TN, 2University of Tennessee, Jackson, TN (13)

ABSTRACT

In 2015, Palmer amaranth (*Amaranthus palmeri*) with resistance to glyphosate and protoporphyrinogen oxidase (PPO) inhibitors was confirmed throughout West Tennessee. Historically, growers have relied on PPO herbicides for control of Palmer amaranth preemergence (PRE) and postemergence (POST). However, with auxin, glufosinate and 4-hydroxyphenylpyruvate dioxygenase inhibitor (HPPD) tolerant crops on the horizon growers have POST options to control multiple-resistant Palmer amaranth. Preliminary research at PPO-resistant sites in Tennessee have revealed a higher tolerance to the aforementioned herbicide modes of action (MOA). Therefore, the objective of this study was to compare the efficacy of POST herbicides in PPO-resistant and susceptible Palmer amaranth populations.

Studies were conducted on-farm near Ripley, TN (PPO-resistant) and at the Agricenter International in Memphis, TN (PPO-susceptible) in the 2017 growing season to evaluate available options for control of Palmer amaranth. Plots were 1.5 m wide and 7 m in length. Treatments were applied when Palmer amaranth were 6.5 cm in height. There were 20 treatments total consisting of herbicides used alone, as tank-mixtures or in a two-pass system with the following herbicides: atrazine at 2.24 kg ai ha⁻¹ plus COC at 1% v/v, mesotrione at 70 g ai ha⁻¹ plus NIS 0.25% v/v, glufosinate at 660 g ai ha⁻¹, fomesafen at 270 g ai ha⁻¹ plus MSO at 1% v/v, dicamba at 560 g ae ha⁻¹, 2,4-D at 1.05 kg ae ha⁻¹ and 2,4-D at 1.05 kg ae ha⁻¹ + glyphosate at 1.12 kg ae ha⁻¹. Treatments were arranged within a randomized complete block design and replicated four times at each location. Palmer amaranth control was visually assessed 7, 14, 21 and 28 DAI (days after initial application). All data were subjected to ANOVA and estimates of the least square means were used for mean separation with α = 0.05.

In Memphis, regardless of herbicides applied alone, in tank-mixtures or in a two-pass system, Palmer amaranth control was ≥ 99% 14 DAI. However, mesotrione applied alone provided 88% control 14 DAI this location. Contrarily, in Ripley mesotrione and fomesafen applied alone provided 38 and 34% control, respectively, of Palmer amaranth. Whereas, atrazine, glufosinate, dicamba and 2,4-D + glyphosate provided greater than 90% control when applied alone. Treatments that included 2,4-D + glyphosate, 2,4-D or dicamba plus/ or fb glufosinate provided greater than 92% control. These data provide that PPO-resistant Palmer amaranth are effectively controlled by herbicides that are the framework of LibertyLink, Enlist and Xtend systems. However, like fomesafen, less activity was observed with mesotrione at the PPO-resistant location. Further research is needed to evaluate HPPD herbicides on the PPO-resistant population near Ripley, TN for potential resistance.
THE EFFECT OF GRASP (PENOXUSLAM) AND REGIMENT (BISPYRIBAC) CONCENTRATION ON BOLT SOYBEAN (GLYCINE MAX) GROWTH AND YIELD.

D.C. Walker*1, D.B. Reynolds2, J. Bond3; 1Mississippi State University, Starkville, MS, 2Mississippi State University, Mississippi State, MS, 3Delta Research and Extension Center, Stoneville, MS (14)

ABSTRACT

DuPont Pioneer’s new herbicide-tolerant soybean, BOLT™ is a further development of their sulfonylurea tolerant soybean line. This technology allows producers to spray LeadOff® (rimsulfuron, thifensulfuron-methyl) and Basis® Blend (rimsulfuron, thifensulfuron-methyl) at burndown with no soybean plantback interval. Off-target deposition of ALS inhibiting herbicides used in rice can result in severe soybean injury and yield loss. The increased tolerance to ALS herbicides by BOLT soybean may provide protection to these off-target herbicides. Therefore, an overall evaluation of soybean with BOLT technology as a drift mitigation tool for off-target deposition of Grasp and Regiment herbicides on rice is necessary. If successful, BOLT soybean use could be widely adopted by growers to provide a means of mitigating off-target herbicides. The two main objectives of this study were to determine the tolerance level of BOLT soybean to titrated rates of Grasp and Regiment and their effects on yield. Experiments were conducted in 2016 and 2017 in Brooksville and Starkville, MS. Six rates of each herbicide (1X, 1/4X, 1/16X, 1/64X, 1/256X, 1/1024X of a full labeled rate) were applied to BOLT soybean at the V3 stage of growth. The full labeled rate for Grasp is 40.3 g ai ha\(^{-1}\) and Regiment is 33.6 g ai ha\(^{-1}\). Applications also included a surfactant (Grasp including MSO – premium blend at 2.33 L ha\(^{-1}\) and Regiment including Dyne-a-Pack at 1% v/v). All applications were made at 140 L ha\(^{-1}\) using Teejet AIXR 110015 nozzles. Visual injury ratings were recorded 7, 14, 21, and 28 DAT and plant heights and node counts were recorded 14, 28 and 98 DAT. Soybean yields were recorded at the conclusion of the growing season. Results indicate that BOLT soybean had a relatively higher tolerance to Grasp than Regiment at the rates evaluated. Furthermore, if drift rates of Grasp had a concentration lower than 1/4X of the full rate, then BOLT soybean yield was not affected. If drift rates of Regiment had a concentration lower than 1/16X of the full rate, then BOLT soybean yield was unaffected. Yield reductions for Grasp treated plants were 17 and 11% for the 1X and 1/4X rates. Regiment treated plants had yield reductions of 34, 15, and 10% for the 1X, 1/4X, and 1/16X rates. Bolt soybean may provide protection against yield loss if drift rates are less than 1/16X of the typical labeled rates of application used in rice.
COMPARISON OF VARIOUS TANK CLEANERS FOR REMOVAL OF DICAMBA FROM CONTAMINATED SPRAYERS. Z.A. Carpenter*, D.B. Reynolds, A.B. Johnson, A. Meredith, M. Green; Mississippi State University, Mississippi State, MS (15)

ABSTRACT

The release of dicamba tolerant soybeans by Monsanto will aid growers in weed control. However, several challenges are also forthcoming, one being sprayer hygiene. Glyphosate is very water soluble, allowing it to be easily removed from spray tanks through a triple rinse with water alone. However, 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 which commercial tank cleaners are most effective in the removal of auxin herbicides from spray tanks using a standard triple rinse washout procedure. Field experiments were conducted in 2016 and 2017 in Brooksville and Starkville, MS. Eight different cleaners were evaluated, along with a no cleanout treatment and a treatment consisting of only 3 rinses with water. In 2016 a large scale sprayer was used while in 2017 a small scale sprayer was designed to replicate the cleanout procedures used on commercial sprayers. During both years the cleanout procedure was identical. The system was first contaminated with dicamba (Clarity in 2016, Xtendimax in 2017) at 590 kg ae/ha and rhodamine WT dye at 0.2% v/v. 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 soybeans 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 cleaner efficacy. Plants were harvested at end of the growing season for yield. At 28 DAT, visual injury and height reductions did not differ among tank cleaners when averaged over all rinses. Averaged over cleaners, visual injury incrementally decreased with each additional rinse but was not totally eliminated. Injury ranged from 50% with the first rinsate to 13% with the glyphosate solution following tank cleanout. Plant heights did not differ from check when rinsates from the third or fourth rinses were applied. Following a triple rinse system an application of glyphosate resulted in yield equivalent to the untreated regardless of the cleaner used. HPLC analysis of this spray solution confirmed that analyte concentration did not differ among tank cleaners. These data would indicate that a triple rinse system is necessary to achieve analyte concentrations low enough to not result in yield losses. These data also show that no differences were detected among the cleaners tested in regard to their effectiveness.
TARGET-SITE MUTATIONS IN PENNSYLVANIA SMARTWEED (POLYGONUM PENSYLVANICUM L.) CONFER HIGH LEVEL OF RESISTANCE TO ALS INHIBITORS. V. Varanasi*, C. Brabham, J. Norsworthy, C. Brabham; University of Arkansas, Fayetteville, AR (16)

ABSTRACT

Pennsylvania smartweed, a member of the knotweed family (Polygonaceae), is a summer annual broadleaf weed of horticultural and agronomic crops distributed throughout the United States. Pennsylvania smartweed has become a major concern for Midsouth rice farmers because of reduced tillage systems. Acetolactate synthase (ALS) inhibitors have been extensively used for controlling smartweeds in Clearfield® rice. In the present study, we confirmed resistance to different ALS inhibitors and characterized the underlying resistance mechanism in a Pennsylvania smartweed population. Resistant (R) plants were collected in 2016 from a field in southeast Missouri near Arkansas. A dose-response experiment was conducted in the greenhouse with the following rates of the herbicides applied to R plants: Londax (bensulfuron-methyl) at 1, 16, 32, 64, 128, and 256x (x = 67.3 g ai ha⁻¹); Newpath (imazethapyr) at 0.5, 1, 4, 8, 16, and 32x (x = 105.8 g ai ha⁻¹); Regiment (bispyribac-sodium) at 0.5, 1, 4, 8, 16, and 32x (x = 31.9 g ai ha⁻¹), respectively. Susceptible (S) plants were treated with 0.125, 0.25, 0.5, 1, and 2x rates of the above herbicides. Dry biomass data collected 3 weeks after treatment was analyzed and resistance index (R/S) was calculated based on the GR₅₀ ratios. The target-site ALS gene was amplified from R and S plants and sequences analyzed for mutations, known to confer ALS-inhibitor resistance. Pennsylvania smartweed population was found to be resistant to Londax (R/S = 2330), Newpath (R/S = 12), and Regiment (R/S = 6), respectively. Sequencing of the ALS gene from R plants revealed two previously known mutations (Pro197Ser, Ala122Ser) conferring resistance to sulfonylureas and imidazolinones. This is the first report of ALS-inhibitor resistance in Pennsylvania smartweed.
THE LEVEL OF PPO-INHIBITOR RESISTANCE CONFERRED BY DIFFERENT MUTATIONS IN PALMER AMARANTH. A. C. Brabham*, V. Varanasi, J. Norsworthy, C. Brabham; University of Arkansas, Fayetteville, AR (17)

ABSTRACT

In Arkansas, target-site resistance to protoporphyrinogen oxidase (PPO)-inhibiting herbicides in Palmer amaranth accessions is widespread. The predominant resistance mechanism in the northeast part of the state is a deletion of the 210th glycine residue (ΔG210) in the PPO enzyme while an arginine to a glycine substitution at the 128th amino acid position (R128G) is most prevalent in the middle part of the state. The likelihood of an accession containing both resistant alleles is probably and several accession and plants within these accessions were found to contain both alleles. Thus, we were interested in determining the allelic effect of each mutation alone in a homozygous state (R128G/R128G or ΔG210/ΔG210) or in combination (R128G/ΔG210) on the level of resistance to the PPO-inhibiting herbicide fomesafen. To create each genotypic combination, R128G/ΔG210 plants were crossed in the greenhouse and the subsequent progeny were used for experimentation. Prior to treatments, seedlings were genotyped using a TaqMan allelic discrimination assay and ED50 and ED90 values were calculated from dose response curves generated from percent survival and relative dry weight reduction, respectively, for each genotype. A total of 273 plants were screened and the genotypic frequency segregated into an expected 1:2:1 ratio of R128G/R128G: R128G/ΔG210: ΔG210/ΔG210, respectively. This indicates each allele can spread via pollen and seed-mediated gene flow. Based on percent survival ED50 values, the level of fomesafen resistance conferred by each allelic combination from highest to lowest numerically was ΔG210/ΔG210 (2,534 g ai ha⁻¹), R128G/ΔG210 (1,805 g ha⁻¹), and R128G/R128G (1,539 g ha⁻¹), however these values were not significantly different. Together, this data indicates homozygous resistant plants, regardless of the allelic combination, are highly resistant to fomesafen and will produce resistant progeny.
PIGWEED RESISTANCE SURVEY IN ALABAMA. K.J. Price*, S. Li; Auburn University, Auburn, AL (18)

ABSTRACT

Continued reliance on the same mode of action for weed management over time has led to the development of herbicide resistant weeds throughout the United States. Palmer amaranth is one of the most difficult weeds to control in the southeast because it has developed resistance for multiple modes of actions including ALS inhibitors (Group 2), Photosystem II inhibitors (Group 5), EPSP synthase inhibitor (Group 9), PPO inhibitors (Group 14) and HPPD inhibitors (Group 27). Not only is palmer amaranth a strong competitor, but it is also a prolific seed producer. A single plant can produce up to 500,000 in a crop setting, making it easy for resistance to spread. Palmer amaranth resistance has not been surveyed in Alabama since 2008 when the first case of glyphosate-resistant palmer amaranth was confirmed. Therefore, the objective of this survey was to identify the resistant level and distributions of herbicide resistant Palmer amaranth in Alabama to POST herbicides that are commonly used in peanut, cotton, and soybeans. Mature seed heads were collected from 57 cotton, peanut and soybean fields in 16 counties on multiple female plants per field in 2015-16. Seed heads from each location were cleaned and Palmer seeds were planted in 10-cm pots filled with 50/50 sand and organic potting medium in a greenhouse. Once majority of the seedlings in a pot reached a height of 2.54 cm, they were treated with the following herbicides: glyphosate, fomesafen, glufosinate, lactofen, imazapic, oxyfluorfen, pyrithiobac sodium, and trifloxysulfuron-sodium at 2X and 4X label rates in a spray chamber. NIS at 0.25% v/v was used for all treatments. At 14 to 18 days after treatment, plant counts were recorded to determine the mortality rates of each population. Only one location collected in 2016 was not resistant to glyphosate while all 56 other locations showed glyphosate resistance at different levels. In 2015, Palmer amaranth from two locations showed signs of PPO inhibitor resistance, therefore, additional PPO inhibitors were tested on these populations. Results showed one of these two populations had become PPO-inhibitor resistant. Overall, lactofen 560 g ai ha⁻¹ and glufosinate 1310 g ai ha⁻¹ had the highest mortality with 100% and 92% respectively in 2015, as well as 95 % for both treatments in 2016. Glyphosate and ALS inhibitors tested were ineffective on controlling most of the collected populations. Results of this survey indicated that Alabama producers should avoid using glyphosate, pyrithiobac sodium, and trifloxysulfuron-sodium in cotton, and imazapic and imazethapyr in peanuts where herbicide resistant Palmer amaranth is expected to present. Glufosinate and PPO-inhibitors based programs will be more effective to control this problematic weed in Alabama while using residual herbicides and rotating modes of action are key components to successful weed control programs in row crops.
PEANUT VARIETY TOLERANCE TO FLUMIOXAZIN AND PARAQUAT TANK MIXES. K.J. Price*, S. Li; Auburn University, Auburn, AL (19)

ABSTRACT

Flumioxazin and paraquat are vital herbicides commonly used in peanut production throughout the southeast. Tank-mixes with paraquat are often used to reduce peanut injury caused by paraquat and broaden the spectrum of postemergence (POST) weed control. Flumioxazin is used as a preemergence (PRE) herbicide in peanuts for residual weed control. However, little research has been conducted to evaluate these herbicides on newer peanut varieties for tolerance. The objective was to conduct multi-location (Macon, Henry and Baldwin County AL) and multi-year (2016-2017) studies to evaluate newer peanut variety tolerance to flumioxazin and paraquat based herbicide programs and determine if the stunting and injury observed led to yield losses. In the first study, paraquat was evaluated on its own at various rates and in six different tank combinations with bentazon + acifluorfen, S-metolachlor, pyroxasulfone, acetochlor, pyroxasulfone + carfentrazone, or 2, 4-DB. The second study evaluated the effects of flumioxazin at 2/3 rate, 1X, 2X labeled rates as well as tank mixed with diclosulam at 1X and 2X labeled rates. Four peanut varieties evaluated in both studies were Georgia 06G, Georgia 12Y, Georgia 14N, TuffRunner 511, and Georgia 09B was only included in the flumioxazin study as a fifth variety. Peanut growth parameters including stand count, plant height and widths were collected 3 and 7 weeks after treatment. No variety reacted differently to the herbicide treatments in both studies thus varieties were combined during data analysis. In 2016, paraquat alone and two of the tank mixes caused significant plant height reductions of 4-15% at 50-55 days after planting (DAP). By 72-78 DAP the tank mix with pyroxasulfone 122 g ai ha\(^{-1}\) + carfentrazone 9 g ai ha\(^{-1}\) and paraquat alone at 2X the labeled rate reduced heights by 6 and 10% respectively. Only paraquat at 2X labeled rate had a significant yield loss of 9% at harvest among all treatments in 2016. In 2017, all treatments had plant width reductions by 11-27% at 45-48 DAP and by 66-68 DAP, all but one tank mix, paraquat 280 g ai ha\(^{-1}\) + bentazon 560 g ai ha\(^{-1}\) + acifluorfen 280 g ai ha\(^{-1}\), had significantly reduced plant widths by 8-13%. Paraquat tank mix treatments caused a plant height reduction of 5-8% at 45-48 DAP however they recovered by 66-68 DAP. There was no significant yield loss observed in 2017. In 2016 Macon County trial, flumioxazin treatments caused 6-17% stand loss and 5-25% plant height reductions but no other location had significant growth stunting. In 2017, height reduction was observed as 7-17% at 22-29 DAP in Macon and Henry County. There was no significant yield loss caused by flumioxazin treatments observed for either year. Overall, the newer peanut varieties are tolerant to frequently used flumioxazin and paraquat based treatments. Some observable stunting and injury may occur, however, our data suggests significant peanut yield loss at end of the season is not likely to happen.
TOLERANCE OF RICE VARIETIES TO EARLY-POSTEMERGENCE APPLICATIONS OF TOPRAMEZONE. M.H. Moore*, R.C. Scott2, J. Norsworthy1, B. Davis1, M. Fogleman1; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas - Extension Service, Lonoke, AR (20)

ABSTRACT

In the mid-southern United States, there are over 20 rice cultivars and hybrids grown commercially each year. Because of this wide variety of rice germplasm, there lies potential for varying tolerance to herbicides that could be used in controlling weeds during the growing season. While extensively used in corn, limited studies have been conducted on the tolerance of rice to the 4-hydroxyphenolpyruvate dioxygenase (HPPD) inhibiting herbicides. Some of these herbicides have shown potential to control a wide spectrum of rice weeds. Therefore in 2017 at the University of Arkansas Rice Research and Extension Center near Stuttgart, Arkansas, a field study was conducted to assess the tolerance of 10 commonly planted rice cultivars (Roy J, Diamond, LaKast, Jupiter, Titan, Rondo, CL151, CL172, CLXL 745, and XL 753) to topramezone, mesotrione, or tembotrione at the 2- to 3-leaf stage. After application, visual injury was assessed 2 and 4 weeks after treatment (WAT) and grain yield was taken at physiological maturity. Yields were then turned into percent of the nontreated check for each corresponding rice cultivar. The cultivar “Rondo” exhibited the most injury with over 90% crop injury observed at 4 WAT for all herbicide; grain yield was also reduced by 75% when applied with topramezone and 100% when applied with mesotrione and tembotrione. “Jupiter” was least affected by each treatment with mesotrione showing the most injury of the herbicides at 20% 4 WAT and less than 10% in yield reduction for all treatments. Based on these findings, it is concluded these HPPD-inhibiting herbicides pose a high degree of risk that would be deemed unacceptable by most growers.
THE EFFECT OF DICAMBA DRIFT RATES ON SOYBEAN GRAIN QUALITY. M. Zaccaro*, J. Norsworthy, D. Moseley; University of Arkansas, Fayetteville, AR (21)

ABSTRACT

The United States is one of the largest producers and exporters of soybean, which is a major food source worldwide providing protein, oil, and many other nutrients to humans and animals. The increase of area planted to dicamba-resistant soybean may generate losses on susceptible crops. Previous research detected an interaction of dicamba rate and application timing affected seed composition and seed mass in glyphosate-resistant soybean. The objective of this study was to evaluate if seed mass and concentrations of seed protein and oil changed after low rates of dicamba were applied to soybean at the at R5 growth stage. A study was established in 2017 at the Arkansas Agricultural Research and Extension Center in Fayetteville, AR where glufosinate-resistant soybean was treated with a range of dicamba rates from 3/4X to 1/256X, with the labeled rate for dicamba-resistant soybean being 560 g ae ha\(^{-1}\) (1X). Soybean was harvested at maturity using a small-plot combine. Weight per 100 seed along with protein and oil content were determined with a near infrared spectroscopy analyzer. Dicamba rate had no effect on seed mass. A significant linear response was detected for soybean seed protein and oil concentrations versus dicamba rate. Predicted soybean seed protein concentration increased from 38.28% at 2.2 g ae ha\(^{-1}\) of dicamba to 40.28% at 420 g ae ha\(^{-1}\). Predicted accumulation of seed oil decreased from 23.35% at the lowest rate of dicamba to 20.89% at highest. Even though the treatments had no significant impact on seed mass, a significant change in seed composition was observed. Future efforts will focus on quantifying dicamba and its metabolites in seeds.
PPO-RESISTANT AND SUSCEPTIBLE PALMER AMARANTH BIOTYPE RESPONSE TO GROUP 14 AND 15 RESIDUAL HERBICIDES. J. Copeland*1, L. Steckel1, M. Wiggins2; 1University of Tennessee, Jackson, TN, 2FMC, Humboldt, TN (22)

ABSTRACT

Glyphosate-resistant Palmer amaranth (Amaranthus palmeri) is the most problematic weed in row-cropping systems. In years past, growers have relied heavily on group 14 (PPO inhibitors) and group 15 (long-chain fatty acid inhibitors) for control GR Palmer amaranth populations. As a result, PPO-resistant Palmer amaranth biotypes were discovered in 2015 in Tennessee populations. However, data is lacking on the residual efficacy of group 14 and 15 herbicides on PPO-resistant Palmer amaranth. Considering these herbicides are utilized on nearly every acre to control Palmer amaranth, studies were conducted to evaluate the efficacy if group 14 and 15 residual herbicides on PPO-resistant Palmer amaranth.

Two studies were conducted at both Ripley, Tennessee (PPO-R) and Dyersburg, Tennessee (PPO-S) in 2017. In study one (group 14 herbicides), treatments included a nontreated, sulfentrazone, saflufenacil, flumioxazin, sulfentrazone + metribuzin at 0.5X, 1X, 1.5X, and 2X field-use rate for a silt loam soil. In study two (group 15 herbicides), treatments included a nontreated, pyroxasulfone, S-metolachlor, dimethenamid-P, and pyroxasulfone + fluthiacet-methyl at 0.5X, 1X, 1.5X, and 2X field-use rate. Plots were 1.5 m wide and 9.1 m in length. Treatments were replicated three times and arranged within a randomized complete block design. Visual control was assessed 21, 28, 35 and 42 days after treatment and expressed as ED75 (effective dose to control 75% of Palmer amaranth) and as a percentage compared to the nontreated check. Data were subject to an analysis of variance using the PROC Glimmix in SAS 9.4. Using a 3-parameter sigmoidal equation, trends from results were constructed in Sigma Plot 14.

In study one, ED75 values of sulfentrazone was less at PPO-S site, 109 g ai ha⁻¹, compared to PPO-R site. ED75 values of flumioxazin at PPO-R site (121 g ai ha⁻¹) were 10 times greater than the PPO-S site (12 g ai ha⁻¹) 35 DAT. In study two, ED75 values of S-metolachlor were less at PPO-S site (178 g ai ha⁻¹) compared to PPO-R site (634 g ai ha⁻¹), 28 DAT. Percent control of Palmer amaranth with pyroxasulfone at 90 g ai ha⁻¹ was greater at PPO-S site (92%) compared to PPO-R site (79%) 35 DAT.

ED75 values suggest that group 14 herbicides applied were less effective on Palmer amaranth at this PPO-resistant site. In fields that are infested with PPO-resistant Palmer amaranth, premixes of residual herbicides that contain effective modes of action should be utilized. Growers that rely on group 15 herbicides to control PPO-resistant Palmer amaranth should be cognizant of the inconsistencies in control shown in these data.
VARIATION IN GOOSEGRASS PHENOTYPES COLLECTED FROM DIFFERENT MANAGED AREAS. J.S. McElroy*, A. Boyd, J. Harris; Auburn University, Auburn, AL (23)

ABSTRACT

Goosegrass (Eleusine indica) is a common and troublesome weed in agronomic crops and turfgrass throughout the world. It is an annual species that can perenniate in tropical environments and is considered one of the top ten weeds worldwide. Little is understood regarding the phenotypic diversity of goosegrass. Research was conducted in 2017 to investigate the phenotypic diversity of goosegrass ecotypes collected from different managed and unmanaged areas. Research was conducted at the Sports Surface Field Lab in Auburn, AL. Research was initiated as a single-year garden plot experiment with 10 replicates per ecotypes. Eleven ecotypes were evaluated collected from either non-crop unfertilized areas, row-crop areas, golf course fairways, or golf course putting greens. Suffixes of NC (non-crop), GC (golf course), GCPG (golf course putting green), and Crop (agronomic crop) are provided to distinguish ecotypes by collection area. Goosegrass seedlings were first germinated in a greenhouse environment with 28/22 C day/night temperatures with a 14-h photoperiod with supplemental lighting extending day length. Seedlings were transplanted 2-wks after germination into individual 1800 ml pots. Pots were filled with Marvyn sandy loam soil with pH 6.4 and 1.2% OM. Pots were transported to the field 1-wk after transplanting. Plants were irrigated daily and were fertilized every three weeks with approximately 20 lb N/A using Scott’s Miracle Gro All-Purpose fertilizer (24-8-16). Pots were allowed to grow and develop until 6 July 2017, at which time measurements were taken. Various morphological measurements were taken including but not limited to length of stem, spike, and leaf parts, and seedhead, tiller, and spikelet numbers. Descriptive statistics of dependent variables were generated using Excel. Means were subjected to principle component analysis using XLStat Base.

Two distinct groups could be separated based on principle components analysis. The first group was comprised of ecotypes collected from crop types areas – TN River, Wire Road, and PBU. A second group was comprised of ecotypes collected from turfgrass/golf course areas – Clanton, NC-WT, RB, CCV, Craft, and Woodward. These ecotypes were collected from areas such as golf course fairways and rough that received mowing 1-3 times per week. Aug-NC is a population collected from a gravel parking lot in Augusta, GA, (thus labeled NC for non-crop). Aug-NC was intermediate between turfgrass/golf course types and crop types. Texas-GCPG was completely separate from all other types. Texas-GCPG is a dwarf mutant goosegrass ecotypes collected from a golf course putting green. Texas-GCPG produced twice as many seedheads and tillers per plant as all other plant and did not exceed 25 cm length from base to spike. Overall goosegrass collected from golf courses had shorter stem lengths, shorter leaf lengths, shorter length between leaves, more prostrate growth habit, and more tillers per plant compared to ecotypes collected from crop areas. It was hypothesized that goosegrass collected from golf courses and undergo regular turfgrass management practices such as low, frequent mowing are plants that simply acclimate to such management practices and with the removal of such management practices these ecotypes would return to a “normal” phenotype present in non-mowed crop collected phenotypes. From this research we conclude that ecotypes collected from managed turfgrass environments possess a distinct separate phenotype that likely has been selected for through these intensive management practices. Ecotypes do not revert back to the
normal wild-type phenotype as possessed by ecotypes collected from crop environments. Rather, the ecotypes maintain a different phenotype best suited for environment from which they were selected.
DECONSTRUCTING SPEEDZONE CONTROL OF GOOSEGRASS. J. Peppers*, A. Boyd, J.S. McElroy; Department of Crop, Soil and Environmental Sciences, Auburn University, Auburn, AL (24)

ABSTRACT

Goosegrass [Eleusine indica (L.) Gaertn] is a tough, clumping summer annual grassy weed. Goosegrass can withstand a wide variety of stressors and is very adaptable. Few post-emergence herbicides are available that offer acceptable control. Herbicide resistance to dinitroanilines, triazines, oxadiazoles and glyphosate further complicate control efforts. Speedzone (PBI Gordon, Kansas City, MO) is a combination product that has shown the ability to control goosegrass with two or three applications. Speedzone is composed of carfentrazone-ethyl, 2,4-D ester, mecoprop-p acid, and dicamba acid. Theoretically based on the modes of action of the previous herbicides (auxin mimics and PPO-inhibition), Speedzone should not be effective in controlling goosegrass. It has been theorized that while the individual components of Speedzone are not effective in controlling goosegrass, the combination has a synergistic effect that results in control. However, other researchers have reported inconsistent results of goosegrass control. This leads to a secondary hypothesis that inconsistent control is due to inherent variation between goosegrass populations. In this experiment, we attempted to resolve both hypotheses by evaluating five biotypes of goosegrass treated with Speedzone or one of its deconstructed components.

A greenhouse evaluation was conducted in 2017 at the Plant Science Research Center located in Auburn, Alabama. Five different biotypes were used and designated as: Tennessee River (Town Creek, AL), PBU (Tallassee, AL), Clanton (Clanton, AL), Craft Farms (Gulf Shores, AL), and Augusta (Augusta, GA). The goosegrass populations were between 2-4 tillers at the time of the first application. The applied treatments were Speedzone (0.26 kg ai ha⁻¹), carfentrazone (0.0002 and 0.0009 kg ai ha⁻¹), mecoprop (0.016 and 0.49 kg ai ha⁻¹), 2,4-D (0.24 and 0.86 kg ai ha⁻¹) and dicamba (0.001 and 0.039 kg ai ha⁻¹). These treatments were compared to a non-treated control. Two applications of each treatment were applied two weeks apart. Herbicide damage was visually rated on a 0-100% scale. The treatments were arranged in a randomized complete block design with three replications and the trial was repeated in time. All data was analyzed using PROC GLM and Fisher’s Protected LSD (P<0.05) was utilized for means separation.

At the conclusion of the trial, 35 days after initial treatment (DAT), Augusta biotype control was 100% for mecoprop (0.49), 80% for 2,4-D (0.86) and 73% for Speedzone. All other treatments showed 0% control on this date. Control of the Clanton biotype was 73% for mecoprop (0.49) and 53% for 2,4-D (0.86). All other treatments ranged from 0-40%. Control of the Craft Farms biotype at 35 DAT was 93% for dicamba (0.039) and 57% for Speedzone. All other treatments showed no control. Control of the PBU biotype was 97% for mecoprop (0.49) and 47% dicamba (0.039). All other treatments ranged from 0-33% on this date. Control of the Tennessee River biotype at 35 DAT was 97% for Speedzone. All other treatments ranged from 0-47%. Results indicate that goosegrass control with Speedzone is highly variable across biotypes. High levels of control were observed for the components mecoprop, dicamba and 2,4-D at labeled rates, but also variable across biotypes. Further research is needed to determine why biotype differentiation leads to differential herbicide effects.

ABSTRACT

Research has shown glufosinate to be an effective postemergence broadleaf herbicide; however, glufosinate is less effective in controlling grass weed species. Commonly, herbicides are added to glufosinate applications to control grass species, but many struggle to control specific grass weed species. Thiencarbazone-methyl (TCM), an ALS herbicide, could provide growers another option to supplement glufosinate for postemergence grass weed control. A field experiment was conducted at the Agricultural Research and Extension Center in Fayetteville, Arkansas in the summer of 2016 and 2017 to determine the postemergence grass activity of TCM with and without glufosinate to several common glufosinate/herbicide tank-mixes. The experiment was set up as a two factor, randomized complete block design with factor-A being presence of glufosinate (no glufosinate or 595 g/ha of glufosinate) and factor-B being herbicide additive (17 g ha\(^{-1}\) of TCM, 33.5 g ha\(^{-1}\) of TCM, 67 g ha\(^{-1}\) of TCM, 105 g ha\(^{-1}\) of imazethapyr, 280 g ha\(^{-1}\) of clethodim, or no herbicide additive). Data were collected on johnsongrass (\textit{Sorghum halepense}), broadleaf signalgrass (\textit{Urochloa platyphylla}), and goosegrass (\textit{Eleusine indica}) control at 14, 21, and 28 days after application (DAA). Alone, TCM provided johnsongrass control of 74-81% across rates; however, the addition of glufosinate increased johnsongrass control to a comparable level to clethodim + glufosinate (93-97%). All herbicide additives + glufosinate increased johnsongrass control compared to glufosinate alone (83%). With the exception of clethodim (80%), all tank-mix partners alone (48-52%) were less effective for goosegrass control compared to treatments containing glufosinate (80-92%). Likewise, no tank-mix partner significantly increased goosegrass control over glufosinate alone. Based on this research TCM appears to have value as a herbicide additive for glufosinate in an ALS-resistant soybean system.
LARGE CRABGRASS (DIGITARIA SANGUINALIS) MANAGEMENT IN HYBRID BERMUDAGRASS HAY MEADOWS. R. Strahan*, J. Holmes, M. Voitier, E.K. Twidwell; LSU AgCenter, Baton Rouge, LA (27)

ABSTRACT

Large crabgrass (Digitaria sanguinalis (L.) Scop.) is a significant problem for hay producers in the southeastern United States, as there are few herbicide options for its selective removal from bermudagrass (Cynodon dactylon (L.) Pers.) hay meadows. Large crabgrass, a prodigious seed producer, rapidly spreads throughout bermudagrass fields, where it often outcompetes the crop and significantly reduces hay quality and yields. Bermudagrass meadows infested with crabgrass often become unusable for hay production.

A field study was conducted in the spring of 2017 in a hybrid bermudagrass (Alicia cultivar) hay meadow in Lincoln Parish, near Choudrant, LA. The purpose of the study was to evaluate the effectiveness of several herbicides for controlling large crabgrass in a heavily invested site.

The experiment was conducted as a randomized complete block with 3 replications. Herbicides included glyphosate (Cornerstone 4 AS), quinclorac (Facet 1.5 L) and pendimethalin (Prowl H2O 3.8 AS). There were 10 total treatments including an unsprayed check, applied 5 days after hay harvest. Herbicides were sprayed with a CO2 backpack sprayer delivering 27.5 GPA. Approximately 80 lb/A nitrogen fertilizer were applied at 0 and 40 days after herbicide application (DAA). The hay was harvested for a second time 35 DAA. Visual ratings of percent crabgrass control, percent bermudagrass injury, and percent bermudagrass cover were collected at approximately 2 week intervals. Data were subjected to analysis of variance (P=0.05) and means were separated using Fisher’s LSD.

At 24 DAA, quinclorac applied at 0.38 or 0.56 lbs/A + glyphosate at 0.19 or 0.25 w/o pendimethalin provided at least 90% large crabgrass control and <20% bermudagrass injury. Tank-mixes of quinclorac + glyphosate were more effective than when quinclorac was applied alone. Glyphosate applied alone at 0.31 lbs/A was equally effective on large crabgrass but was too injurious to the bermudagrass. Bermudagrass in plots treated at this higher rate of glyphosate declined and the plots were more prone to infestations of large crabgrass, purple nutsedge (Cyperus rotundus) and goosegrass (Eleucine indica).

By 91 DAA, tank-mixes of quinclorac at 0.38 lbs/A + pendimethalin at 1.9 lbs/A + glyphosate at 0.19 or 0.25 lbs/A were more effective than quinclorac applied alone or tank-mixed with glyphosate at 0.19 lbs/A. Although there were no statistical differences in control for most other herbicide treatments by 91 DAA, there was a trend of increased long term control with quinclorac + glyphosate + pendimethalin tank-mixes. This trend of increasing control percentages could likely be attributed to the soil residual of pendimethalin.

There were no statistical differences among herbicide treatments for bermudagrass plot coverage by 91 DAA. However, all plots treated with herbicides had significantly more bermudagrass coverage than the untreated plots. Untreated plots had near 100% large crabgrass coverage, indicating the importance of using herbicides to control large crabgrass populations.
EXPLORING NON-CONVENTIONAL WAYS TO DETERMINE HERBICIDE-RESISTANCE IN PALMER AMARANTH. V. Singh*1, S. Abugho1, A. Prosvirin1, M. Bagavathiannan2; 1Texas A&M University, College Station, TX, 2Texas A&M AgriLife Research, College Station, TX (28)

ABSTRACT

Herbicide resistance is one of the major problem in weed management, posing great challenges to herbicide sustainability and crop production in world agriculture. Green house assays are generally time consuming and requires much efforts in determining herbicide resistance. Alternatively, hyperspectral imaging, and Raman spectroscopy provides precision based approach to differentiate resistant and susceptible plant types due to change in leaf tissue components after herbicide application. Greenhouse studies were conducted at Texas A&M University during spring and fall 2017 to determine herbicide-resistance in Palmer amaranth through hyperspectral imaging and Raman spectroscopy. The glyphosate-resistant population chosen was 16-fold less sensitive to glyphosate compared with susceptible population. Raman spectroscopy and hyperspectral imaging were performed on treated (1X) and non-treated resistant and susceptible populations immediately after treatment, 1 and 2 DAT. β-carotene peaks were prominent in resistant population at 1150 & 1520 of Raman shift (cm⁻¹). The hyperspectral imaging data was highly variable and could not be analysed. However, Raman spectra indicated β-carotene was almost double in the resistant Palmer amaranth population at 2 DAT in comparison to susceptible population. Raman spectroscopy of carotene content in plants is a useful and simple tool for monitoring herbicide stress. This technology holds promise for mobile automated systems and precision agriculture.
IDENTIFICATION OF HERBICIDES FOR WEED CONTROL IN CARINATA (BRASSICA CARINATA). R. Leon*1, J. Ferrell2, M. Mulvaney3; 1North Carolina State University, Raleigh, NC, 2University of Florida, Gainesville, FL, 3University of Florida, Jay, FL (29)

ABSTRACT

Carinata is a new crop with potential for biojet-fuel and biodiesel production, but there is no information about herbicide tolerance for this crop. Field experiments were conducted from 2014 to 2016 to determine the safety of several preemergence (PRE) and postemergence (POST) herbicides in carinata. Pendimethalin at 1080 g ai ha⁻¹ applied preplant incorporated (PPI) and PRE, caused no carinata injury, or plant density and yield reductions. S-metolachlor was also safe at multiple rates applied at PRE, 3 d after planting (DAP) and at the 2- to 6-leaf stage. Flumioxazin at 72 g ai ha⁻¹ applied PRE caused prevented crop establishment. Among the POST herbicides evaluated, clopyralid at 210 g ae ha⁻¹ and clethodim at 136 g ai ha⁻¹ caused minor injury to carinata but did not reduce yield compared to the nontreated control. Acifluorfen at 420 g ai ha⁻¹, bentazon at 840 g ai ha⁻¹, and carfentrazzone at 18 g ai ha⁻¹ applied POST to carinata caused 75 to 100% injury. The present study suggested that pendimethalin, S-metolachlor, clopyralid and clethodim can be safely used for weed control in carinata, and flumioxazin, acifluorfen, bentazon, and carfentrazzone can be used to control volunteer carinata plants in rotational crops.
NUTSEDGE CONTROL BY PREEMERGENCE HERBICIDES IN DIFFERENT SUNNHEMP POPULATIONS. T. Batts¹, R. Randhawa*², P. Dittmar²; ¹LSU Ag Center, Baton Rouge, LA, ²University of Florida, Gainesville, FL (30)

ABSTRACT

Yellow and purple nutsedge (Cyperus esculentus and C. rotundus) are one of the most difficult weeds to control. Different cover crops such as sunnhemp has displayed potential for effective nutseed control. However, cover crop seeds can be expensive and also cover crops take quite a bit of time in canopy closure which gives nutsedge a chance to emergence. A higher seeding rate is required for quick canopy closure however that adds to increased costs of weed control. On the vice-versa, reducing the planting density would save money, but reduces the weed control too. Therefore, lower seed rate coupled with pre-emergence herbicides could be helpful in commercially acceptable weed control.

A field trial was conducted in summer 2017 at Gainesville, Florida to assess the optimum seed rate of sunnhemp with different herbicides combinations to provide the same level of control as a high cover crop seeding rate. The experiment consisted of 12 treatments laid in 4x3 factorial design with 3 replicates per treatment. Treatments consisted of sunnhemp at three planting densities; zero, low and high and four chemical options; s-metolachlor (dual magnum; Syngenta Crop protection LLC; NC) at 1071 g ai ha⁻¹, halosulfuron (sandea; Canyon Group LLC, Arizona) at 53 g ai ha⁻¹, imazethapyr (pursuit; BASF, Research Triangle Park, NC) at 70 g ai ha⁻¹ and no herbicide. Herbicide treatments were made using a hand-held spray boom equipped with two TTI 11002 nozzles calibrated to deliver total spray volume of 187 L ha⁻¹ at 172 kPa. For data collection, visible control of nutsedge and sunnhemp injury were measures on 0 (no control/injury) to 100 (complete plant necrosis) scale at 21 and 56 days after planting. Data analysis were performed using JMP 1.1.0 (SAS Institute Inc., Cary, NC). ANOVA was performed and effects were considered significant when P < 0.05. Subsequently, multiple comparison tests were performed using Fisher’s protected LSD (P < 0.05).

Results indicated that at 21 days after planting (DAP), all herbicides had a significantly better nutseed control (>22%) relative to the non-treated plots however, population density did not affect nutseed control. At 56 DAP, herbicides and density effect was observed to be significant but no interaction was observed. Both, pursuit and dual resulted in significantly higher (61%) nutseed control than non-treated (38%) while high density planting resulted in better control (72%) than the low density (60%) and zero density (20%) plantings. None of the treatments resulted in significant injury to sunnhemp population at any of the rating dates. We could summarize from data that pursuit, dual and high-density planting have better efficacy in nutseed control however no interaction could be established between herbicides and planting densities. More extensive research including more herbicides, planting densities and spatial replications would be needed to make appropriate conclusions and recommendations to growers.
EVALUATION OF WEED SEEDLING EMERGENCE AND DENSITY IN ORGANIC GRAIN PRODUCTION SYSTEMS UNDER DIFFERENT MANAGEMENT PRACTICES. S.L. Samuelson*, R. Schnell2, N. Rajan1, M. Bagavathiannan3; 1Texas A&M University, College Station, TX, 2Texas A&M, College Station, TX, 3Texas A&M AgriLife Research, College Station, TX (31)

ABSTRACT

Organic food production is increasing for the past decade due to consumer demand. In an effort to lessen our dependence on herbicides, the adoption of cover crops, as a means of weed management, has been encouraged. The objective of this study is to observe weed population dynamics with varied management tactics in an organic grain production system. The study was established in September 2016 at the Texas A&M University research farm on land that was previously left fallow for several years (2006-2016). The experimental design is a randomized strip-split plot design with three replications. The rotation for main crops is soybeans-corn-sorghum. All three main crops are in rotation each year and represent the main plot factor. The treatments under each main crop are four sub-plots that 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 as 3, but conventional tillage to prepare seedbed for planting. Soil seedbank samples were taken to observe seedbank dynamics overtime with variable management practices. At 21 days after planting (DAP) weed seedling emergence and density observations were taken by arbitrarily placing 1 m² quadrats in the plots and recording what was present. Similar observations were performed in the fall after harvesting the grain crops, 21 DAP the summer cover crop. No treatment provided effective control at either timing. Conventional tillage provided some weed suppression in the spring after planting of the cash crop, and the cover crops provided some control in the fall. Having the field remain dormant for 10 years supplied the soil with a rich seedbank that makes growing crops for yield challenging. The coming years will provide valuable data to see how these treatments affect the weed seedbank.
HERBICIDE SYNERGY FOR LONG-TERM WEED CONTROL IN CITRUS. R. Kanissery*; University of Florida, Southwest Florida REC, Immokalee, FL (32)

ABSTRACT

Weed control is a major component of Florida citrus grove management as warm and humid climate along with frequent rainfall provides a conducive environment for prolific weed emergence and growth in citrus groves. Although there are several pre and post-emergent herbicide products available for managing a diversity of citrus weeds, there is always an inadequacy in the weed control spectrum of any particular herbicide product. Mixing multiple herbicides during a single application is a common practice, and clearly a common practice for improving weed management limitations. ‘Synergism’ in the case of herbicides, occurs when a combination of two or more herbicides works better or the effect is more prolonged than the sum of the effects of the individual ingredients alone. When herbicides are mixed in a single application, it facilitates the possibility of cumulatively using less herbicide product. Additionally, the number of spraying operations and associated costs can be reduced. A field study was conducted at the UF-IFAS Southwest Florida Research and Education Center during the fall season of 2017, to evaluate the long-term citrus weed control prospects of combining herbicide products during a single application. When compared to the control (application of glyphosate alone), the combination of pre-emergent herbicides in this study exhibited significantly greater and a longer duration (up to 150 days) of citrus weed control. The combination of pre-emergent herbicides Indaziflam and Flumioxazin exhibited a synergistic outcome (calculated by Colby’s method) at different levels of application rate tested.
WEED MANAGEMENT OPTIONS IN OKLAHOMA SOYBEAN. T.A. Baughman*1, R. Peterson2, D. Teeter1; 1Oklahoma State University, Ardmore, OK, 2OSU- Institute for Agricultural BioScience, Ardmore, OK (33)

ABSTRACT

The development of resistant weed issues in Oklahoma soybean has increased in severity. These weeds have included Palmer amaranth (Amaranthus palmeri), tall waterhemp (Amaranthus tuberculatus), and giant ragweed (Ambrosia trifida). The advent of new herbicide technologies like Roundup Ready Xtend and Balance GT soybean herbicide systems give growers potential options to manage these problem weeds. Studies were conducted during the 2017 growing season to evaluate various herbicide programs for effective weed control in both these systems. Weed control trials where established at the Oklahoma State University Mingo Valley Research Station near Bixby, OK. The soil type is a Radley silt loam with 0.6% OM and 6.4 pH. Soybean were planted on May 30, 2017 in 30 inch rows. The first trial was planted to soybean cultivar “FG72” that was tolerant to isoxaflutole (Balance Bean) and glyphosate. Balance Bean at 3.0 fl oz/A was applied in combination with various PRE herbicides. These include Dual II Magnum (16 fl oz/A), Spartan (5 fl oz/A), Tricor (5.33 oz/A), Valor (2 oz/A), Warrant (3 pt/A), or Zidua (1.5 oz/A). All PRE herbicides were followed with a POST application of Roundup PowerMax at 32 fl oz/A. Three additional studies were planted to Roundup Ready 2 Xtend soybean cultivar “AG47X6”. The first study evaluated various PRE residual herbicides including: Authority Elite (25 fl oz/A), Cinch (1.33 pt/A), Rowel (2 oz/A), Tricor (8 oz/A), Warrant (48 fl oz/A), Warrant Ultra (48 fl oz/A), Zidua (1.5 oz/A), or Zidua Pro (4.5 fl oz/A). All PRE herbicides were followed with a POST application of Engenia (12.8 fl oz/A) + Roundup PowerMax (32 fl oz/A). The second study evaluated residual herbicides applied either PRE or POST at their labeled rates including Cinch (1.33 pt/A), Warrant (48 fl oz/A), Warrant Ultra (48 fl oz/A), or Zidua (1.5 oz/A). All POST herbicide combinations included Engenia (12.8 fl oz/A) + Roundup PowerMax (32 fl oz/A). The final study evaluated PRE residuals either alone or in combination with Tricor (5.3 oz/A). These included Cinch (1.33 pt/A), Rowel (2 oz/A), Warrant (48 fl oz/A), or Zidua (1.5 oz/A). All PRE herbicide programs were followed by Engenia (12.8 fl oz/A) + Roundup PowerMax (32 fl oz/A). All POST herbicides treatments were applied at the V2-V3 growth stage. Palmer amaranth and ivyleaf morningglory (Ipomoea hederacea) were visually evaluated season long for control with late season evaluations presented. Plots were harvested with a small plot combine to determine yield. Late season Palmer amaranth control was 99% when Balance Bean was applied in combination with either Valor or Warrant PRE and followed by Roundup PowerMax POST. Variation in control with Spartan may have been due to potential PPO-resistant Palmer amaranth at this location. Ivyleaf morningglory control was at least 98% except when Balance Bean was applied in combination with Spartan or Zidua. Soybean yield were similar across all treatments. Palmer amaranth control was 100% and ivyleaf morningglory control was at least 98% regardless of the PRE herbicide program when followed by a POST application of Engenia + Roundup PowerMax. Palmer amaranth control and ivyleaf morningglory control was at least 97% regardless if the residual herbicide was applied PRE and followed by a by a POST application of Engenia + Roundup PowerMax or if the residual herbicide was applied in combination with the POST herbicide. While PRE + POST applications were just as effective as PRE followed by POST combinations the ability for a grower to makes these POST
combinations in a timely fashion across all his acres should be considered. Late season Palmer amaranth and ivyleaf morningglory control was 100% whether a PRE herbicides was applied alone or in combination with Tricor. Soybean yields exceeded 45 bu/A with all Roundup Ready Xtend programs. A residual herbicide is an important component of the Roundup Ready Xtend soybean system but the Xtend system allows more flexibility in the choice of that residual. This research indicates that both the Balance GT and Roundup Ready Xtend programs can be effective tools for weed management in Oklahoma soybean.
TABASCO PEPPER TOLERANCE TO OVER THE TOP APPLICATIONS OF HALOSULFURON. R. Strahan*, K.K. Fontenot, M. Voitier, M. Sexton; LSU AgCenter, Baton Rouge, LA (34)

ABSTRACT

Purple nutsedge (Cyperus rotundus L.) is a significant weed of tabasco peppers grown on plastic mulch in Avery Island, LA, and the only one observed to pierce the plastic mulch layer, allowing it compete directly with the crop. This presents a difficult pest control problem for growers, as there is no effective sedge control herbicide labeled for over the top application on this crop. Due to its effectiveness at controlling many sedge species, halosulfuron is commonly used to control purple nutsedge in other vegetable crops, but is not specifically labeled for over the top application in tabasco peppers.

The experiment was conducted as a randomized complete block with 4 replications. There were 4 total treatments applied at flower initiation approximately 60 days after planting, including unsprayed plots. Halosulfuron was applied over the pepper plants at rates of 0.25, 0.50, and 1.00 oz/A, with 0.25% v/v non-ionic surfactant using a CO2 backpack sprayer delivering 18 GPA. Pepper plant height and width data were collected 30 days after application (DAA).

At 90 DAA, 5 whole stalks were randomly harvested from each plot and processed in the laboratory. Peppers were removed from plants, segregated by color (red, orange, and yellow/green), and weighed. Data were subjected to analysis of variance (P=0.05) and means were separated using Fisher’s LSD.

Regardless of rate, halosulfuron applications did not significantly reduce red, orange, or yellow tabasco pepper yield versus the unsprayed check. Although the herbicide caused some minor leaf chlorosis, there were no differences observed for plant height or canopy width. Halosulfuron did not delay crop maturity.
SOYBEAN VARIETY RESPONSE TO DELAYED HARVEST WHEN TREATED WITH AND WITHOUT PARAQUAT. J. Copes*1, O. Clark1, M. Foster2; 1 Northeast Research Station Louisiana State University Agricultural Center, Saint Joseph, LA, 2 School of Plant, Environmental, and Soil Sciences, LSU AgCenter, Baton Rouge, LA (37)

ABSTRACT

In 2017, two field trials were conducted at the Northeast Research Station near Saint Joseph, Louisiana examining how paraquat, applied as a harvest aid, influenced time of harvest, seed quality, and yield, and also how delayed harvest affected these parameters. Field trial one was conducted in a randomized complete block design with a factorial treatment arrangement replicated four times. Twelve soybean varieties (Asgrow varieties 38X8, 46X6, 47X6, and 53X6; Credenz varieties 4181RY and 5375RY; Dyna-Grow varieties S34RY95, S48XT56, and S52RY75; Syngenta variety RJ S41009R-DBLX; and Terral REV varieties 47R34 and 56R53) were either treated with paraquat or not treated. Soybeans in the paraquat treated plots were harvested once completely desiccated and seed was near 13% moisture, and treatments that did not receive paraquat, were harvested once the plants had dried down naturally. Field trial two was conducted as a strip trial consisting of three factors: soybean variety, harvest aid, and harvest timing. Five soybean varieties (Asgrow varieties 43X7, 46X6, and 51X8; Syngenta variety RJ S41009R-DBLX; Terral REV variety 56R63) were planted as strips and replicated four times. Within each strip, plots received paraquat or no paraquat and harvested when seed moisture reached 13%, 13% plus ten days, and 13% plus twenty days. Soybean varieties for both field trials were selected to span from late-maturity group III or early IV to mid-maturity group V. Both trial were planted on May 17, 2017, and paraquat treatments were applied to soybean varieties once they reached the R6.5 growth stage or as soon as possible. Soybeans were rated once a week for desiccation and pod shatter.

In field trial one, paraquat applications resulted in 0-13 day earlier harvest compared to treatments not receiving paraquat. For all varieties the pre-harvest interval of 15 days would negate the benefit of applying paraquat as a soybean desiccant, unless weeds were present.

Yield was greatest for treatments not receiving paraquat compared to treatments receiving paraquat, except for DG S52RY75 and REV 47R34. On average, yield was significantly greater (4.9 bu/a) for varieties not receiving paraquat compared to varieties receiving paraquat. These results cannot be explained since paraquat was applied at or after varieties reaching the R6.5 growth stage. Purple seed stain, mold, and and overall seed quality was only affected by soybean variety. AG 38X8, RJ S41009 DBLX, and CZ 4181 RY varieties had the greatest percentage of seed with purple seed stain at 15.2, 21.2, and 21.4, respectively. DG S43RY95, AG 46X6, REV 47R34, AG 47X6, and DG S48XT56 had the greatest percentage of moldy seed at 3.9, 3.9, 3.6, 4.5, and 5.3, respectively. Green seed (seeds with a green color once dried) and split seed was influenced by soybean variety and harvest aid application. On average paraquat treatment resulted in greater percentage of green seed compared to no paraquat treatments, 0.8 compared to 0.3, respectively. Split seeds were greater for treatments not receiving paraquat compared to paraquat treatments (3.4 vs 2.1). This could have been due to lower harvest seed moisture for no paraquat treatments.
In field trial two, there was no difference in harvest dates of treatments receiving paraquat compared to no paraquat. Therefore, there was no benefit of applying paraquat as a soybean desiccant. Averaged across soybean varieties and harvest aid treatments, seed moisture content was significantly lower as harvest was delayed, 11.8, 11.1, and 10.9 for the 13% seed moisture harvest date, 13% plus 10 day, and 13% plus 20 day, respectively. Delaying harvest did not influence yield, 69.8, 70.4, and 69.8 bu/a for 13% plus 10 day, and 13% plus 20 day, respectively. Whether or not paraquat was applied did not influence yield, 70.2 bu/a for paraquat treated compared to 69.9 for no paraquat. Soybean variety had the largest influence on yield. Purple seed stain and mold were only influenced by soybean variety. Very little pod shatter was observed in the study, however shatter tended to increase with delayed harvest. Green seed, split seed, and overall soybean seed quality was influenced by both soybean variety and harvest timing. Overall seed quality ranged from 1.4 to 2.0 when averaged across harvest date and harvest aid application, and ranged from 2.7 to 4.7 when averaged across soybean varieties and harvest aid applications. The number of split seed tended to increase as harvest was delayed 2.7, 4.7, and 3.7 for 13% plus 10 day, and 13% plus 20 day, respectively. Soybean variety was probably the most influencing factor affecting overall seed quality.

In this study, applying paraquat as a soybean desiccant was not beneficial. In field trial one, only from 0 to 13 day earlier harvest was gained when paraquat was applied. In field trial two, harvest dates were equal between paraquat and no paraquat treatments. In field trial one soybean yield was significantly reduced by applying paraquat as a harvest aid. These differences could not be explained. In field trial two, however, paraquat treatments did not affect soybean yield. Overall seed quality was mainly influenced by soybean variety, in particular varieties prone to having purple seed stain.
EVALUATING APPLICATION TIMINGS OF CHELATED IRON AND TOPRAMEZONE FOR BERMUDAGRASS SAFETY. A. Boyd*, J.S. McElroy; Department of Crop and Soil Environmental Science, Auburn University, Auburn, AL (38)

ABSTRACT

Bermudagrass (*Cynodon dactylon*) is one of the most common turfgrass species planted on golf courses, home lawns, and sports fields. Due to recent herbicide restrictions or losses, postemergence control options for grassy weeds have been severely limited. Previous research has shown that the HPPD inhibitor, topramezone (Pylex, BASF, Research Triangle Park, NC), offers excellent control of goosegrass, crabgrasses, and some broadleaf weeds, but application to bermudagrass can cause severe whitening of leaf tissue. As with other HPPD inhibiting herbicides, the carotenoid biosynthesis pathway is affected inducing bleaching symptoms leading to necrosis. A previous research trial conducted at Auburn University found that if topramezone is mixed with chelated iron, the bleaching symptoms are greatly reduced. No research has been conducted to determine whether the reduced bleaching effects are similar if the chelated iron and topramezone are applied at different times. Field trials were conducted in the summer of 2016 and 2017 (Auburn University) to determine whether the application timing of chelated iron affected the safening effects of topramezone on bermudagrass. All topramezone treatments were applied at 12.3 g a.i. ha⁻¹, and chelated iron treatments were applied at 610 g a.i. ha⁻¹. The chelated iron treatments were applied based on the initial topramezone application. Applications were made 7 days before the topramezone treatment (DBTT), 3 DBTT, 2 DBTT, 1 DBTT, 10 minutes before topramezone treatment, 10 minutes after topramezone treatment, 1 day after topramezone treatment (DATT), 2 DATT, 3 DATT, and 7 DATT. These treatments were compared to topramezone mixed with chelated iron, topramezone applied alone, and a non-treated control. Bermudagrass injury and bleaching symptoms were visually rated on a 0 to 100% scale. The treatments were arranged as a randomized complete block design with 4 replications. All data was analyzed using PROC GLM and Fisher’s Protected LSD (P<0.05) was utilized for means separation.

Single applications of topramezone in any combination only induced bleaching symptoms, and no chlorosis or necrosis. Thus injury will be referred to as bleaching. Results presented were pooled across the various runs and the main effects of treatment were sorted by days after treatment (DAT). At 7 DAT, bleaching percentages ranged from 13-25% across all treatments except for topramezone alone (50%) and topramezone/chelated iron (7 DBTT)(35%). By 12 DAT, all of the treatments had bleaching percentages of 25% or less. Symptoms of necrosis started to appear at 12 DAT and ranged from 2-14% across all treatments which received chelated iron and 31% for the topramezone alone treatment. By 16 DAT, all of the treatments bleached bermudagrass 15% or less. Similar to 12 DAT, necrosis percentages ranged from 2-18% for all treatments which received chelated iron, while the topramezone alone treatment was 32%. Bleaching symptoms had subsided by 22 DAT. By 22 DAT, necrosis ranged 0-10% across all treatments. Based on the data from the trial, all of the treatments where chelated iron was applied before or after the topramezone yielded reduced symptoms of bleaching and necrosis when compared to topramezone applied alone. The mixture of topramezone and chelated iron yielded the lowest bleaching and necrosis percentages for all rating dates. Further research is needed to determine whether these results also apply to different cultivars of bermudagrass.
EFFECT OF WEED SIZE AT APPLICATION ON GLUFOSINATE AND PYROXASULFONE EFFICACY AND SOYBEAN YIELD IN A MID-SOUTHERN PRODUCTION SYSTEM. B. Varner*, J. Buol, D.B. Reynolds; Mississippi State University, Mississippi State, MS (39)

ABSTRACT

Since the introduction of glyphosate tolerant crops, usage has increased dramatically. Glyphosate resistance in weed populations has also developed due to extensive use of a single mode of action. It is recommended that herbicides with different modes of action be incorporated into weed control programs. Growers often delay their postemergence applications because of reasons out of their control or in an effort to have as many emerged weeds as possible before application. This delay may affect postemergence herbicide efficacy due to larger weeds and it may also allow for an extended period of interference that may affect soybean yield. Research was conducted with the Liberty Link herbicide system to help combat the use of single modes of actions and to determine the effect of delayed applications on herbicide efficacy and soybean yield. The research was conducted on an off-station location near Starkville, MS. Authority MTZ (sulfentrazone & metribuzin at 0.126 + 0.189 kg ai/ha), Liberty 280 SL (glufosinate at 0.595 kg ai/ha), Zidua (pyroxasulfone 0.119 kg ai/ha), and Ammonium Sulfate were applied at different weed growth stages. Liberty was applied postemergence at 1X rate (0.595 kg ai/ha), 1.25X rate, and 1.5X rate. Postemergence herbicide treatments were applied to <=3 in. weeds, <=6 in. weeds, and <=9 in. weeds. Treatments that were applied to <=3 in. weeds showed 80% control on tall waterhemp. Treatments that were applied PRE alone and to <=6 in. weeds showed 60 to 70% control of tall waterhemp. Treatments applied to <=3 in. weeds, and <=6 in. weeds did not differ in yield. Treatments that were delayed until weeds were <=9 in. weeds resulted in reduced yields due to reduced efficacy and to a longer period of weed interference before being controlled.
TOLERANCE OF SOUTHERNPEA TO PYROXASULFONE. C. Rouse, J.L. Pendergraft*, N. Roma-Burgos; Department of Crop Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR (40)

ABSTRACT

Southernpea (Vigna unguiculata L.) is a valuable legume vegetable crop grown in small acreage in the USA. It is a reliable source of cash for vegetable growers and a useful component of vegetable crop rotation systems. As in other broadleaf crops, the major weed problems in southernpea are broadleaves, especially Palmer amaranth (Amaranthus palmeri S. Wats.) and morningglory species (Ipomoea spp.). Among the newer herbicide chemistries with good residual activity is pyroxasulfone. This has good activity on Palmer amaranth, other small-seeded broadleaf weeds, and grasses. It can augment morningglory control if mixed with other herbicide modes of action; thus, it is registered for use in corn, cotton, soybean, and wheat. Pyroxasulfone is also being considered for registered in several special crops, including southernpea. Experiments were conducted in 2017 in Fayetteville and Kibler, AR to evaluate the tolerance of southernpea to pyroxasulfone. Thirteen herbicide treatments with pyroxasulfone alone, or in combination with other southernpea herbicides, were tested. Stand loss from pyroxasulfone PRE was significant at Fayetteville. Pyroxasulfone PRE followed by fomesafen POST also reduced crop stand in both locations. This treatment caused the highest injury across locations. Yield was reduced by all treatments containing pyroxasulfone PRE in Fayetteville, and by three treatments containing pyroxasulfone in Kibler. We conclude that pyroxasulfone is risky to use PRE in southernpea; however, POST application together with complementary herbicide modes of action is safe for the crop and effective. Future studies could include testing preplant applications with burndown herbicides and repeating this experiment to generate a robust data to support recommended use patterns for registration in southernpea.
PERFORMANCE OF XTENDFLEX COTTON VARIETIES IN THE TEXAS HIGH PLAINS. S. Byrd*1, J. Bell2, G. Morgan3; 1Texas A&M AgriLife Extension, Lubbock, TX, 2Texas A&M AgriLife Extension, Amarillo, TX, 3Texas A&M AgriLife Extension, College Station, TX (41)

ABSTRACT

The release of dicamba tolerant cotton varieties, or varieties with the XtendFlex™ (XF) trait, has resulted in an enormous shift in acreage planted in Texas to certain cotton seed brands and traits. Varieties containing the XF trait are offered by multiple cotton seed companies, including DeltaPine, Americot/NexGen, CROPLAN genetics, and AllTex/DynaGro. In 2015, the year varieties containing the XF trait were first commercially available, XF varieties accounted for only 4% of the 4.8 million acres of cotton planted in Texas. However, in 2016 XF varieties were planted on 43% of the 5.7 million acres in Texas, while another acreage increase occurred in 2017 with 63% of 6.9 million acres planted to XF varieties. Considering the lack of experience with, or knowledge of these varieties, the rate and magnitude of adoption of XF varieties was tremendous. This rapid adoption has resulted in questions surrounding how these varieties perform in this region compared to the types of varieties that were popular and dominated the market in the Texas High Plains in the years leading up to 2016. Data from on-farm variety trials was utilized in this survey, which compared varieties containing the XF trait to those that didn’t in dryland and irrigated trials in 2016 and 2017. Location and variety type (XF or non-XF) were pooled for each year and trial type. In 2016 non-XF varieties yielded 18 lbs. acre⁻¹ more than XF varieties in dryland trials, while XF varieties yielded 28 lbs. acre⁻¹ greater than non-XF varieties in irrigated trials. In 2017 non-XF varieties produced 61 and 106 more lbs. acre⁻¹ in dryland and irrigated trials, respectively. It is also important to note that these numbers are averages across all XF and non-XF varieties included in on-farm trials each year, and there are several very strong performing individual varieties available in either trait package.
LONGEVITY OF CONTROL ACHIEVED BY PREPLANT AND PREEMERGENCE SOIL RESIDUAL HERBICIDES IN SOYBEAN. G.L. Priess*, J. Norsworthy, Z.D. Lancaster, J.T. Richburg; University of Arkansas, Fayetteville, AR, 2University of Arkansas - Extension Service, Lonoke, AR (42)

ABSTRACT

Use of residual herbicides preplant or at planting is often the first line of defense for ensuring a successful weed control program. Residual herbicides reduce selection for the evolution of resistance to postemergence herbicides. This slows the evolution of resistance by reducing the number of weeds that need to be controlled postemergence. Residuals need to be overlapped so there is no high levels of weed seed germination during the critical weed-free period. Thus, the longevity of residual herbicides needs to be evaluated when applied as a preplant or preemergence herbicide. Applying as a preplant may increase the likelihood for activation prior to planting but it may likewise shorten the length of residual activity after crop planting. Hence, a field experiments were conducted in Crawfordsville, Fayetteville and Marianna AR, to determine the residual longevity of herbicides in soybean. The trials were conducted as a two-factor factorial, with factor-A being the application timing (preplant or preemergence) and factor-B being the herbicide treatments. Preplant applications were made two weeks prior to planting and preemergence applications were made at planting. Injury and weed control ratings were taken weekly for ten weeks. Emerged weeds were counted and removed from established two 0.5 m² quadrants in each plot every other week. Data collected was subjected to linear regression to determine the number of days the residual herbicide combination maintained weed control ratings above >80%. In general, in-crop residual control of preemergence applications persisted longer than preplant applications. S-metolachlor + metribuzin maintained >80% control of Palmer amaranth <14 days when applied preplant. When applied at planting S-metolachlor + metribuzin maintained >80% control for 38 days. Injury ratings showed that preemergence applications resulted in higher levels of injury than herbicide combination applied preplant. The results suggest that longevity of weed control and the risk for injury should be taken into consideration when making an application timing and herbicide decision.
EFFECT OF REDUCED RATES OF ENLIST DUO AND ROUNDUP XTEND ON SWEET POTATO. D. Miller*1, M. Mize2; 1LSU AgCenter, St Joseph, LA, 2LSU AgCenter, St. Joseph, LA (43)

ABSTRACT

A field study was conducted in 2017 at the Sweet Potato Research Station near Chase, La with the objective to evaluate impacts of reduced rates and application timing of hormonal herbicides applied with glyphosate on sweetpotato. A four replication factorial arrangement of treatments was used and included herbicide application timing (Factor A: 10 or 30 d after planting (DAP), herbicide (Factor B: Enlist Duo 75 oz/A use rate or Roundup Xtend 56 oz/A use rate), and reduced use rate (Factor C: 1/10, 1/33, 1/66, or 1/100 of the use rate). A non-treated control was included to aid in making visual assessments but was not included in the statistical analysis. Treatments were applied to each 3 x 7.62 m plot at the scheduled timing following planting of ‘Beauregard’ sweet potato on July 5. Parameter measurements included visual crop injury (chlorosis, stunting, twisting, leaf crinkling) 7, 14, and 28 d after application (DAT) and yield (U.S. #1, canner, jumbo, and total).

An interaction of herbicide and reduced herbicide rate was observed for visual injury 7 DAT & 28 DAT. At 7 DAT greatest injury was observed with Enlist Duo applied at the highest rate (66%). With the exception of the highest rate (66 vs 31%), injury observed at reduced rates of 1/33 (26 vs 25%), 1/66 (20 vs 22%) and 1/100 (18 vs 19%) was equivalent for Enlist Duo and Roundup Xtend. At 28 DAT results were similar with greatest injury observed at the highest rate of Enlist Duo (47%). At each reduced rate below 1/10x (47 vs 21%), injury was equal for both herbicides at 1/33 (14 vs 16%), 1/66 (13 vs 15) and 1/100 (14 vs 13%).

An interaction of herbicides and application interval was observed for visual injury 7, 14 & 28 DAT. At 7 DAT, Enlist Duo applied 30 DAP resulted in 38% injury which was greater than all other treatments, which resulted in equal injury ranging from 23 to 27%. Results were similar at 14 DAT with Enlist Duo applied 30 DAP resulting in greatest injury of 43% and other treatments resulting in equal injury ranging from 29 to 34%. At 28 DAT again greatest visual injury was observed with Enlist Duo applied 30 DAP (38%), while Roundup Xtend applied 30 DAP resulted in 23% injury which was great than that for the 10 DAP applications (6 and 10%).

For injury 14 DAT, greatest injury (66%) was observed with the highest rate averaged over herbicides and application timings. The 1/33 x rate resulted in 30% injury which was greater than that observed for the two lowest rates (22 and 20%).

An interaction of herbicides and reduced rates was observed for canner sweet potato yield. With the exception of the highest reduced rate applied where Enlist Duo resulted in a lower yield (162 vs 95 bu/A), yield was equivalent for herbicides at each reduced rate of 1/33 (195 vs 162 bu/A), 1/66 (187 vs 164 bu/A) and 1/100 (138 vs 157 bu/A). Total sweet potato yield was lower for Enlist Duo compared to Roundup Xtend (457 vs 516 bu/A) when averaged across reduced herbicide rates and application intervals. Jumbo sweet potato yield was greater for the 10 DAP application interval compared to the 30 DAP interval (193 vs 135 bu/A) when averaged across herbicides and reduced herbicide rates. Similarly, total sweet potato yield was greater for the 10
DAP application timing compared to the 30 DAP interval (523 vs 450 bu/A). U.S. #1 sweet potato yield was lowest for the highest herbicide rate applied (103 vs 166 to 192 bu/A) when averaged across herbicides and application intervals while jumbo sweet potato yield was lowest for the two highest herbicide rates applied (135 and 128 vs 200 and 193 bu/A). Total sweet potato yield was lowest for the highest herbicides rates applied (394 vs 486 to 535 bu/A).
EVALUATION OF BICYCLOPYRONE FOR WEED MANAGEMENT AND CROP TOLERANCE IN SWEET POTATO. D. Miller*1, M. Mize2; 1LSU AgCenter, St Joseph, LA, 2LSU AgCenter, St. Joseph, LA (44)

ABSTRACT

A field study was conducted in 2017 at the Sweet Potato Research Station near Chase, La with the objective to evaluate crop tolerance and weed management programs with bicyclopyrone in sweet potato. A four replication randomized complete block design was used and included the following herbicide programs: bicyclopyrone @ 3.42 oz/A pre-transplant (PRE); Valor @ 2 oz/A PRE; Valor @ 2.99 oz/A PRE; bicyclopyrone at 3.42 oz/A PRE followed by (fb) Dual Magnum @ 1.3 pt/A 7 d after planting Post (7DAPOT); Valor @ 2.99 oz/A PRE fb Dual Magnum @ 1.3 pt/A 7DAPOT; Valor @ 2.99 oz/A fb Dual Magnum @ 1.3 pt/A + bicyclopyrone @ 3.42 oz/A 7 d after planting Layby; Valor @ 2.99 oz/A fb Dual Magnum @ 1.3 pt/A + bicyclopyrone @ 3.42 oz/A 35 d after planting Layby; and Valor @ 2.99 oz/A PRE fb Command @ 2.5 pt/A 7DAPOT. Sweetpotato ‘Beauregard’ was planted on July 5. Soil was a silt loam with pH 5.8. Parameter measurements included visual weed control and crop injury 21 d after PRE/14 d after DAPOT, 37 d after PRE/30 d after DAPOT, 15 d after Layby, and yield (U.S. #1, canner, jumbo, and total).

At 21 d after PRE/14 d after DAPOT, Control of barnyardgrass, goosegrass, broadleaf signalgrass, yellow nutsedge, common purselane, cutleaf groundcherry, entireleaf morningglory and carpetweed was at least 100, 100, 100, 90, 100, 86, 100, and 100%, respectively. Bicyclopyrone PRE resulted in 6% injury, which was equivalent to that for other PRE only programs. Valor PRE followed by Dual Magnum + bicyclopyrone 7 DAPOT resulted in 20% injury, which was equivalent to the 14% for Valor PRE followed by Dual Magnum 7 DAPOT and greater than all other PRE/POST programs (5-10%).

At 37 d after PRE/30 d after DAPOT, control of barnyardgrass, goosegrass, broadleaf signalgrass, yellow nutsedge, common purselane, cutleaf groundcherry, entireleaf morningglory, and carpetweed was at least 85, 95, 100, 93, 88, 98, and 94%, respectively. Control of cutleaf groundcherry was poor with PRE only programs (25-33%) and Valor PRE followed by Command 7 DAPOT (45%). All other programs controlled cutleaf groundcherry at least 96%. All treatments resulted in no visual injury at this rating interval.

At 15 d after layby, control of barnyardgrass, goosegrass, broadleaf signalgrass, yellow nutsedge, common purselane, cutleaf groundcherry, entireleaf morningglory, and carpetweed was at least 100, 100, 100, 98, 100, 94, 100, and 100%, respectively, for the Valor PRE fb Dual Magnum 7 DAPOT fb bicyclopyrone 35 DAP LYBY treatment. Injury for this treatment was 9%.

U.S. #1 sweet potato yield ranged from 97 to 159 bu/A and was equivalent for all treatments. Bicyclopyrone applied PRE followed by Dual Magnum 7 DAPOT resulted in a canner yield of 167 bu/A, which was greater than all other treatments which had an equivalent yield ranging from 70 to 117 bu/A. Greatest jumbo sweet potato yield, with the exception of Valor PRE followed by Command 7 DAPOT was observed with programs including PRE and POST herbicide applications. Bicyclopyrone applied PRE followed by Dual Magnum 7 DAPOT
resulted in a total sweet potato yield of 528 bu/A, which was equal to that observed for Valor PRE followed by Dual Magnum + bicyclopyrone 7 DAP LYBY (422 bu/A), and greater than all other treatments (219 to 381 bu/A).
Ducksalad Management with Postemergence Rice Herbicides. E.P. Webster*1, B. McKnight2, G.M. Telo2, S.Y. Rustom2, L.C. Webster2, M.J. Osterholt2; 1Louisiana State University, Baton Rouge, LA, 2Louisiana State University AgCenter, Baton Rouge, LA (45)

**ABSTRACT**

In south Louisiana, ducksalad [Heteranthera limosa (Sw.) Willd.] is often a common weed problem early in the growing season, and it is often a problem at planting in water-seeded production systems. In south Louisiana, rice growers often hold water during the winter months to reduce pumping costs in the spring when preparing fields for water-seeding, and another benefit to holding water is a reduction in winter vegetation. Producers will also hold water during the winter months to improve waterfowl habitat, and continue to hold the water in preparation for water-seeding rice. Crawfish producers will also hold water for extended periods, and this continuous flood usually occurs from October through June. These fields under extended flood conditions are a perfect habitat for early season ducksalad growth and infestations.

A field study was conducted during the 2017 growing season at the LSU AgCenter H. Rouse Caffey Rice Research Station near Crowley, Louisiana. The research area was not planted with rice in order to promote ducksalad infestation and growth. The area was treated as a water-seeded production system by flooding the area for 48 hours to simulate planting and draining. The research area was drained for 5 days and the permanent flood was established to simulate a pin-point system. Immediately after flooding, a 1-m diameter ring was placed in the center of each 1.5- by 5-m plot. The herbicides evaluated were: 1) bentazon at 873 g ai ha⁻¹, 2) bensulfuron at 28 g ai ha⁻¹, 3) bensulfuron at 14 g ai ha⁻¹ plus halosulfuron at 26 g ai ha⁻¹, 4) benzobicyclon at 246 g ai ha⁻¹, 5) bispyribac at 28 g ai ha⁻¹, 6) florpyrauxifen-benzyl at 29 g ai ha⁻¹, 7) halosulfuron at 53 g ai ha⁻¹, 8) imazosulfuron at 210 g ai ha⁻¹, 9) orthosulfamuron at 80 g ai ha⁻¹, 10) orthosulfamuron plus halosulfuron at 87 g ai ha⁻¹, 11) orthosulfamuron plus quinclorac at 490 g ai ha⁻¹, 12) penoxsulam at 40 g ai ha⁻¹, 13) penoxsulam plus triclopyr 403 g ai ha⁻¹, 14) quinclorac 420 g ai ha⁻¹, 15) safufenacil at 25 g ai ha⁻¹, 16) triclopyr at 280 g ai ha⁻¹, 17) a nontreated was added for comparison. A crop oil concentrate (Agri-dex, Helena Chemical, Memphis, TN) at 1% v/v was added to all herbicides except bispyribac which received a silicon based adjuvant at 1% v/v (Dyne-A-Pak, Helena Chemical, Memphis, TN). Visual control was evaluated at 42 days after treatment (DAT).

At 42 DAT, benzobicyclon, bispyribac, florpyrauxifen-benzyl, penoxsulam, and penoxsulam plus triclopyr controlled ducksalad 95 to 98%. Ducksalad treated with orthosulfamuron, orthosulfamuron plus halosulfuron, and orthosulfamuron plus quinclorac was controlled 75 to 85%. However, all other herbicides evaluated controlled ducksalad less than 45%. These findings indicate the new herbicides, benzobicyclon and Loyant, can be useful options with an early season ducksalad infestation.
AUTOMATED SEED COUNTS AND VERIFICATION OF SEED PRODUCTION ESTIMATES OF PALMER AMARANTH USING A COMPUTERIZED PARTICLE ANALYZER, M. Bertucci*1, K. Jennings2, B.E. Jackson1, P. Bartley1; 1NC State University, Raleigh, NC, 2North Carolina State University, Raleigh, NC (46)

ABSTRACT

The competitive ability, reproductive potential, and fecundity of Palmer amaranth have been studied extensively. Previous experiments have reported that a single female Palmer amaranth is capable of producing 200,000 to 600,000 seeds. Since hand-counting all seeds from harvested Palmer amaranth is prohibitively time consuming, subsamples are hand-counted, weighed, and extrapolated to calculate total seed number. However, the relative error of extrapolation associated with seed production estimates has yet to be explored. A Computerized Particle Analyzer II (CPA; W.S. Tyler Group), an image analysis instrument, was evaluated and used to determine the relative error of extrapolation from two subsampling methods, 100-count seed weights and 0.5 g seed counts. Forty-six hand-counted subsamples ranging from 500 to 5000 Palmer amaranth seeds determined that the relationship of hand-counts vs. CPA counts was described by the following linear equation: \( y = 3.5 + 0.987x; R^2 = 0.999 \). A slope of 1 would represent perfect agreement between counting methods, so CPA seed counts were considered to be highly accurate. With the accuracy of the CPA established, CPA seed counts of eight Palmer amaranth seed collections (25 g) were used as a standard to calculate the relative error of extrapolation for both subsampling methods. Relative seed count error was calculated by subtracting the extrapolated count from the CPA count then dividing the difference by CPA count. ANOVA determined that there was no significant difference in relative error between subsampling methods, and the relative errors were 1.6 and 0.8% for the 100-count and 0.5 g methods, respectively. Thus, either subsampling method can be used to estimate Palmer amaranth seed production accurately.
EVALUATION OF SOIL TYPE AND MOISTURE LEVELS ON VIRGINIA BUTTONWEED CONTROL WITH INDAZIFLAM. S. Williams*, P. McCullough; University of Georgia, Griffin, GA (47)

ABSTRACT

A greenhouse experiment was conducted to evaluate the efficacy of indaziflam for controlling Virginia buttonweed as influenced by soil texture and moistures. Three individual plants were then taken from vegetative stems and transplanted to pots filled with one of three soils including sand, sandy loam, or clay. The organic matter content measured 0.1%, 2.1%, and 1.6% for the sand, sandy loam, and clay, respectively, and CEC measured 0.6, 4.4, and 9.8 meq/100 g, respectively. The pH measured 6.4, 5.4, and 5.0 for the sand, sandy loam, and clay, respectively. Plants were allowed to resume active growth in the greenhouse for three weeks, watered as needed, and fertilized to promote growth. The pots were then subjected to one of two irrigation regimens including regular (five days per week) or limited watering (as needed to prevent permanent wilt). Pots were acclimated to these irrigation programs for two weeks before herbicide treatment. Indaziflam was then applied to pots at 0 or 19 g ai ha⁻¹.

At one month after treatment, buttonweed had the highest control levels under the sandy soil with low moisture, averaging 88%. The control levels were reduced to 68% under sandy soils that received regular irrigation. There was no influence of irrigation levels on buttonweed control under the sandy loam or clay soils. Buttonweed control averaged 54% and 70% control under sandy loam and clay soils, respectively. Generally, biomass increased under high moisture compared to low and the hierarchical rank of soils from high to low was: clay > sandy loam > sand. Indaziflam reduced biomass of buttonweed across soils and moisture levels by ~50 to 75% from the nontreated. The least amount of biomass for indaziflam-treated plants was noted under low moisture and sandy soil, averaging 9 grams pot⁻¹. All other plants treated with indaziflam across other soil types averaged ~25 grams of biomass, except under high moisture with a sandy loam soil that had 50 grams pot⁻¹. Results suggest that indaziflam has greater efficacy for Virginia buttonweed control under dry, sandy soils than the other moisture levels and soils tested. These treatments could help enhance buttonweed control in a sequential program with other herbicides.
SPECTRAL REFLECTANCE PATTERNS OF PALMER AMARANTH AND SOYBEAN.
J. Sanders*, W. Everman; North Carolina State University, Raleigh, NC (48)

ABSTRACT

The widespread and rapid proliferation of unmanned aerial vehicles (UAVs) into the civilian market has inspired curiosity regarding their utility for agricultural production, where they could be utilized to rapidly acquire aerial imagery and diagnose issues related to crop health or pest status. Using UAVs and spectral reflectance measurements from remotely sensed imagery, it may be possible to detect discrete population densities of Palmer amaranth (Amaranthus palmeri) growing in soybean (Glycine max).

In 2016 and 2017, two field studies were implemented to study the influence of various Palmer amaranth weed densities to examine how date, species and Palmer amaranth weed density influences the spectral behavior of Palmer amaranth and soybean for various wavelengths of light. Five band multispectral imagery was acquired via UAV and analyzed to acquire spectral readings referenced to these various weed densities. Spectral measurements were then analyzed to examine the manner in which discrete Palmer amaranth population densities influence spectral reflectance behavior of individual plants of Palmer amaranth and soybean across red, blue, green, near infrared and red-edge light. Palmer amaranth and soybean were found to differ significantly in their levels of spectral reflectance within every waveband. Furthermore, the spectral response of Palmer amaranth was found to significantly increase as a function of increasing weed density while that of soybean declined as Palmer amaranth weed density was increased.
GERMINATION RESPONSE OF BOUTELOUA CURTIPENDULA AND SCHIZACHYRIUM SCOPARIUM TO PREEMERGENCE HERBICIDES AT PLANTING. M.P. Richard*,1, J. McCurdy1, B.S. Baldwin2, J.I. Morrison2, E. Begitschke1, Z.D. Small2; 1Mississippi State University, Starkville, MS, 2Mississippi State University, Mississippi State, MS (49)

ABSTRACT

Native warm season grasses (NWSG), such as little bluestem (Schizachyrium scoparium) and sideoats grama (Bouteloua curtipendula), are a popular choice for low maintenance golf course roughs. Weed competition, especially annual grasses, is one of the biggest problems superintendents face when establishing healthy NWSG stands. Preemergence herbicides are regularly used on golf courses to control annual weeds. The use of preemergence herbicides in native grass establishment have been successful, but minimal research exists with commonly used turfgrass preemergence herbicides. Research was conducted as a randomized complete block design at the Mississippi State University R.R. Foil Plant Science Research Center to evaluate the effects of prodiamine (0.84 kg ha\(^{-1}\)), pendimethalin (1.65 kg ha\(^{-1}\)), oxadiazon (4.5 kg ha\(^{-1}\)), indaziflam (0.03 kg ha\(^{-1}\)), imazapic (0.07 kg ha\(^{-1}\)), metolachlor (2.78 kg ha\(^{-1}\)), atrazine (1.12 kg ha\(^{-1}\)), dimethenamid (1.68 kg ha\(^{-1}\)), dithiopyr (0.42 kg ha\(^{-1}\)), simazine (1.12 kg ha\(^{-1}\)), and isoxaben (1.12 kg ha\(^{-1}\)) on little bluestem and sideoats grama germination and establishment. On 17 April, 2017 grasses (a 50/50 mix) were drill seeded (16 kg ha\(^{-1}\)) in a native Marietta silt loam soil at 0.7 cm planting depth. Herbicide treatments were applied in a water carrier volume of 374 L ha\(^{-1}\) directly after planting. Plots received 1 cm natural rain fall within six hours of planting. Plant count per species and % total native grass ground cover were recorded monthly and 161 days after treatment (DAT) [27 September, 2017]; respectively. Data were analyzed using PROC GLM within SAS (Version 9.4; SAS Institute Inc., Cary, NC) and means were separated using Fisher’s Protected LSD (\(\alpha=0.05\)). Imazapic increased little bluestem plant count 60%, compared to the non-treated, but decreased sideoats grama plant count 50%, 161 DAT. Imazapic reduced bermudagrass infestation greater than 90%. Atrazine, simazine, and isoxaben resulted in plant counts similar to the non-treated (at all evaluations), for both grasses. Atrazine, simazine, isoxaben, imazapic, and the non-treated resulted in 30-60% total native grass ground cover while all other herbicides resulted in less than 10% native grass ground cover. In general, preemergence applications of atrazine, simazine, isoxaben, and imazapic could be effective for establishment of little bluestem and sideoats grama. This study will be replicated in 2018.
PEANUT RESPONSE TO METRIBUZIN. E.P. Prostko*, O. Carter; University of Georgia, Tifton, GA (50)

ABSTRACT

In Georgia, peanut can be grown in rotation with various crops that are treated with metribuzin. Current rotational crop restrictions for metribuzin would prohibit peanut planting for 18 months after application. Peanut tolerance to metribuzin has not been well documented. Therefore, the objective of this research was to evaluate the tolerance of peanut to metribuzin. A small-plot, replicated field trial was conducted in 2017 at the UGA Ponder Research Farm near Ty Ty, Georgia. The soil type at this location was a Fuquay sand with 0.53% OM, 94% sand, 4% silt, 2% clay, 6.0 pH, and 3.5 CEC. ‘GA-06G’ peanut were planted in twin rows on April 24. In a randomized complete block design with 4 replications, metribuzin (TriCor® 4F) was applied preemergence 2 days after planting (DAP) at 0, 0.031, 0.062, 0.125, 0.25, 0.375, and 0.50 lb ai/A. The recommended use rate of metribuzin for soybeans and post-harvest/field corn in most Georgia soils is 0.25 lb ai/A. In the first 10 DAP, the plot area received 2.08” of rainfall and irrigation. All treatments were applied using a CO2-powered, backpack sprayer calibrated to deliver 15 GPA @ 35 PSI and 3.5 MPH using 11002AIXR nozzles. The plot area was maintained weed-free using a combination of hand-weeding and labeled herbicides (flumioxazin, diclosulam, imazapic, pendimethalin, s-metolachlor, and 2,4-DB). Data collected included visual estimates of peanut injury, stand reductions based upon the number of emerged peanut plants/5 row feet @ 31 DAP, and yield. All data were subjected to ANOVA and means separated using Duncan’s Multiple Range Test (P=0.10). Generally, there was a rate response to metribuzin for peanut injury, stand reduction, and yield reduction. Metribuzin rates ranging from 0.125 to 0.50 lb ai/A caused significant peanut injury and stand reductions. Metribuzin at rates ranging from 0.25 to 0.50 lb ai/A caused significant peanut yield reductions. Peanut yields were not significantly reduced by metribuzin at rates of 0.125 lb ai/A and below. Based upon these results, peanut grown in crop rotations where metribuzin @ 0.25 lb ai/A was applied could be safely planted after 2 half-lives have occurred (~120 days).

ABSTRACT

Grass weed control in grain sorghum has always been a problem for producers in Arkansas. In particular growers have never had a good option for Johnsongrass control and face annual problems with weeds like Palmer amaranth. This makes it imperative that new weed control technologies be developed. In 2016 and 2017, trials were conducted in Newport, AR to evaluate the control of Johnsongrass and Palmer amaranth in DuPont™ Inzen™ (ALS-resistant) grain sorghum with DuPont™ Zest™ WDG herbicide which contains the active ingredient nicosulfuron.

A study was conducted in 2016 at the University of Arkansas Research and Extension Center near Newport, AR, to evaluate the effectiveness of different herbicide combinations in Inzen™ grain sorghum. A randomized complete block design with three replications was used for the trial. Treatments included: 1) rimsulfuron at 0.25 oz/a + thifensulfuron at 0.25 oz/a + atrazine 4L at 0.75 lb/a PRE, followed by Zest (nicosulfuron) at 12 fl oz/a + atrazine 4L Mid-POST; 2) Cinch ATZ (s-metolachlor + atrazine) at 2.00 pt/a as PRE followed by Zest + atrazine Mid-POST; 3) Zest + atrazine 4L Early- POST; 4) Cinch ATZ + Zest + atrazine 4L Early-POST; 5) Cinch (s-metolachlor) at 1.33 pt/a PRE followed by Zest + atrazine 4L Mid-POST; 6) Cinch ATZ alone PRE; 7) Untreated check; 8) Cinch ATZ PRE followed by GWN 10456 + Zest Mid-POST. With the exception of treatment 1 (89%), all treatments controlled Johnsongrass greater than 94% at 30 days after application (DAA). All treatment, with the exception of Zest plus atrazine alone applied Early-POST (23%) and Cinch ATZ applied alone PRE (67%), controlled Johnsongrass greater than 87% 60 DAA. Yield data was not collected for this trial during 2016.

In 2017, another study was done at the same location to evaluate more herbicide combinations in Inzen™ grain sorghum. A randomized complete block design with four replications was used for this trial. Treatments included: 1) rimsulfuron + thifensulfuron + atrazine as timing A= PRE, followed by Zest at 0.67 oz/a + atrazine 4L applied as a C timing for 2-4 inch weeds; 2) rimsulfuron + thifensulfuron + Cinch as PRE followed by Zest as a C timing; 3) rimsulfuron + thifensulfuron + Cinch as PRE followed by Zest + atrazine applied as a C timing; 4) Cinch ATZ PRE followed by Zest + atrazine as a C timing; 5) this treatment did not have a PRE but had a B timing for 2-4 inch weeds including Cinch ATZ + Zest; 6) Cinch as PRE followed by Zest + atrazine as a C timing; 7) Cinch ATZ as PRE with no other timing applications. An untreated check was included. No injury was observed throughout the season for all treatments. Johnsongrass did not appear in the trial during 2017. All treatments controlled Palmer amaranth greater than 70% at 30 DAA. All treatments controlled Palmer amaranth above 75% up to 90 DAA. Yields were greater than the untreated check for all treatments, ranging from 83- 96 bu/a. Based on this research Inzen grain sorghum will have a fit with southern grain sorghum weed spectrums.
ASSESSMENT OF DICAMBA CONTAINING HERBICIDE PROGRAMS FOR WEED CONTROL IN SOYBEANS. M. Flessner*1, L. Rector1, D. Mayonado2; 1Virginia Tech, Blacksburg, VA, 2Monsanto, Salisbury, MD (52)

ABSTRACT

Increasing cases of weeds with glyphosate resistance has made weed management more difficult in glyphosate-based systems, prompting the need for alternatives. Postemergent (POST) weed control in soybeans is important to protect yields and reduce weed populations for future years. Research was conducted to assess and compare weed control of dicamba- and glufosinate-based herbicide programs in soybeans.

The study was conducted in Blacksburg, Virginia, and implemented as a randomized complete block design with four replications. The study consisted of eight treatments including two nontreated checks: one for the dicamba resistant system (Roundup Ready 2 Xtend) and one for the glufosinate resistant system (Liberty Link). Treatments consisted of a preemergent (PRE) of flumioxazin (Rowel) at 0.07 kg ha⁻¹ followed by (fb) dicamba (Xtendimax with VaporGrip) at 0.56 kg ae ha⁻¹ + Intact at 0.5% v v⁻¹, + glyphosate at 1.27 kg ae ha⁻¹ (Roundup Powermax), a PRE of flumioxazin + dicamba fb dicamba + Intact + and glyphosate, a PRE of flumioxazin + dicamba fb dicamba + Intact + glyphosate + acetochlor (Warrant) at 1.26 kg ha⁻¹, a PRE of flumioxazin fb glufosinate (Liberty) at 0.60 kg ha⁻¹, a PRE of sulfentrazone at 0.28 kg ha⁻¹ + chlorimuron ethyl at 0.018 kg ha⁻¹ (Authority Maxx) fb glufosinate, and a PRE of sulfentrazone + chlorimuron ethyl fb glufosinate + pyroxasulfone (Zidua) at 0.12 kg ha⁻¹. Herbicide products and rates were constant across all treatments. Soybeans were planted on 76 cm rows in a no-tillage system for each respective herbicide program. PRE treatments were applied on May 31st, 2017, directly after planting, and POST treatments were applied on June 22nd when weeds were ~7.6 cm tall. Plots were 4 rows wide by 7.6 meters. Treatments were applied with a hand boom at 112 L ha⁻¹. Visible crop injury and weed control were evaluated on a 0 (no control) to 100% (complete necrosis) scale 14 and 39 days after POST application (DAP). Weeds rated were pitted morningglory (Ipomoea lacunosa), redroot pigweed (Amaranthus retroflexus), large crabgrass (Digitaria sanguinalis), and giant foxtail (Setaria faberi). Giant foxtail was only rated 39 DAP. Data were subjected to ANOVA followed by means separation using Fishers Protected LSD(0.05). Data from nontreated plots were excluded from the analysis.

Both programs provided >75% pitted morningglory control and >95% redroot pigweed control 39 DAP with no differences detected. Within the glufosinate-based system, POST glufosinate treatments with a grass controlling residual herbicide increased control of annual grasses by >10% when compared to glufosinate alone. Across grass species, no control differences were observed between dicamba- and glufosinate-based systems. Off-target dicamba movement resulted in 7 to 15% damage to glufosinate resistant soybeans 39 DAP. To increase control of grass species, a residual herbicide should be added to glufosinate-based herbicide programs. This research indicates that both dicamba- and glufosinate-based systems resulted in similar, effective weed control. Future research is needed to corroborate these findings across multiple site-years and determine control in glyphosate resistant weed populations.
HERBICIDAL CONTROL OF JAPANESE STILTGRASS (MICROSTEGIUM VIMINEUM) IN PASTURES AND HAYFIELDS. K. Bamber*, M. Flessner; Virginia Tech, Blacksburg, VA (53)

ABSTRACT

Japanese stiltgrass (Microstegium vimineum (Trin.) A. (Camus)) is an annual grassy weed that is found in many Virginia pastures and hayfields. Once established, Japanese stiltgrass can form dense patches and outcompete desired grasses, thereby reducing forage or hay quantity and quality. Germination rates can be high within a growing season, so timing of post-emergence herbicide application may have an influence on weed control.

To compare control from herbicides applied early and late post-emergence to Japanese stiltgrass, a field study was established in a hayfield in Giles County, VA in both 2015 and 2016. Two field studies were established in a pasture in Rockingham County, VA in 2017. Both fields had natural populations of Japanese stiltgrass. Treatments were arranged in a randomized complete block design with four replications. Early post-emergence treatments were applied when Japanese stiltgrass was less than 2.5 cm tall (13 April 2015 and 20 April 2017) and late post-emergence treatments were applied when Japanese stiltgrass was between 7.5 and 30 cm tall (8 June 2015, 13 May 2016, and 29 June 2017). Data collected included visible weed control ratings taken at 4 and 8 weeks after treatment (WAT) for late post-emergence treatments in 2015 and at 4, 8 and 12 WAT for all other treatments 2015-2017. Treatments were rated on a 0 (no control) to 100 (complete control) scale. Herbicides were not compared to one another because weed control ratings within an application timing and rating date were always similar. For each herbicide, early post-emergence control ratings were compared with late post-emergence control ratings at 4, 8 and 12 WAT to determine which application timing was more effective. Data were analyzed in JMP Pro 13 using ANOVA with means separated with Fisher’s Protected LSD at a significance level of α = 0.05. Data are presented by herbicide and rating timing. Data are separated by application timing but not by year. Early and late post-emergence applications of aminopyralid + metsulfuron, and aminocyclopyrachlor resulted in the same Japanese stiltgrass control 4 and 8 WAT. At 12 WAT, late post-emergence applications of aminopyralid + metsulfuron, and aminocyclopyrachlor controlled Japanese stiltgrass better than early post-emergence applications. Early and late post-emergence applications of aminopyralid resulted in the same control of Japanese stiltgrass at 4 WAT (Figure 1). Late post-emergence applications of aminopyralid controlled Japanese stiltgrass better than early post-emergence applications at 8 and 12 WAT. Late post-emergence applications of glyphosate and glyphosate + pendimethalin controlled Japanese stiltgrass better than early post-emergence applications at 4, 8 and 12 WAT. Late post-emergence applications may have done better long term than early post-emergence applications due to weather differences. There were 42 ± 0.7 days with low temperatures under 13°C in the 12 weeks following early post-emergence applications but only 15 ± 11 days with low temperatures under 13°C in the 12 weeks following late post-emergence applications. Late post-emergence applications of aminopyralid, aminopyralid + metsulfuron, aminocyclopyrachlor, glyphosate, and glyphosate + pendimethalin control Japanese stiltgrass better than early post-emergence applications over a 12 week period.
EFFECT OF DRIFT CONTROL ADJUVANTS ON DROPLET EVAPORATION, PH, AND VISCOSITY USING ENGENIATM AND XTENDIMAXTM APPROVED TANK MIXES. J. Ferguson*1, P.H. Urach Ferreira1, M.T. Wesley1, D.B. Reynolds2; 1Mississippi State University, MS State, MS, 2Mississippi State University, Mississippi State, MS (54)

ABSTRACT

New dicamba products have led to increasing complexity of labeling which makes selecting among the various technologies a greater challenge for growers. Discerning which tank-mix partners to use within these labels have created a flurry of questions from growers and applicators which need answering. When tank-mixing with herbicides that require the use of a drift reduction adjuvant (DRA), questions about which DRA is the best choice for growers and applicators have arisen. DRA’s vary in their composition, which will invariably impact the tank mix physical and chemical properties. A study was conducted at Mississippi State University to determine the effect that tank-mix DRAs labeled with Xtendimax and Engenia have on the tank-mix pH, viscosity and droplet evaporation. Viscosities ranged from 1.4 to 1.8 centipoise, where tank-mixes that included a DRA showed an increased viscosity compared to the Engenia™ and Xtendimax™ plus water alone tank-mixes. Tank-mix viscosities with Adjulock and On-Site were lower than the herbicide plus water alone tank-mixes for both Engenia™ and Xtendimax™. Tank-mix pH changes were most apparent when comparing the Engenia™ tank-mixes to the Xtendimax™ tank-mixes, where pH dropped by a whole point with Xtendimax™. DRA had little effect on the tank-mix pH except for Adjulock which increased the tank-mix pH by 0.3 when tank-mixed with Xtendimax™ and clethodim. Droplet evaporation time was variable across tank-mix, but all DRAs reduced the evaporation time compared to the tank-mixes with Engenia™ or Xtendimax™ alone. The Xtendimax™ alone solution resulted in the longest droplet evaporation time, which warrants further research. This study was conducted in a laboratory setting under ambient conditions, so repeating the study using variable conditions would be a worthwhile endeavor. Results from this study suggest that DRA type affects tank-mix viscosity, but that viscosity does not change from one dicamba formulation tank-mix to another. Dicamba formulation type has a significant effect on tank mix pH, where Xtendimax™ results in a lower pH compared to Engenia™.
PERFORMANCE OF S-METOLACHLOR AND DICAMBA PREMIX IN BOLGARD II XTENDFLEX COTTON. A. Ross*1, T. Barber1, R.C. Doherty2, Z. Hill3; 1University of Arkansas, Lonoke, AR, 2University of Arkansas at Monticello, Monticello, AR, 3University of Arkansas Cooperative Extension Service, Monticello, AR (55)

ABSTRACT

With the evolution of glyphosate resistance, Palmer amaranth became the most troublesome weed of cotton in the U.S. In 2013, a survey of crop consultants in the Midsouth listed the weed as the most problematic in cotton. Palmer amaranth causes yield loss in cotton by competing for light, moisture, and soil nutrients. With commercialization of Xtendflex cotton, growers have in-crop options available to control glyphosate-resistant Palmer amaranth. A study was conducted in 2017 at the Lon Mann Cotton Research Station near Marianna, AR to determine the level of control and length of residual activity of dicamba alone and pre-mixed with S-metolachlor on Palmer amaranth. The test was designed as a randomized complete block with six POST herbicide treatments applied to 2- to 4-inch weeds. Dicamba was applied alone at (0.5 lb ae/A) or in a pre-mix with S-metolachlor at (0.94 lb ai/A). A tank-mix dicamba + glyphosate (1.0 lb ae/A), the dicamba and S-metolachlor pre-mix + glyphosate (1.0 lb ae/A), or the dicamba and S-metolachlor pre-mix + glufosinate (0.53 lb ai/A) was also applied and compared back to a standard of glyphosate (1.0 lb ae/A) + S-metolachlor (0.94 lb ai/A). A visual weed control assessment was taken 2 weeks after POST application and no significant differences were seen in the level of control with dicamba alone from the dicamba plus S-metolachlor pre-mix. All treatments provided 93% or greater control, with the exception of the standard, which only provided 10% control of Palmer amaranth. Five weeks after the POST application, another visual weed control assessment was taken. At this time, any treatment containing the dicamba plus S-metolachlor pre-mix provided 88% or greater control, which was significantly higher than the control level of Palmer amaranth observed with dicamba alone, which only provided 66% control. No visible injury was observed with any application, demonstrating that these treatments could offer alternatives for weed control in cotton.
PRESENCE AND DISTRIBUTION PALMER AMARANTH RESISTANT TO PPO-INHIBITING HERBICIDES IN THE NORTH CAROLINA COASTAL Plains. D.J. Mahoney*1, D. Jordan2, A. Hare2, N. Roma-Burgos3, K. Jennings2, R. Leon2, M. Vann2; 1NC State University, Cary, NC, 2North Carolina State University, Raleigh, NC, 3University of Arkansas, Fayetteville, AR (56)

ABSTRACT

In a survey conducted by the Weed Science Society of America, Palmer amaranth (Amaranthus palmeri S. Wats.) was named the most troublesome weed in the United States. Palmer amaranth is a highly competitive, obligate cross-pollinator whose pollen has been documented to travel great distances. Along with immense herbicide selection pressure, these characteristics have led to Palmer amaranth populations resistant to several modes of action with some populations expressing multiple resistance. Most recently, Palmer amaranth populations resistant to PPO-inhibiting herbicides have been confirmed in Arkansas, Illinois, and Tennessee. Evolved resistance was conferred by a glycine deletion (∆G210) and/or a glycine (R128G) or methionine (R128M) substitution for arginine within the PPX2 gene. While resistance in North Carolina (NC) has been suspected, it has yet to be confirmed in this species. Many crops grown in NC rely heavily on PPO-inhibiting herbicides for weed management; thus, rapid detection of resistant populations is critical to ensure management practices are adjusted to minimize widespread development of resistant populations. The objective of this research was to determine the presence and distribution of Palmer amaranth populations resistant to PPO-inhibiting herbicides in the NC Coastal Plain.

In fall 2016, Palmer amaranth populations (125 total) were collected from various agronomic fields primarily in the NC Coastal Plain, including cotton (12 samples), peanut (34 samples), soybean (58 samples), and sweet potato (21 samples). A known resistant population from Arkansas was included for comparison. 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 fomesafen (280 g a.i. ha⁻¹) plus a nonionic surfactant (0.25% v v⁻¹). Plants were estimated visually (0 to 100%) and mortality recorded 3 wks after application. Plants surviving fomesafen were repotted to obtain tissue (100 mg) for genotyping via KASP assay based on the ∆G210, R128G, or R128M mutations. Three experimental runs were completed.

Four populations from NC (35, 52, 53, and 56 from Edgecombe and Halifax counties) had survivors through the first two experimental runs, although percent survival was relatively low (1-10%). Therefore, a third experimental run was included using fewer populations but allowing for an increase individual plants to be screened. Four populations (6, 17, 32, and 107) were included and regarded as “susceptible” since no survivors were detected in the first two experimental runs. When pooled over experimental runs, percent survival of the Arkansas population (45%) was greatest. Percent survival from NC populations were as follows: population 56 (37%) > 52 (24%) > 17 (14%) = 32 (13%) > 35 (2%) = 53 (2%) = 6 (< 1%) = 107 (0%). Genotyping has been completed on survivors through the first two experimental runs. It was determined that all surviving plants from the Arkansas population possessed the ∆G210 mutation. Two survivors from NC population 52 were found to be heterozygous for the ∆G210
mutation. The R128G and R128M mutations were not detected in any sample. Known mutations have not been detected in the other survivors from NC suggesting resistance may be conferred by other mechanisms. Genotyping and heritability work is ongoing to further characterize the mechanism of resistance in these populations.
EARLY-SEASON CONTROL OF PROBLEMATIC WEEDS USING ACETOCHLOR IN CLEARFIELD RICE HERBICIDE PROGRAMS. M. Fogleman*, J. Norsworthy, G.L. Priess, Z.D. Lancaster; University of Arkansas, Fayetteville, AR (57)

ABSTRACT

Today, most rice herbicide programs in Arkansas are focused on barnyardgrass (*Echinochloa crus-galli*) control. Heavy reliance on the same herbicide sites of action (SOA) has led to cases of herbicide-resistant barnyardgrass in many rice fields across the state. Repeated use of the same herbicide SOA is ineffective and may be overcome by targeting alternative SOA. Efficacious on barnyardgrass in row crops and relatively low risk for evolution of resistance, very long-chain fatty acid (VLCFA)-inhibiting herbicides such as acetochlor are promising candidates for weed control in rice. Field experiments were conducted in 2016 and 2017 at the Pine Tree Research Station (PTRS) near Colt, Arkansas to evaluate the efficacy of acetochlor (Warrant)-containing rice herbicide programs. Experiments were designed as a randomized complete block with herbicide treatments consisting of acetochlor at 1050 g ai ha⁻¹ or clomazone (Command) at 450 g ai ha⁻¹ applied alone, or as part of a season-long program. Acetochlor or clomazone was applied delayed preemergence (DPRE) A) alone, B) followed by imazethapyr (Newpath) at 70 g ai ha⁻¹ early postemergence (EPOST), or C) followed by imazethapyr EPOST followed by imazethapyr pre-flood (PREFLD). A nontreated, weedy check was also included for comparison. Clomazone alone controlled (98-100%) barnyardgrass better than acetochlor alone (69-98%) when evaluated early season. However, both clomazone- and acetochlor-based programs provided >96% barnyardgrass control late-season and yielded >9600 kg ha⁻¹. If acetochlor were registered for use in U.S. rice, it could be used as a resistance management tool by targeting an alternative SOA while providing weed control comparable to standard programs used today. Future research should establish the utility of acetochlor in providing weedy rice control as well as other problematic weeds for which clomazone provides little or marginal control.
AUXIN STEWARDSHIP TRAINING IN NORTH CAROLINA. A.C. York*1, J.P. Jones2, D.L. Jordan1, W.J. Everman1; 1North Carolina State University, Raleigh, NC, 2North Carolina Department of Agriculture and Consumer Services, Raleigh, NC (58)

ABSTRACT

Farmers in North Carolina produce a diversity of agronomic and horticultural crops, and most are highly sensitive to auxin herbicides. In anticipation of significant auxin use in Xtend and Enlist cotton and soybean in 2017, N.C. State University (NCSU) and N.C. Department of Agriculture and Consumer Services (NCDACS) provided training on best management practices to avoid off-target auxin deposition. The state issued 24(c) SLN labels for Engenia, Enlist Duo, Fexapan, and XtendiMax herbicides mandating training before application to Enlist or Xtend crops.

Training was held at 38 sites during January through March, 2017 covering the state’s soybean and cotton production regions. Participation in training was tracked via pesticide applicator licenses through NCDACS. Training focused on the following: technologies and products; label requirements; relative sensitivity of NC crops to auxins; auxin symptoms and speed of expression; impacts of off-target deposition (yield, crop marketability); sources of off-target deposition (contaminated equipment, vapor drift, spray drift); proper equipment cleanout; factors affecting vapor drift (temperature, formulations, inversions); factors affecting spray drift (nozzle type and pressure, sprayer speed, boom height, wind speed and direction, tank mixes and adjuvants); how to avoid spray drift; and buffer zones. Data were provided to illustrate each point.

A total of 2903 individuals were certified. A survey was distributed at 32 of 38 meetings to characterize participants and to measure effectiveness of training. A total of 2118 individuals completed at least parts of the survey. Based upon the survey, growers comprised 81% of trainees. Participants identifying as dealers, consultants, and custom applicators made up 7, 3, and 2% of trainees, respectively. Industry personnel, extension agents, and individuals identifying as farm workers together made up 7% of the trainees.

Survey respondents preferred face-to-face delivery of training. Ninety-one to 95% of respondents indicated a preference for oral training. Ninety-nine to 100% of respondents indicated the training was worth their time invested, and 99 to 100% of growers and applicators said the training would help them avoid drift. Similarly, 99 to 100% of dealers and consultants said the training would help them better advise their customers and clients.

Industry representatives also offered training in North Carolina in 2017, but that training did not satisfy requirements of NC 24(c) labels. At the time of NCSU training, 71% of dealers and 49% of consultants had attended industry-delivered training while only 30 to 35% of growers, applicators, and “others” had attended industry training. Among respondents who had attended industry training, 77 to 93% indicated NCSU training was more detailed while 91 to 97% said NCSU training was more beneficial.
North Carolina growers planted an estimated 570,000 and 196,000 acres of Xtend soybean and cotton, respectively, in 2017. An estimated 235,000 and 74,000 acres of soybean and cotton, respectively, received dicamba in-season. No estimates are available for Enlist acreage.

NCDACS investigated 15 dicamba drift incidences in 2017. These included one peanut (7 acres), six soybean (288 acres), and eight tobacco (194 acres) complaints. No complaints were received from commercial vegetable growers or homeowners, and no complaints related to 2,4-D use on Enlist crops were received.

Training will again be provided by NCSU extension specialists and NCDACS at 31 sites in 2018. Additionally, selected extension agents will be trained to deliver the program at additional sites as needed. Training will also be offered in Spanish at a limited number of sites. Each participant will be issued a card as evidence of completion of training. It is the intent that dealers will sell the auxin products only to individuals presenting proof of training.
Efficacy of Flazasulfuron for Controlling Common Lespedeza and Field Sandbur in Turfgrass. P. McCullough*, S. Williams; University of Georgia, Griffin, GA (59)

ABSTRACT

Field experiments were conducted in Griffin and Americus, GA from June to August 2017 to evaluate the efficacy of flazasulfuron (Katana 25DF) for controlling common lespedeza and field sandbur, respectively. Treatments were applied to a ‘TifBlair’ centipedegrass lawn with common lespedeza at the early branching stage in June. In the other experiment, treatments were made to a bermudagrass lawn prior to seedhead emergence of the field sandbur population. Katana at 1.5, 2, and 2.5 oz/acre provided poor control (<70%) of common lespedeza from 2 to 8 weeks after treatment (WAT). Atrazine and metsulfuron provided fair (70 to 79%) to good (80 to 89%) control of lespedeza from 4 to 8 WAT and were similar on most dates. In the other experiment, Katana at 1.5 oz/acre provided about 70% control of sandbur at 3 WAT, but control was poor at 6 and 8 WAT. Katana at 2, 2.5, and 3 oz/acre provided 85 to 97% control of sandbur at 8 WAT, and there was no difference among these treatments. These Katana rates all provided superior control to the lowest rate and imazapic. Results suggest single applications of Katana provide unacceptable control of common lespedeza, at rates evaluated, but provide excellent field sandbur control at 2 to 3 oz/acre. Sequential treatments may be required to maintain acceptable sandbur control from the 1.5 oz/acre rate and warrant further investigation.
EFFICACY OF TAVIUM™ HERBICIDE PLUS VAPORGRIP® TECHNOLOGY IN DICAMBA TOLERANT SOYBEANS AND COTTON. J. Holloway, Jr*¹, B. Miller², E. Hitchner³, S.A. Payne⁴, D. Porter⁵; ¹Syngenta Crop Protection, LLC, Jackson, TN, ²Syngenta Crop Protection LLC, Fargo, ND, ³SYngenta Crop Protection, LLC, Elmer, NJ, ⁴Syngenta Crop Protection, LLC, Slater, IA, ⁵Syngenta Crop Protection, Greensboro, NC (60)

ABSTRACT

Tavium Plus VaporGrip Technology is a new herbicide under development by Syngenta for use in dicamba tolerant soybeans and cotton. It is a convenient premix containing 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. Tavium Plus VaporGrip Technology provides postemergence control of over 50 broadleaf weeds as well as extended residual control of key broadleaf weeds such as waterhemp and Palmer amaranth as well as troublesome grasses. Tavium Plus VaporGrip Technology offers flexibility in application timing by allowing one application from preplant burndown through preemergence and one application postemergence in both dicamba tolerant cotton and soybeans. By employing two modes of action, Tavium Plus VaporGrip Technology is an effective resistance management tool which will fit well into an integrated weed management program by delivering postemergence control and enabling overlapping residual activity.
ANTARES PRIME FOR PREEMERGENCE WEED CONTROL IN SOYBEAN. M.C. Cox*, M.W. Wayland, J.R. Roberts*; Helena Chemical Company, Memphis, TN (61)

ABSTRACT

Weed resistance to multiple herbicide modes-of-action in soybean systems warrants progression of pre-mixed herbicide formulations. Antares Prime herbicide is a novel, liquid pre-mixture of sulfentrazone and cloransulam-methyl labelled for use as a preemergent or preplant burndown herbicide in conventional and genetically-modified soybean systems. Field studies conducted across five states in the U.S. from 2016 to 2017 evaluated preemergence control of various weed species with Antares Prime compared to a dry formulation competitor.

In 2016, Antares Prime at 0.17 kg ai ha⁻¹ controlled giant foxtail (*Setaria faberi*) better than a commercial, dry formulation of sulfentrazone + cloransulam-methyl in Illinois, at 42 DAT. Antares Prime, at the same rate, controlled common lambsquarters (*Chenopodium album*) equivalent to the dry formulation in Iowa. In 2017, Antares Prime at 0.19 and 0.20 kg ai ha⁻¹ controlled common ragweed (*Ambrosia artemisiifolia*) and redroot pigweed (*Amaranthus retroflexus*), respectively, better than the commercial dry formulation at 0.20 kg ai ha⁻¹ at 28-35 DAT in Iowa. Antares Prime is a valuable option for preemergence weed control in soybeans due to its ease of handling, tank-mixing compatibility attributes, and field performance.
EVALUATION OF PRE AND POST HERBICIDE APPLICATIONS ON WEED CONTROL AND SEED PRODUCTION IN PEANUT. T. Bararpour*1, R.R. Hale2, J. Gore2, J. Bond3, J.M. Sarver4, D.R. Cook4, J.W. Seale1; 1Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 2Mississippi State University, Stoneville, MS, 3Delta Research and Extension Center, Stoneville, MS, 4Mississippi State University, Starkville, MS (62)

ABSTRACT

One of the greatest problems facing peanut (Arachis hypogaea) producers in Mississippi is weed control. A field study was conducted in 2017 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate preemergence (PRE) and postemergence (POST) herbicide applications on weed control and weed seed production in Mississippi peanut. Peanut (Georgia-D6G) was planted at a seeding rate of 8 seeds/ft on May 23, 2017. The study was designed as a randomized complete block with 14 treatments and four replications. Treatments were as follows: 1) Valor (flumioxazin) PRE at 1.5 oz/A followed by (fb) Gramoxone (paraquat) at 12 fl oz/A + non-ionic surfactant (NIS) at 0.25% v/v at EPOST [two- to three-weeks after emergence (WAE)]; 2) Dual Magnum (S-metolachlor) PRE at 1 pt/A fb Gramoxone + NIS at EPOST; 3) Valor PRE fb Dual Magnum + Gramoxone + NIS at EPOST; 4) Valor PRE fb Cobra (lactofen) at 12 fl oz/A + Select Max (clethodim) 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 (four- to five-WAE); 6) Dual Magnum PRE fb Cobra + Select Max + COC at EPOST; 7) Dual Magnum PRE fb Cobra + Select Max + COC at MPOST; 8) Warrant (acetochlor) PRE at 3 pt/A fb Cobra + COC at EPOST; 9) Valor PRE fb Gramoxone + NIS at EPOST fb Cobra + Select Max + COC at EPOST; 10) Warrant PRE fb Dual Magnum + Gramoxone + NIS at EPOST fb Cobra + COC at MPOST; 11) Warrant 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.

There was no peanut injury from any herbicide applications 10 WAE. Treatments 5, 6, 7, and 9 provided 94 to 100% control of barnyardgrass (Echinochloa crus-galli) and broadleaf signalgrass (Urochloa platyphylla). Barnyardgrass control was < 60% from the application of treatments 1, 8, and 11. All treatments except treatments 2, 6, 7, and 8 provided 100% control of pitted morningglory (Ipomoea lacunosa). All treatments provided excellent control (99 to 100%) of prickly sida (Sida spinosa). Palmer amaranth (Amaranthus palmeri) control was > 96% from all treatments except treatments 2 and 7. Treatment 5 (Valor PRE fb Cobra + Select Max + COC at MPOST) reduced weed dry weight and seed production > 98% compared to nontreated check. Treatment 4 (same herbicide application as treatment 5) applied at EPOST, reduced weed dry weight and seed production only 76 and 60% (compared to nontreated check), respectively. Therefore, time of application is critical not only for effective weed control but also to stop weed seed deposition to the soil seedbank. Treatment 5 provided highest (4,228 lb/A) peanut yield. However, treatments 6, 7, 9, and 12 provided comparable peanut yield as treatment 5. Weed interference reduced peanut yield 88% as compared to the treatment with maximum yield (Trt. 5). Valor PRE fb Cobra + Select Max + COC applied at MPOST provided the best herbicide program in terms of weed control, weed seed production, and peanut yield.
WEED CONTROL PROGRAMS WITH ENGENIA IN COTTON. T. Bararpour*1, R.R. Hale2, A. Rhodes3, D.R. Chastain2; 1Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 2Mississippi State University, Stoneville, MS, 3BASF Corporation, Madison, MS (63)

ABSTRACT

Cotton (Gossypium hirsutum) is a major crop in Mississippi. Widespread glyphosate-resistant (GR) Palmer amaranth (Amaranthus palmeri), the most troublesome weed in Mississippi row crop production, has led to a heavy reliance on PRE herbicides in addition to POST residual herbicides in cotton. A field study was conducted in 2017 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate weed control programs with Engenia in Bollgard II Xtendflex cotton. Cotton (DP1522 B2XF) was planted at seeding rate of 3 seeds/ft on May 16, 2017. The study was designed as a randomized complete block with five treatments and four replications. Treatments were as follows: 1) Cotoran (fluometuron) at 25.6 PRE followed by (fb) Liberty 280 (glufosinate) at 29 at five- to six-leaf cotton; 2) Cotoran PRE fb Liberty 280 at two- to three-leaf cotton fb Liberty 280 at five- to six-leaf cotton; 3) Prowl H2O (pendimethalin) at 32 + Cotoran PRE fb Engenia (dicamba) at 12.8 + Outlook (dimethenamid-p) at 12.8 + Roundup PowerMax (RPM) (glyphosate) at 32 + non-ionic surfactant (NIS) at 0.25% v/v at two- to three-leaf cotton fb Engenia + RPM + NIS at five- to six-leaf cotton; 4) Prowl H2O + Cotoran PRE fb RPM + Engenia + Outlook + NIS at two- to three-leaf fb Engenia + Zidua (pyroxasulfone) at 1.5 + RPM + NIS at layby; 5) Prowl H2O + Cotoran PRE fb RPM + Engenia + NIS at two- to three-leaf cotton fb Liberty 280 + Outlook + ammonium sulfate (AMS) at 10 at five- to six-leaf cotton. A nontreated check was included. Herbicide rates were in fl oz/A.

Cotton injury was 0, 0, 6, 6, and 1% at 4 wk after emergence (WAE), and 0, 0, 2, 4, and 0% at 9 WAE from treatments 1 through 5, respectively. There was no cotton injury by 12 WAE. Glyphosate-resistant Palmer amaranth control was 65, 96, 100, 100, and 100% from the application of treatments 1 through 5 at 4 WAE, respectively. There were no differences in entireleaf morningglory (Ipomoea hederacea var. integriuscula) control (99 to 100%) among treatments at 9 WAE. Treatment 1 through 5 provided 95, 93, 99, 100, and 100% control of broadleaf signalgrass (Urochloa platyphylla) at 9 WAE, respectively. All treatments provided excellent control (99 to 100%) of hemp sesbania (Sesbania exaltata) and yellow nutsedge (Cyperus esculentus). Seedcotton yield was 1,370; 1,361; 1,411; 1,304; and 1,273 lb/A for treatments 1 through 5, respectively. Weed interference reduced cotton yield 90.4% as compared to the treatment with maximum yield (Trt. 3). There were no differences between treatment without Engenia application (Trt. 1 or 2) and treatment with Engenia (Trt. 3, 4, or 5) in terms of cotton yield. However, treatments with Engenia provided better Palmer amaranth control than treatment without Engenia (Trt. 1). Engenia will provide growers an option to fight GR weeds especially in cotton, but it needs a herbicide partner for grass control.
EVALUATION OF BURNDOWN HERBICIDE MIXTURES FOR HORSEWEED CONTROL. R.R. Hale,*1, T. Bararpour2, J. Bond3, L. Walton4; 1Mississippi State University, Stoneville, MS, 2Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 3Delta Research and Extension Center, Stoneville, MS, 4Dow AgroSciences, Tupelo, MS (64)

ABSTRACT

Horseweed (Conyza canadensis) is a troublesome winter annual that can be difficult to control prior to planting. In Mississippi, there are populations of horseweed that are resistant to glyphosate or paraquat, or both. Planting into a weed-free seed bed is critical for seed germination and allows the plant to uptake available water and nutrients without interference to establish a good stand. A bareground study was conducted in 2017 at the Delta Research and Extension Center, in Stoneville, MS, to evaluate pre-plant burndown herbicides on horseweed efficacy. At the time of herbicide applications there were three horseweed sizes: 2 to 3, 4 to 6, and 7 to 10 inches. Treatments were arranged in a randomized complete block design. Herbicide treatments included: 1) Durango® DMA® (glyphosate) at 32 fl oz/A; 2) Durango® DMA® + 2,4-D (Ester LV) at 11.4 fl oz/A; 3) Elevore™ (halaxifen-methyl) at 1 fl oz/A + Durango® DMA® + methylated seed oil (MSO) at 1% (v/v); 4) Elevore™ + Durango® DMA® + 2,4-D + MSO; 5) Elevore™ + FirstRate® (cloransulam) at 0.3 oz/A + Durango® DMA® + MSO; 6) Elevore™ + Surveil™ (cloransulam + flumioxazin) at 3 oz/A + Durango® DMA® + MSO; 7) Liberty® (glufosinate) at 29 fl oz/A; 8) Sharpen® (saflufenacil) at 1.5 fl oz/A + Durango® DMA® + MSO; 9) Clarity® (dicamba) at 1 pt/A + Durango® DMA®. All treatments contained 34% N-Pak® ammonium sulfate (AMS) liquid at 2.5% (v/v). An untreated check was included. Horseweed density were 12 plants m−2.

Treatments 4 through 10 provided 93 to 100% control of 2 to 3 inches horseweed 8 wk after treatment (WAT). The same treatments (Trt. 4 through 10) provided 90 to 98% control of 4 to 6 inches horseweed. Horseweed (2 to 3 inches) control was ≤87% from treatments 1 through 3. The same treatments (1 through 3) provided ≤81% control of 4 to 6 inches horseweed 8WAT. Horseweed ≥7 inches were difficult to control. Only treatments 5, 6, and 9 provided 86 to 93% control of horseweed (≥7 inches) 8 WAT. Horseweed (≥7 inches) control was 56, 75, and 73% for treatments 1 through 3, respectively. Treatments 4, 7, and 8 provided 80% control of ≥7 inches horseweed 8 WAT. Overall, treatments 4 through 10 provided >90% control of horseweed ranged from 2 to 6 inches. For horseweed (≥7 inches), only treatments 5, 6, and 9 provided adequate (>86%) control. Based on these results, understanding seasonal emergence periods of particular weed species are critical to achieve maximum control of weeds that may be present in the field.
LATE-SEASON HERBICIDE APPLICATIONS CONTAINING PYROXASULFONE FOR WEED CONTROL IN PEANUT. R.R. Hale*1, T. Bararpour2, J. Bond3, J.W. Seale1, J. Gore1, D.R. Cook4; 1Mississippi State University, Stoneville, MS, 2Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 3Delta Research and Extension Center, Stoneville, MS, 4Mississippi State University, Starkville, MS (65)

ABSTRACT

In peanut (Arachis hypogaea), producers are limited by herbicide options when both grasses and broadleaf weeds are present. Pyroxasulfone (Zidua) is a very long chain fatty acid (VLCFA)-inhibiting herbicide that provides residual weed control of grasses and broadleaf weeds, and was recently registered for use in peanut in Mississippi. Tank-mixing herbicides with multiple modes of action that provide additional residual control is recommended. A field study was conducted in 2017 at the Delta Research and Extension Center in Stoneville, MS, to evaluate the addition of pyroxasulfone with commonly used herbicides in peanut. Peanut (Georgia-D6G) was planted in this study. Treatments were arranged in a randomized complete block design. An untreated check was included. Herbicide treatments included: 1) S-metolachlor (Dual Magnum) at 1,068 g ai ha\(^{-1}\) PRE fb paraquat (Gramoxone) at 210 g ai ha\(^{-1}\) + bentazon (Basagran) at 561 g ai ha\(^{-1}\) 3 wk after planting (EPOST); 2) S-metolachlor PRE fb paraquat + bentazon at EPOST fb clethodim (Select) at 85 g ai ha\(^{-1}\) + pyroxasulfone at 91 g ai ha\(^{-1}\) + non-ionic surfactant (NIS) at 0.25% (v/v) at 4 wk after EPOST (LPOST); 3) S-metolachlor PRE fb paraquat + bentazon at EPOST fb [bentazon + acifluorfen (Storm)] at 841 g ai ha\(^{-1}\) + pyroxasulfone + NIS at LPOST fb clethodim + crop oil concentrate (COC) at 1% (v/v) at 3 wk after LPOST (VLPOST); 4) S-metolachlor PRE fb bentazon + paraquat at EPOST fb [bentazon + acifluorfen] + acetochlor (Warrant) at 1,261 g ai ha\(^{-1}\) + pyroxasulfone + NIS at LPOST fb clethodim + COC at VLPOST; 5) S-metolachlor PRE fb bentazon + paraquat at EPOST fb pyroxasulfone + lactofen (Cobra) at 210 g ai ha\(^{-1}\) + clethodim + COC at LPOST; 6) S-metolachlor PRE fb bentazon + paraquat at EPOST fb lactofen + clethodim + COC at LPOST fb lactofen + clethodim + COC at VLPOST; 7) S-metolachlor PRE fb bentazon + paraquat at EPOST fb clethodim + COC at LPOST. Peanut yield was recorded at maturity.

No peanut injury was observed for any treatment combination. Treatments 2, 5, 6, and 7 provided 89, 89, 82, and 87% barnyardgrass (Echinochloa crus-galli) control 3 wk after LPOST. No differences in barnyardgrass control were observed 3 wk after VLPOST, except treatment 1 (45%). Palmer amaranth (Amaranthus palmeri) control was 67, 80, 82, 87, 78, and 82% for treatments 1 through 6, respectively, 3 wk after LPOST. No differences were observed for hemp sesbania (Sesbania herbacea) and pitted morningglory (Ipomoea lacunosa) with control ranging from 97 to 100%. There were no differences in Palmer amaranth control 5 wk after LPOST, except treatment 7 (37%). Significant differences were observed for peanut yield. Treatments 2, 4, 5, and 6 produced 4,995; 4,564; 4,541; and 4630 kg ha\(^{-1}\), respectively. Based on these results, pyroxasulfone may provide additional control of grass and broadleaf weeds in peanut. All programs containing pyroxasulfone provided greater weed control and yields, except treatment 3. It is recommended to control weeds early, overlap residual herbicides, and apply multiple modes of action.
RESPONSE OF PEANUT TO SIMULATED DRIFT RATES OF DICAMBA. J.W. Seale*, T. Bararpour1, R.R. Hale2, J. Bond3, J. Gore2, B. Lawrence2; 1Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 2Mississippi State University, Stoneville, MS, 3Delta Research and Extension Center, Stoneville, MS (66)

ABSTRACT

One of the biggest issues facing peanut (Arachis hypogaea) growers in Mississippi is the use of dicamba on neighboring crops. Peanuts are sensitive to dicamba herbicides due to their growth and development habits. A field study was conducted in 2017 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate simulated drift rates of Clarity (dicamba) on peanuts at three growth stages. Peanuts (Georgia-D6G) were planted on beds with 40-inch row spacing at a seeding rate of 8 seeds/foot. The study was designed as a randomized complete block with a 3 (peanut growth stage) by 4 (herbicide Trt.) factorial treatment arrangement. Each treatment was replicated four times. Applications were made at three peanut growth stages: beginning bloom (BBL), beginning pegging (BPE), and beginning pod (BPO). Clarity was applied at 1/16 X and 1/32 X (simulated drift rates) rates 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. A nontreated check was included. The labeled rate (1 X) of Clarity was 16 fl oz/A.

Peanut injury was not significantly different when comparing both simulated drift rates of Clarity with and without NIS; however, treatments containing NIS showed greater (numerically) injury at both Clarity rates than treatments without NIS at BPO growth stage of peanut. Visual injury at 12 wk after emergence (WAE) was greater at the BPO growth stage when treated with 1/16 X rates than 1/32 X rates. Simulated drift rate of Clarity at 1/16 X (with or without NIS) caused 9 to 10% (highest) peanut injury at BPO (12 WAE). Clarity at 1/32 X (with or without NIS) caused 5 to 6% peanut injury at BPO. There was no peanut injury from simulated drift rates of Clarity applications at BBL or BPE growth stages. Peanut injury was 0, 0.6, and 6.1% (averaged over herbicide treatments) at BBL, BPE, and BPO at 12 WAE, respectively. Simulated drift rate of Clarity at 1/32 X (with or without NIS) did not reduce peanut yield as compared to nontreated check (averaged over growth stage). However, Clarity at 1/16 X without and with NIS reduced peanut yield 20 (3,762 lb/A) and 34% (3,141 lb/A) (averaged over growth stage) when compared to nontreated check (4,728 lb/A), respectively. In general, peanuts can recover from injury when Clarity drift occurs at early peanut development stages. The most damaging peanut stage from Clarity drift is during BPO growth stage.
EVALUATION OF TOPRAMEZONE IN PREPLANT BURNDOWN APPLICATIONS IN CORN. J.W. Seale*1, T. Bararpour1, R.R. Hale2, J. Bond3, B. Golden3, N. French II4, B. Lawrence2, T. Phillips5; 1Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 2Mississippi State University, Stoneville, MS, 3Delta Research and Extension Center, Stoneville, MS, 4AMVAC Chemical Corporation, Little Rock, AR, 5Mississippi State University: Delta Research & Extension Center, Stoneville, MS (67)

ABSTRACT

Corn (Zea Mays) is one of the major crops grown in Mississippi. The abundance of glyphosate-resistant (GR) weeds has resulted in growers needing to integrate multiple modes of action into weed control programs. GR Palmer amaranth (Amaranthus palmeri) has become the most problematic weed in Mississippi row crop production and has created a scenario that forces growers to rely heavily on PRE and POST residual herbicides in corn. A field study was conducted in 2017 at the Delta Research and Extension Center in Stoneville, MS, to evaluate weed control programs with Impact® (topramezone) herbicide in GlyTol LibertyLink® corn. Corn (Mycogen Hybrid 2D848) was planted on beds with 40-inch row spacing at a seeding rate of 2.4 seeds/ft on April 19, 2017. The study was designed as a randomized complete block with eight herbicide treatments and four replications. Treatments were as follows: 1) Dual II Magnum (S-metolachlor) at 1.19 lb ai/A + Impact (topramezone) at 0.0164 lb ai/A + AAtrex (atrazine) at 1.0 lb ai/A; 2) Dual II Magnum + Impact + Roundup PowerMax (glyphosate) at 1.13 lb ai/A + AAtrex; 3) Dual II Magnum + Impact + Liberty 280 SL (glufosinate) at 0.53 lb ai/A + AAtrex; 4) Dual II Magnum + Impact + Sharpen (saflufenacil) at 0.0223 lb ai/A + AAtrex; 5) Dual II Magnum + Impact + 2,4-D Amine at 0.5 lb ai/A + AAtrex; 6) Dual II Magnum + Impact + Clarity (dicamba) at 0.5 lb ai/A + AAtrex; 7) Dual II Magnum + Roundup PowerMax + Clarity + AAtrex; 8) Dual II Magnum + Impact + Gramoxone Inteon (paraquat) at 0.5 lb ai/A + AAtrex.

All treatments were applied 14 d prior to planting (PREP) and included MSO at 0.5% (v/v) and UAN 28% at 2.5% (v/v). A nontreated check was included.

Corn injury was 2.5, 0, 0, 1.3, 3.3, 1.3, and 1.3% at 3 wk after treatment (WAT) for treatments 1 through 8, respectively, but visual injury symptoms had subsided by 4 WAT. All treatments provided >95 and >90% control of henbit (Lamium amplexicaule) and swinecress (Coronopus didymus), respectively. All treatments provided excellent (>90%) control of Palmer amaranth, broadleaf signalgrass (Urochloa platyphylla), and yellow nutsedge (Cyperus esculentus) (except Trt. 3 and 6) 3 WAT. Palmer amaranth control was 100, 100, 99, 99, 94, 100, 100, and 100% for treatments 1 through 8 (3 WAT), respectively. However, the control of Palmer amaranth observed decreased to 85, 89, 90, 91, 89, 95, 90, and 94% (new emergence) 10 WAT for treatments 1 through 8, respectively. Broadleaf signalgrass control was 85, 95, 91, 96, 91, 91, 93, and 98% for treatments 1 through 8 (3 WAT), respectively. Broadleaf signalgrass control reduced to 74, 90, 86, 86, 90, 91, 90, and 93% for treatments 1 through 8 at 10 WAT, respectively. Both Palmer amaranth and broadleaf signalgrass expressed a decrease in control at 10 WAT when compared to ratings 3 WAT. Corn yield was 141, 148, 169, 178, 163, 165, 158, and 165 bu/A for treatments 1 through 8, respectively. Weed interference reduced the corn yield 82% as compared to the treatment with the maximum yield (Trt. 4). Treatments including topramezone had exceptional control of all weed species (Trt. 1 through 6 and Trt. 8).
Topramezone will provide growers an option to fight weeds in corn when applying PREP herbicide applications.
BROADLEAF WEED CONTROL WITH HALOSULFURON PLUS PROSULFURON IN DRILL-SEEDED RICE. J.D. Peeples, H.M. Edwards, B.H. Lawrence, T.L. Sanders, N.G. Corban, AND J.A. Bond. J. Peeples Jr.*; Delta Research and Extension Center, Stoneville, MS (68)

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 (Permit) has been the primary treatment for sedge control in rice, but it also controls some broadleaf weed species. Halosulfuron, along with other herbicides targeting broadleaf weeds, has been used extensively in recent years, and resistance is becoming problematic. Halosulfuron plus prosulfuron (Gambit) is an acetolactate synthase (ALS) herbicide from Gowan Company that will be marketed for broadleaf and sedge control in rice. Research was conducted to (1) identify the optimum rate of a prepackaged mixture of halosulfuron plus prosulfuron for broadleaf weed control in rice and (2) compare the efficacy of a prepackaged mixture of halosulfuron plus prosulfuron to that of other herbicides targeting broadleaf weeds in rice.

Two studies were conducted at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate halosulfuron plus prosulfuron in rice. For both studies, the experimental design was a randomized complete block with four replications. The first study (Rate Study) evaluated rates of halosulfuron plus prosulfuron and was conducted from 2015 to through 2017. Treatments included halosulfuron plus prosulfuron at 0.037, 0.049, and 0.074 lb ai/A, and halosulfuron plus thifensulfuron (Permit Plus) at 0.035 lb ai/A. Treatments were applied when rice was at the two- to three-leaf growth stage. The second study (Broadleaf Herbicide Comparison) compared the efficacy of halosulfuron plus prosulfuron to other common broadleaf herbicides and was conducted in 2017. Treatments included halosulfuron plus prosulfuron at 0.049 and 0.099 lb/A, florpyrauxifen-benzyl (Loyant) at 0.026 lb ai/A, penoxsulam plus triclopyr (Grasp Xtra) at 0.25 lb/A, halosulfuron plus thifensulfuron at 0.035 lb/A, and saflufenacil (Sharpen) at 0.022 lb ai/A. Treatments were applied when rice was at the three- to four-leaf growth stage. Visual estimates of rice injury and weed control were recorded 7, 14, and 28 d after treatment (DAT). Data were subjected to ANOVA and estimates of the least square means were used for mean separation.

In the Rate Study, all rates of halosulfuron plus prosulfuron controlled hemp sesbania and ivyleaf morningglory ≥ 96% 14 DAT. Control of hemp sesbania with halosulfuron plus prosulfuron was greater than with halosulfuron plus thifensulfuron 14 DAT. The highest rate of halosulfuron plus prosulfuron (0.074 lb/A) was required for ivyleaf morningglory control greater than that with halosulfuron plus thifensulfuron 14 DAT. Volunteer soybean cultivars were glyphosate- and ALS-resistant. All rates of halosulfuron plus prosulfuron controlled volunteer soybean ≥ 93% 14 and 28 DAT, respectively. No differences in Palmer amaranth control were detected 7, 14, or 28 DAT.

In the Broadleaf Herbicide Comparison, hemp sesbania was controlled ≥ 97% with all treatments 14 DAT. Ivyleaf morningglory control 14 DAT was greater with saflufenacil than with either rate of halosulfuron plus prosulfuron. Both rates of halosulfuron plus prosulfuron,
florpyrauxifen-benzyl, penoxsulam plus triclopyr, and saflufenacil controlled volunteer soybean \( \geq 94\% \) 14 DAT. Florpyrauxifen-benzyl, penoxsulam plus triclopyr, and saflufenacil controlled Palmer amaranth better than both rates of halosulfuron plus prosulfuron and halosulfuron plus thifensulfuron 14 DAT.

Halosulfuron plus prosulfuron at all rates evaluated controlled more hemp sesbania and volunteer soybean than halosulfuron plus thifensulfuron. Halosulfuron plus prosulfuron at 0.074 lb/A controlled more ivyleaf morningglory than halosulfuron plus thifensulfuron in the Rate Study; however, in the Broadleaf Herbicide Comparison, halosulfuron plus prosulfuron offered no advantage in ivyleaf morningglory control over halosulfuron plus thifensulfuron. The efficacy of halosulfuron plus prosulfuron compared with penoxsulam plus triclopyr, florpyrauxifen-benzyl, and saflufenacil was species specific. Halosulfuron plus prosulfuron at 0.099 lb/A can serve as an alternative broadleaf herbicide for rice when hemp sesbania or volunteer soybean are the primary targets.
Field studies were conducted in 2014 through 2017 in south Texas to determine sesame (Sesamum indicum L.) response to simulated drift from applications of glyphosate + dicamba and 2,4-D alone. Sesame injury with low rates of these herbicides manifested themselves as distorted plant growth at lower concentrations while at the higher concentrations they affected cell walls and nucleic acid metabolism and inhibited cell division and growth, leading to plant death.

Study 1. All rates of glyphosate + dicamba (1X=1.68 kg ae ha\(^{-1}\)), with the exception of the 1/32 and 1/64X rates, caused a reduction in sesame height when compared with the untreated check. Also, sesame injury and a reduction in yield were noted with all rates of glyphosate + dicamba. Injury and a yield reduction increased as rate increased. The 1/4X rate of glyphosate + dicamba caused greater injury and reduction in yield than comparable rates of glyphosate, dicamba, 2,4-D, or glufosinate alone.

Study 2. Sesame plant height was decreased from the untreated check with 2,4-D (1X=0.56 kg ae ha\(^{-1}\)) down to the 1/8X rate; however, rates from 1/16X to 1/256X caused no reduction in height from the untreated check and no injury. Yield was greatly affected by the 1X and 1/16X rates but other rates caused a reduction in yield from the untreated check of no greater than 107 kg ha\(^{-1}\).

Study 3. Sesame injury was similar regardless of carrier volume and this injury was greatest with 2,4-D applications (1X=0.56 kg ae ha\(^{-1}\)) to the smaller sesame. Yields reflect much of the same trends.
INVESTIGATING A MECHANISM FOR GLYPHOSATE ANTAGONISM CAUSED BY MIXTURES WITH DICAMBA OR GLUFOSINATE IN ECHINOCHLOA CRUS-GALLI. C. Meyer*1, J. Norsworthy1, R. Beffa2; 1University of Arkansas, Fayetteville, AR, 2Bayer AG, Frankfurt am Main, Germany (70)

ABSTRACT

In the field, tank-mixtures of glyphosate + glufosinate and glyphosate + dicamba have not performed as expected, resulting in survivors of various grass species [e.g. barnyardgrass (Echinochloa crus-galli)]. Herbicide absorption and translocation of 14C-labeled glyphosate and 14C-labeled glufosinate was evaluated in barnyardgrass to identify a potential mechanism for antagonism observed in field experiments. Glyphosate labeled with 14C was applied in the lab alone and in combination with nonradiolabeled (cold) glufosinate or dicamba. In a second experiment, 14C-glufosinate was applied alone and in combination with cold glyphosate or dicamba. Barnyardgrass plants were treated at the 4- to 5-leaf stage and radiolabeled herbicide was spotted onto the second-youngest fully expanded leaf. At 48 h after treatment, plant tissue was sectioned and the treated leaf was washed to remove any radioactive material that was not absorbed. Plant tissues were dried, oxidized, and radioactivity quantified in each section with a liquid scintillation counter. A tank-mixture of glufosinate + glyphosate reduced uptake of 14C-glyphosate from 32% of applied for glyphosate alone to 22% for the tank mixture. For glyphosate alone, 50% of absorbed radioactivity moved out of the treated leaf compared to 28% for glyphosate + glufosinate. Uptake of 14C-glyphosate was not affected by the addition of dicamba, nor was translocation different between these two treatments. In the 14C-glufosinate experiment, when glufosinate was applied alone 68% of the applied 14C-glufosinate was absorbed compared to 44% when applied in mixture with cold glyphosate. These data suggest the source of antagonism observed in the field for tank-mixtures of glyphosate + glufosinate could altered absorption and translocation. Thus, increasing use rates or utilizing sequential applications may be needed to mitigate antagonism and reduce the likelihood of evolving herbicide resistance. For the antagonism observed in the field for glyphosate + dicamba, no mechanism was identified, and further investigation to understand the reduced performance of this mixture.
FLORPYRAUXIFEN-BENZYL HERBICIDE ACTIVITY ON COMMON GRASS WEEDS IN LOUISIANA RICE. G.M. Telo*, B. McKnight1, E.P. Webster2, S.Y. Rustom1, M.J. Osterholt1, L.C. Webster1; 1Louisiana State University AgCenter, Baton Rouge, LA, 2Louisiana State University, Baton Rouge, LA (71)

ABSTRACT

Weeds can be found in rice (Oryza sativa L.) production and can cause yield loss wherever rice is grown; therefore, effective weed control is very important for successful rice production. Florpyrauxifen-benzyl is a new synthetic auxin postemergence herbicide for control of broadleaf, grass, and sedge weeds in rice. Grass weeds are common in Louisiana rice production, and many can be difficult to control. Individual studies were conducted to evaluate the activity of florpyrauxifen on brook crowngrass (Paspalum acuminatum Raddi), fall panicum (Panicum dichotomiflorum Michx.), Nealley’s sprangletop (Leptochloa nealleyi Vasey), rice cutgrass (Leersia oryzoides L.), southern watergrass (Luziola fluitans Michx.), and water paspalum (Paspalum modestum Mez).

A series of studies were established in a glasshouse in November 2016 and repeated in February 2017 on the Louisiana State University campus in Baton Rouge, Louisiana. The experimental design was a two-factor factorial in a completely randomized design with five replications. Factor A consisted of florpyrauxifen applied at 0 or 30 g ai ha⁻¹. Factor B, for each grass evaluated, consisted of application timings at two growth stages, 1) three- to four-leaf; 2) one- to two-tiller. Florpyrauxifen was applied with a CO₂-pressurized backpack sprayer calibrated at 145 kPa to deliver 140 L ha⁻¹ of solution, a methylated seed oil was added at 1% v v⁻¹. Weed control and leaf number were evaluated at 5, 10, 15, and 21 days after treatment (DAT).

At 21 DAT, fall panicum treated with florpyrauxifen at three- to four-leaf stage was controlled 91%, compared with 72% control with the later application timing. Fall panicum leaf production ceased following florpyrauxifen treatment across all evaluation dates. Nealley’s sprangletop control was 82 and 78% at 21 DAT; and leaf number was reduced 41 and 40% when treated with florpyrauxifen at the three- to four-leaf and one- to two-tiller growth stage, respectively.

Brook crownggrass, rice cutgrass, southern watergrass, and water paspalum control did not exceed 71, 12, 56, and 36%, respectively. Consequently, plants treated with florpyrauxifen indicated a difference for leaf number when compared with the nontreated, except rice cutgrass. Results from this glasshouse study indicate that florpyrauxifen provides suppression of fall panicum at 91% control and Nealley’s sprangletop at 82% control when treated at the three- to four-leaf stage.
CHANGE IN WEED SPECIES DIVERSITY AND DENSITY FOLLOWING REPEATED USE OF GLYPHOSATE IN FOUR FIELDS IN NORTH CAROLINA. D. Jordan*1, A.C. York2; 1North Carolina State University, Raleigh, NC, 2North Carolina State University, Cary, NC (73)

ABSTRACT

Glyphosate-resistant corn (Zea mays L.), cotton (Gossypium hirsutum L.), and soybean [Glycine max (L.) Merr.] are widely planted in the southern United States. However, reliance on glyphosate as the primary or only herbicide resulted in shifts in weed species and evolution of glyphosate resistance. In this brief we present information documenting the change in weed species richness and density from 1999 or 2000 to 2017 in four fields ranging in size from 8 to 20 acres on a single farm near Edenton, NC (36.08 N, -76.52W). Weed densities in 1999 and 2000 were recorded from a 100-ft² section representing each acre of the field after pendimethalin and diclosulam were applied preemergence to peanut (Arachis hypogaea L.) in conventionally-prepared seedbeds but prior to the first postemergence herbicide application (Jordan et al., 2003). Acifluorfen, bentazon, clethodim, and 2,4-DB were applied postemergence after weed densities were recorded. Weed management in cotton and soybean was accomplished exclusively with glyphosate (0.75 lb a.e./acre) applied once or twice per year. Atrazine and S-metolachlor were applied preemergence in corn in 2007 and 2011 in Fields 2 and 3. Weed densities in 2009, 2011, 2013, 2016, and 2017 (Fields 1, 2, and 3) or 2016 and 2017 (Field 4) were determined using the same procedure described for peanut during 1999 and 2000. Weed species in at least one of the fields included broadleaf signalgrass [Urochloa platyphylla (Nash) R.D. Webster], carpetweed (Mollugo verticillata L.), common cocklebur (Xanthium strumarium L.), common ragweed (Ambrosia artemisiifolia L.), entireleaf morningglory (Ipomoea hederacea L. var. integriuscula Gray), eclipta (Eclipta prostrata L.), goosegrass [Eleusine indica (L.) Gaertn.], horsenettle (Solanum carolinense L.), pitted morningglory (Ipomoea lacunosa L.), prickly sida (Sida spinosa L.), purple nutsedge (Cyperus rotundus L.), sicklepod [Senna obtusifolia (L.) H.S. Irwin & Barneby], smooth pigweed (Amaranthus hybridus L.), spreading dayflower (Commelina diffusa Burm. f.), tall morningglory [Ipomoea purpurea (L.) Roth], and yellow nutsedge (Cyperus esculentus L.). A t-test (p < 0.10) was used to compare density of each species observed in peanut to the density observed in soybean for each year. Means for density of each weed in each field was separated using Fisher’s Protected LSD test (p < 0.10) to compare the change in density after 2008 (Fields 1-3) and 2016 and 2017 (Field 4).

In Field 1, the number of weed species present in peanut was 10 compared with 6, 5, 5, 4, and 6 during 2009, 2011, 2013, 2016, and 2017. In Field 2, six weed species were documented in 1999; 2, 2, 5, 4, and 3 weed species found in these respective fields. In Field 3, six weed species were observed in peanut in 2000 compared with 3 to 4 weed species in soybean. While fewer observations were recorded for Field 4, eight weed species were noted in 1998 with 3 and 5 species in 2016 and 2017, respectively. Densities of common cocklebur (Fields 1 and 3), pitted morningglory (all fields), and yellow nutsedge (Fields 1, 3, and 4) were lower after 2008 when glyphosate was applied in soybean for many years compared with densities observed in peanut. Horsenettle density was lower in 2016 and 2017 compared with density in 1998. Carpetweed density in soybean was higher in Fields 1 and 2 than in peanut. Spreading dayflower density in soybean was higher in Fields 1 and 2 but lower in Field 3 compared with...
density in peanut. Goosegrass was not present in the counts in 1999 but as observed in high numbers in 2016 and 2017. Common ragweed density was higher in Fields 1 and 4 in soybean in 2017 than density in peanut.

Differences in weed species richness and density may reflect changes in the soil seedbank, herbicide performance in peanut, emergence patterns in a given year due to weather, or efficacy of glyphosate. For example, pendimethalin and diclosulam may have controlled carpetweed, goosegrass, and spreading dayflower in peanut but without residual herbicide applied at planting in soybean goosegrass was present prior to application of glyphosate. While not confirmed, common ragweed and goosegrass may reflect evolved resistance to glyphosate. These data provide information on long-term changes in weed richness and density after many years of glyphosate. While comparisons may be compromised by use of pendimethalin and diclosulam in peanut, greater richness and sometimes higher densities in 1999 and 2000 are supportive of the value of glyphosate. However, the higher density of common ragweed, most likely due to evolved resistance, reveals the weakness of continuous use of glyphosate.
THE CRITICAL NEED FOR DILIGENT, PROACTIVE HERBICIDE STEWARDSHIP.
N. Rhodes*1, L. Steckel2, D. McIntosh1; 1University of Tennessee, Knoxville, TN, 2University of Tennessee, Jackson, TN (74)

ABSTRACT

Due to the sensitivity of many high value crops and other plants to off-target auxinic herbicides, 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 grants for 2 years 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. In 2015 the website was redesigned in an effort to make it more attractive and user friendly, and the address was changed to herbicidestewardship.com. In 2016 and again in 2017, severe 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 Tennessee alone, over 300,000 acres of Roundup Ready, Liberty Link and conventional soybeans exhibited symptoms of dicamba drift. Other crops damaged in Tennessee included grape, tobacco, vegetables, and ornamentals. We made the decision in 2017 to completely reconstruct and broaden our website to include additional information directly addressing stewardship of dicamba and 2,4-D tolerant crop technology. The new version of the website will be available in early 2018. Use of our website has steadily increased since its inception. The website has been visited over 8000 times since it was launched. Visits came from The United States, China, Japan, Germany, Canada, The United Kingdom, India and Brazil.
STUDY OF ANTHRAQUINONE BIOSYNTHESIS, TRANSPORT AND STORAGE IN SICKLEPOD WEED USING FLUORESCENCE IMAGING. Z. Yue*, T. Tseng;
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ABSTRACT

Sicklepod extract proved to be an effective deer repellent to protect soybean (Yue et al. 2018). Anthraquinone derivative glycosides are the active ingredients in sicklepod extract (Crawford et al. 1990; Werner et al. 2016). Current extraction method is using water; however, this method is labor intensive and time consuming. An alternate method is to locate anthraquinone producing cells or organelles in the plant, and prepare the extract using plant cell cultures.

Fluorescence microscope observation of sicklepod endosperm revealed anthraquinone derivative concentrated on some free floating “cell membrane” of irregular shape. These free floating “cells” are on the scale of 40-60 µm, suggesting biosynthesis of anthraquinone derivatives might occur on these membranes. UV fluorescence property of anthraquinone derivatives have been studied for long using thin layer chromatography (TLC). This property could also be used to observe distribution of anthraquinone derivatives in sicklepod plant in situ. Sicklepod seeds have highest anthraquinone derivative concentrations in sicklepod above-ground plant parts; the total anthraquinone derivative can account up to 1-2% of seed weight. In seed, endosperm accounts for half the weight with around 75% of the endosperm comprised of galactomannans. Hence, the endosperm is transparent thus allowing us to use fluorescence microscope to explore the distribution of anthraquinone derivatives in the endosperm in three dimensions. In the transparent endosperm, yellow fluorescence of anthraquinone derivatives was observed to be concentrated on free floating hollow “cell membranes”, which were similar to the size of sicklepod leaf cells. If these “floating cells” are present at a stage of the endosperm development, which later forms into all cell structure, then this will be in agreement to the observation that anthraquinone is concentrated in cell membrane/wall in leaf, stem and root. This further suggests anthraquinone derivatives are biosynthesized on these membranes and stored in situ. Studies on plant cell culture data suggest anthraquinone biosynthesis related to oblique endoplasmic reticulum (ER). Whether these observed “hollow cells” are the relevant ER still needs to be determined.

Such observation of the endosperm anthraquinone-producing cells or organelles allows us to select these cells for plant cell culture to produce anthraquinone-based deer repellent. These cells contain galactomannans which is soluble in water and lack cellulose which makes residue in extraction.
SPEEDZONE: POSTEMERGENCE GOOSEGRASS CONTROL. A. Estes*, J. Marvin2, B. Aynardi3; 1PBI Gordon, Pendleton, SC, 2PBI Gordon, Overland Park, KS, 3PBI Gordon, Bellefonte, PA (76)

ABSTRACT

Goosegrass (Elusine indica) is a problematic annual grassy weed worldwide. In the past postemergent applications of MSMA have typically been used for control, however the MSMA label has lost most of its labeled use sites, with a complete ban for turf use in Florida. Postemergent applications for goosegrass typically require multiple applications to achieve satisfactory results.

In July 2011 various reports were reported of SpeedZone controlling goosegrass. From those reports various research trials were initiated with some of the first work being done at The University of Nebraska (Leibhart et al 2014). Since then numerous trials have been conducted evaluating SpeedZone for postemergence goosegrass control. Recent research at the University of Tennessee and Clemson University looked at the combination of SpeedZone with metribuzin, and simazine for increased herbicidal activity. Further research at Clemson University has evaluated irrigation immediately following applications of SpeedZone in combination with topramezone for improved warm-season turfgrass tolerance and goosegrass efficacy.

Future work is warranted to understand the mechanism behind the use of SpeedZone for postemergence goosegrass control. Continued research to improve application timing of SpeedZone, for best efficacy throughout the season. Along with continued evaluation of tank mix partners for improved efficacy and turfgrass safety in both cool and warm season turfgrass systems.
VEXIS TECHNOLOGY: NEW OPTION FOR SEDGE AND BROADLEAF WEED CONTROL. A. Estes*1, J. Marvin2, B. Aynardi3; 1PBI Gordon, Pendleton, SC, 2PBI Gordon, Overland Park, KS, 3PBI Gordon, Bellefonte, PA (77)

ABSTRACT

Vexis (pyrimisulfan) a new active ingredient (ai) currently in federal registration by PBI-Gordon Corporation. Vexis is a proprietary sulfonanilide, acetolactate synthase inhibitor, which has shown excellent turf safety on most turfgrass species as well as woody ornamentals. This new technology lends itself to be combined with other ai’s for increased weed spectrum. Rates of Vexis will range from 35-70 g ai/ha with a max annual use rate of 105 g ai/ha. Vexis is expected to be a Toxicity Category IV herbicide, carrying a caution or no signal word.

Initial registration is being formulated as a granule product which lends itself to less off target drift/movement. As a granular formulated product research has shown the ability to be applied to wet or dry turf. In combination with penoxulam (EH1580), excellent herbicidal activity has been observed on plant species in the Cyperacea family as well as numerous broadleaf weed species.

Planned use sites include; home lawns, golf courses, sports turf, sod farms and industrial turf. Vexis is currently in for federal registration and is not for sale.
RESPONSE OF WILDFLOWER SPP. TO POSTEMERGENCE HERBICIDES. G. Henry*1, K. Tucker1, R. Shilling1, J. McCurdy2, M.P. Richard2; 1University of Georgia, Athens, GA, 2Mississippi State University, Starkville, MS (78)

ABSTRACT

The increasing inclusion of wildflowers in urban ecosystems has led to a need for information on postemergence weed control, particularly of broadleaf weeds and sedges. Greenhouse experiments were conducted at the University of Georgia during the summer of 2017. The trial was arranged in a 9 x 7 factorial (9 wildflower species x 7 herbicide treatments) within a randomized complete block design with five replications of treatments. Pots were filled with a soilless potting media. Seed of each wildflower species was evenly distributed over the surface of individual pots. Wildflower species included wild sunflower (WS) (*Helianthus annuus*), California poppy (CP) (*Eschscholzia californica* Cham.), Indian blanket (IB) (*Gaillardia pulchella* Foug.), purple prairie clover (PPC) (*Dalea purpurea* Vent.), purple coneflower (PCF) (*Echinacea purpurea* (L.) Moench), tall blue cornflower (TBC) (*Centaurea cyanus* L.), lance leaf coreopsis (LLC) (*Coreopsis lanceolate* L.), partridge pea (PP) (*Chamaecrista fasciculate* (Michx.) Greene), and plains coreopsis (PC) (*Coreopsis tinctoria* Nutt.). Plants were grown in the greenhouse under day/night temperatures of 29/24 °C throughout the duration of the experiment. Wildflowers were allowed to grow for 4 to 6 weeks before herbicide application. This timing was determined to simulate a postemergence application when wildflowers are mature enough to potentially withstand herbicide applications, yet short enough for herbicides to come into contact with weeds growing within or below the wildflower canopy. Herbicide treatments consisted of fluazifop (Fusilade II) at 0.28 kg ai ha⁻¹, mesotrione (Tenacity) at 0.14 kg ai ha⁻¹, clopyralid (Lontrel) at 0.29 kg ai ha⁻¹, bentazon (Basagran) at 0.56 kg ai ha⁻¹, halosulfuron (Sedgehammer) at 0.053 kg ai ha⁻¹, and imazaquin (Image) at 0.42 kg ai ha⁻¹. A non-treated check was included for comparison. Herbicide treatments were applied using a CO₂ powered sprayer calibrated to deliver 375 L ha⁻¹ at 221 kPa. Visual ratings of % wildflower phytotoxicity were recorded 3 weeks after treatment (WAT) on a scale of 0% (no phytotoxicity) to 100% (complete plant death). Plants were destructively harvested 3 WAT and above-ground biomass (fresh weight) was determined. Fresh weights of treated plants were compared to untreated plants in order to determine % biomass reduction. All wildflowers were tolerant of fluazifop applications (≤ 14% phytotoxicity, ≤ 3% biomass reduction) 3 WAT. Halosulfuron applications caused 84, 37, and 19% phytotoxicity 3 WAT in LLC, WS, and PCF, respectively. This resulted in biomass reductions of 88, 17, and 41%, respectively. Imazaquin applications caused 95, 29, 19, and 9% phytotoxicity 3 WAT in LLC, WS, PCF, and IB, respectively. This resulted in biomass reductions of 94, 16, 46, and 22%, respectively. Basagran caused minimal phytotoxicity, but did result in moderate growth reduction among several wildflower spp. Although % phytotoxicity was ≤ 26%, regardless of wildflower spp., growth was reduced 47, 43, 40, 33, and 28% in PCF, TBC, LLC, PC, and WS, respectively, 3 WAT. The greatest amount of phytotoxicity and growth reduction was observed in response to clopyralid and mesotrione 3 WAT. All wildflower spp. except CP resulted in 42 to 95% phytotoxicity and 44 to 92% growth reduction 3 WAT. Mesotrione caused 27 to 51% phytotoxicity in PCF, PPC, WS, and LLC 3 WAT; however, growth reduction of 21 to 72% was observed in IB, PC, PP, PCF, WS, LLC, and PPC. Further research examining the response of these wildflower spp. in the field is warranted to better understand responses to postemergence herbicides.
TARGETING POSTEMERGENCE DALLISGRASS CONTROL IN THE FALL USING COOLING DEGREE DAYS. G. Henry*1, W. Bowling1, K. Tucker1, J.T. Brosnan2, G. Breeden2; 1University of Georgia, Athens, GA, 2University of Tennessee, Knoxville, TN (79)

ABSTRACT

Field experiments were conducted at Pine Hills Golf Course in Winder, GA during 2016 and 2017. Research was conducted on a common bermudagrass [Cynodon dactylon (L.) Pers.] (3.8 cm) rough with a mature dallisgrass infestation. Plots (1.5 x 1.5 m) contained approximately 75% dallisgrass cover. Treatments were arranged in a 4 x 3 factorial (4 herbicides and 3 rates) within a randomized complete block design with 4 replications. Herbicide treatments were initiated on September 23, 2016 (5 to 125 CDD22C) and consisted of Drive XLR8 (quinclorac) at 1.5, 2.3, and 3.0 kg ai ha⁻¹; MSMA (monosodium methanearsonate) at 6.1, 9.1, and 12.1 kg ai ha⁻¹; Roundup PRO (glyphosate) at 5, 7.6, and 10.1 kg ai ha⁻¹; and Tribute Total (thiencarbazone + foramsulfuron + halosulfuron) at 0.14, 0.18, and 0.22 kg ai ha⁻¹. Methylated seed oil at 0.5% v/v was added to all Drive XLR8 and Tribute Total treatments. An untreated check was included for comparison. Herbicides were applied with a CO₂ powered backpack sprayer calibrated to deliver 843 L ha⁻¹ at 221 kPa. Visual ratings of % dallisgrass cover were recorded at 0, 4, 21, and 36 weeks after initial treatment (WAIT) and converted to percent control by comparing back to % cover at trial initiation (0 WAIT). Initial dallisgrass control (4 WAIT) was greatest in response to Roundup PRO (100%), regardless of rate. Control with MSMA was 74 to 86%, regardless of rate, followed by (fb) Drive XLR8 (45 to 63%) and Tribute Total (25 to 47%) 4 WAIT. Control 21 WAIT was greatest in response to Roundup PRO (100%). All other treatments resulted in dallisgrass control of 85 to 95%, regardless of herbicide or rate 21 WAIT. Long-term dallisgrass control (36 WAIT) was greatest in response to Roundup PRO (≥ 97%), regardless of rate. All other treatments resulted in ≤ 31% dallisgrass control regardless of herbicide or rate 36 WAIT. Targeting herbicide applications based on cooling degree days may only be effective (≥ 97% dallisgrass control) with glyphosate. However, bermudagrass survival was minimal the following summer in response to fall glyphosate applications. Further research needs to examine the timing of bermudagrass dormancy in order to negate the non-selective behavior of glyphosate. Monitoring CO₂ efflux of dallisgrass and bermudagrass during fall may help to establish acclimation differences and aid in dormancy determination.
CROP AND WEED RESPONSE TO S-METOLACHLOR IN FLUE-CURED TOBACCO.
M. Inman*, A.M. Clapp, M. Vann; North Carolina State University, Raleigh, NC (80)

ABSTRACT

The implementation of a comprehensive weed management program in tobacco is a necessity in order to produce optimum leaf yield and quality. Presently, only seven herbicides are currently labeled for use in flue-cured tobacco. Sulfentrazone is the primary herbicide in controlling Palmer amaranth in tobacco production. With the current risk of PPO-resistant Palmer amaranth, additional chemical control options are needed. Currently, S-metolachlor has been successful in providing residual preemergence control of Palmer amaranth in a variety of agronomic and vegetable crops.

Two separate field experiments were established in 2017 to evaluate flue-cured tobacco response to S-metolachlor and to investigate how best S-metolachlor will fit in a tobacco weed management program. The objectives of these studies are to evaluate crop response and weed control using S-metolachlor with various application methods and rates, compare established herbicide programs with and without S-metolachlor, and generate efficacy and pesticide residue data that will support a federal label for US tobacco production.

The first study was located at the Border Belt Research Station in Whiteville, North Carolina and two on-farm locations in Guilford and Wayne counties in North Carolina. Treatments consisted of S-metolachlor alone at two rates (1,069 and 2,138 g ai ha⁻¹) both pre-plant incorporated (PPI) and pre-transplant (PRE-T) as well as S-metolachlor plus sulfentrazone (1,069 + 175 g ai ha⁻¹) PRE-T. A non-treated control was also included. The second study was located at two on-farm locations in Guilford and Wayne counties in North Carolina; separate from the first study. Treatments included S-metolachlor alone (1,069 g ai ha⁻¹), S-metolachlor (1,069 g ai ha⁻¹) plus sulfentrazone (175 g ai ha⁻¹), S-metolachlor (1,069 g ai ha⁻¹) plus clomazone (840 g ai ha⁻¹), S-metolachlor (1,069 g ai ha⁻¹) plus pendimethalin (798 g ai ha⁻¹), S-metolachlor (1,069 g ai ha⁻¹) plus sulfentrazone (175 g ai ha⁻¹) plus clomazone (840 g ai ha⁻¹), sulfentrazone (175 g ai ha⁻¹) plus clomazone (840 g ai ha⁻¹), sulfentrazone (175 g ai ha⁻¹) plus clomazone (840 g ai ha⁻¹) followed by S-metolachlor (1,069 g ai ha⁻¹) post directed at lay-by, sulfentrazone (175 g ai ha⁻¹) plus clomazone (840 g ai ha⁻¹) followed by pendimethalin (798 g ai ha⁻¹)post directed at lay-by, pendimethalin (798 g ai ha⁻¹) alone, and S-metolachlor (1,069 g ai ha⁻¹) postemergence over-the-top 7 days after transplanting. All pre-plant herbicide applications were applied PPI.

Percent visual injury and weed control estimates were recorded throughout the season on a scale from 0 to 100. Plant heights were also recorded 6 weeks after transplanting (WAT). Experimental design was a randomized complete block design with three or four replications (depending on location). Plot sizes were 4 rows (spacing varied by location) by 15 meters. Herbicides were applied with a backpack sprayer calibrated to deliver 187 L ha⁻¹ of spray solution. Weights of cured leaf from each plot were recorded for each harvest position. Quality and value from cured leaf was calculated based on USDA grading scale. Leaf chemistry is currently being evaluated. Data were subjected to analysis of variance (ANOVA) and means separated using Fisher’s Protected LSD (p ≤ 0.05). Other than herbicide treatments, tobacco was grown according to North Carolina Cooperative Extension recommendations.
In the first study, at the Border Belt location, severe stunting was observed when S-metolachlor was applied PPI; plant heights 6WAT were reduced 37 to 51% compared to the non-treated check. Slight stunting and reduced plant growth (22% or less) 6WAT was observed with PRE-T applications of S-metolachlor compared to non-treated check. Other than the 2X PPI application, no difference in yield or value was noted for all treatments despite early season injury. At the Guilford and Wayne locations, no difference was observed for visual injury, yield, quality, and value across all treatments.

Results from the second study show minor differences across treatments in weed control compared to a grower’s standard. S-metolachlor alone may not provide enough control compared to tank-mix of labeled materials. No differences observed in yield, quality, or value across treatments. Also, no injury was observed with any treatment.
PREEMERGENCE AND POSTEMERGENCE CONTROL OF PPO-RESISTANT PALMER AMARANTH IN ROUNDUP READY 2 XTEND SOYBEAN. M. Houston*1, T. Barber2, J. Norsworthy1, H.D. Bowman3; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas, Lonoke, AR, 3University of Arkansas, Fayettevilla, AR (81)

ABSTRACT

With nearly three and a half million acres of soybeans planted in Arkansas each year, proper weed management is important to keep competitive yields. Since the introduction of Roundup Ready soybean, growers have heavily relied on protoporphyrinogen oxidase inhibiting (PPO) herbicides or group 14 herbicides for difficult to control weeds such as morningglory. After glyphosate resistant-Palmer amaranth was identified in the mid-2000s, reliance on PPO-inhibiting herbicides increased drastically thus creating heavy selection pressure on Palmer amaranth with in most cases a single site of action (SOA). Since then multiple Amaranthus species including Palmer amaranth have been identified as PPO-resistant, with PPO-resistant Palmer amaranth being located in most Midsouth states including Arkansas in 2016. On-Farm field trials in Marion and Crawfordsville, AR in 2016 were conducted to assess numerous preemergence (PRE) herbicides and their ability to control PPO-resistant Palmer amaranth. The objective of these trials was to determine the effectiveness of PPO herbicides and combinations when applied PRE in plots infested with PPO-resistant Palmer amaranth. Roundup Ready 2 Xtend soybean was planted in 4 row plots and dicamba was applied postemergence (POST) in all treatments to determine effectiveness on PPO-resistant populations. Plots were arranged as a randomized complete block and herbicide treatments were applied with a tractor mounted sprayer calibrated to deliver 12 gallons per acre. Treatments that included single PPO-inhibiting herbicides such as flumioxazin + chlorimuron or treatment sulfentrazone + cloransulam had control ratings that were less than 70% at 21 days after treatment (DAT). Treatments that lacked multiple SOA also had reduced control ratings such as metolachlor or metribuzin. PRE treatments that provided higher than 80% control included mixtures with more than one effective mode of action. Saflufenacil + dimethenamid-P + pyroxasulfone + metribuzin, flumioxazin + pyroxasulfone, or pyroxasulfone + metribuzin all utilized multiple SOA and provided the longest residual control of PPO-resistant Palmer amaranth. Applications of dicamba were made at 28 days following planting. Some improvement in Palmer amaranth control was noted following application of dicamba (.56 kg ai ha⁻¹), POST however, dicamba treatments did not provide complete control of PPO-resistant Palmer amaranth, especially in plots where PRE herbicides were less effective. Recommendations include PRE programs including some combination or metribuzin and pyroxasulfone, with POST applications of Dicamba being made no later than 21 days after planting.
INFLUENCE OF A CEREAL RYE COVER CROP AND CONSERVATION TILLAGE ON THE CRITICAL WEED FREE PERIOD IN COTTON. A. Price*, 1N.E. Korres2, J. Norsworthy3; 1USDA-ARS, Auburn, AL, 2University of Arkansas, Fayetteville, AR, 3University of Arkansas, Fayetteville, AR (82)

ABSTRACT

In the Southeast and Mid-South U.S., morningglory spp., pigweeds including glyphosate-resistant Palmer amaranth, sicklepod, crabgrass spp., goosegrass, and nutsedge spp. among others, are the major troublesome cotton weeds. Widespread glyphosate resistant horseweed and Palmer amaranth in the southeastern and mid-South United States has reemphasized the need for alternate herbicide resistant weed control strategies, especially in conservation systems. A field experiment was conducted in 2010 through 2012, to evaluate the critical period of weed control (CPWC) in cotton as affected by tillage and cereal rye cover crop. The management systems included conventional tillage with no cover crop, conservation tillage with winter fallow, and conservation tillage with a cereal rye cover crop managed for maximum biomass. Relative yield was regressed as a function of the two constituents of the CPWC: the critical timing for weed removal and critical weed free period. The presence of rye cover crop was removed CPWC onwards for about a week compared to fallow treatment in 2010. However, the presence of the rye cover crop compared with fallow treatment showed no differences in 2012, although the CPWC could be slightly delayed later in the growing season under the presence of rye.
BARNYARDGRASS CONTROL WITH GLYPHOSATE-BASED HERBICIDE MIXTURES. H.M. Edwards*1, T.L. Sanders2, B. Lawrence1, J. Peeples Jr.3, N.G. Corban2, J. Bond4, 1Mississippi State University, Stoneville, MS, 2Mississippi State University, Greenville, MS, 3Delta Research and Extension Center, Stoneville, MS, 4Delta Research and Extension Center, Stoneville, MS (83)

ABSTRACT

Barnyardgrass [Echinochloa crus-galli (L.) Beauv.] is one of the more problematic weeds in southern U.S. soybean production. Barnyardgrass is the most common and troublesome weed of rice in Mississippi, and populations of barnyardgrass in the state have evolved resistance to photosystem II inhibitors, synthetic auxins, acetolactate synthase inhibitors, and/or acetyl CoA carboxylase inhibitors. Glyphosate is included with all PRE treatments in rice to control emerged barnyardgrass. Suspected glyphosate-resistant barnyardgrass samples have been evaluated in Mississippi, but none have tested positive for resistance. However, complaints about the level of barnyardgrass control with glyphosate-based herbicide mixtures are common in Mississippi. Research was conducted to evaluate barnyardgrass control with herbicide mixtures containing different rates of glyphosate and applied at different application timings.

The experiment was conducted in 2017 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, at a site containing a natural barnyardgrass population. The soil texture was a Sharkey clay with a pH of 7.5 and 2.4% organic matter. Individual plots were 6.67 feet wide and measured 15 feet in length. Treatments were arranged in a three-factor factorial within a randomized complete block design with four replications. Factor A was application timing and included an early application to barnyardgrass that was 3 inches in height and a late application to barnyardgrass that was 12 inches in height. Factor B was glyphosate rates of 0, 0.77, and 1.16 lb ae/A. Factor C was herbicide mixture and consisted of no mixture, 2,4-D amine at 1 lb ae/A, dicamba at 0.5 lb ae/A, fomesafen at 0.35 lb ai/A, saflufenacil plus clomazone at 0.045 plus 0.5 lb ai/A, and saflufenacil at 0.045 lb/A. The glyphosate formulation utilized was packaged with a surfactant, so no additional adjuvants were included. Treatments were applied with a CO2-propelled backpack sprayer and hand-held boom equipped with flat-fan nozzles and set to deliver 15 gallons per acre. Barnyardgrass control was visually estimated at 7, 14, and 21 days after treatment (DAT). All data were subjected to ANOVA and estimates of the least square means were used for mean separation at p ≤ 0.05.

Barnyardgrass control 7 DAT was greatest with glyphosate alone (0.77 and 1.16 lb/A) or glyphosate at 1.16 lb/A plus 2,4-D amine or saflufenacil applied at the early application timing. For applications at the late timing, increasing glyphosate rate increased barnyardgrass control with glyphosate plus dicamba or fomesafen. For all application timing and glyphosate rate combinations, the addition of fomesafen to glyphosate reduced barnyardgrass control 7 DAT compared with glyphosate alone. Pooled across glyphosate rates, barnyardgrass control 14 DAT was reduced following the early application timing with all herbicide mixtures compared with no mixture. Following the late application timing, fomesafen and saflufenacil plus clomazone reduced barnyardgrass control 9 to 15% compared with the treatment containing no mixture. With the exception of 2,4-D amine mixed with the highest glyphosate rate, the addition of any herbicide to glyphosate reduced barnyardgrass control 14 DAT compared with glyphosate alone.
Pooled across glyphosate rate and herbicide mixture, barnyardgrass control 21 DAT was greater with applications at the early vs. the late application timing. Pooled across application timings, barnyardgrass control 21 DAT increased when glyphosate rate was increased from 0.77 to 1.16 lb/A for mixtures with 2,4-D amine, fomesafen, and saflufenacil plus clomazone. Reductions in barnyardgrass control 21 DAT with the addition of a herbicide mixture to glyphosate was only observed when saflufenacil plus clomazone was added to glyphosate at 0.77 lb/A and when fomesafen was added to glyphosate at 0.77 and 1.16 lb/A.

Across the different evaluations, barnyardgrass control varied with different combinations of application timings, glyphosate rates, and herbicide mixtures. At all evaluations, and for each combination of application timing and glyphosate rate, the addition of fomesafen reduced barnyardgrass control compared with glyphosate alone. Because of the inconsistencies in barnyardgrass control, glyphosate-based herbicide treatments should include glyphosate at 1.16 lb/A with applications to barnyardgrass ≤ 3 inches. Additionally, mixtures of glyphosate with fomesafen should be avoided where the primary target is barnyardgrass.
WEED SEED RETENTION IN ARKANSAS SOYBEAN. N.E. Korres*1, J. Norsworthy2, L.M. Lazaro3, M. Zaccaro2, H.E. Wright2, C. Brabham2, V. Varanasi2, M. Fogleman2, M.H. Moore2, Z.D. Lancaster2; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas, Fayetteville, AR, 3Louisiana State University AgCenter, Baton Rouge, LA (84)

ABSTRACT

Managing herbicide-resistant weeds imposes a significant constraint on Midsouth cropping systems including soybean. Alternatives to chemical use involves prevention tactics such as harvest weed seed control (HWSC). Seed collection during harvest is feasible only if weeds retain the seeds at harvesting, hence seeds can be collected by the harvester; if seeds are shed before harvesting these tactics will be ineffective in depleting the soil seedbank. Hence, knowledge of weed seed retention is a valuable information for prevention weed control management. A complete randomized block design with four replications was conducted during 2016 and 2017 at Fayetteville, AR in wide-row soybean planted at 260,000 seeds per ha\(^1\), to investigate the behavior of seed shattering of seven weed species before and after soybean maturity. Weed species investigated include Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), sicklepod (*Senna obtusifolia*), barnyardgrass (*Echinochloa crus-galli*), prickly sida (*Sida spinosa*), common cocklebur (*Xanthium strumarium*), and hemp sesbania (*Sesbania herbacea*). Upon flowering initiation, four PVC trays (55.5 x 25.5 x 5.5 cm) with holes covered with landscape fabric were placed at the base of the plant for shattered seed collection on a weekly basis until harvesting. Prickly sida followed by barnyardgrass and to a lesser extent by common cocklebur were the more prone species to seed shattering. Barnyardgrass initiated seed shattering two months before harvesting, approximately a month earlier than the most of other species investigated. Higher seed shattering occurred between 250 and 3400 growing degree days or 35 days before harvesting onwards. The outcome of this research suggests that HWSC tactics are not suitable for barnyardgrass and prickly sida due to early seed shattering although their integration to weed management strategies can be effective in seedbank depletion for the majority of broadleaf species investigated.
PHENOTYPING WEEDY RICE (ORYZA SATIVA) FOR THE DISCOVERY OF HEAT TOLERANCE. S. Stallworth*, T. Tseng; Mississippi State University, Mississippi State, MS (85)

ABSTRACT

Approximately 250,000 acres of rice is planted in the Mississippi Delta area each year contributing more than $130 million to the state’s economy. While favorable for rice, the climate has also given rise to a number of competitive weeds such as weedy rice (WR). WR is a noxious weed with increased competition to cultivated rice in areas of plant height, shatter sensitivity, and panicle length while also proving to withstand extreme climatic conditions. Heat stress tolerant WR could possibly be a source of genetic material for the development of heat stress tolerant rice cultivars. Fifty-four WR accessions were pre-germinated for approximately 3-5 days on filter paper with two positive controls provided by the Mississippi Delta Research Station (DREC), before being subjected to heat stress (37°C) inside growth chambers. Plant height was recorded every 7 days for 28 days and vegetative biomass was recorded at the end of 28 days. Results show that nine WR accessions demonstrated 48% increase in height and produced 0.23 g of biomass than the heat-tolerant rice breeding lines provided by DREC. These heat tolerant WR accessions can potentially serve as a valuable genetic resource for rice improvement that can be achieved through conventional or marker-assisted breeding.
EFFECTS OF SOIL TEXTURE ON COTTON RESPONSE TO PREEMERGENCE APPLICATIONS OF OUTLOOK HERBICIDE. W. Keeling*1, C.D. White2, P.A. Dotray3, K.R. Russell4; 1Texas A&M AgriLife Research, Lubbock, TX, 2Texas A&M Agrilife Research, Lubbock, TX, 3Texas Tech University, Texas A&M AgriLife Research and Extension Service, Lubbock, TX, 4Texas Tech University, Lubbock, TX (86)

ABSTRACT

The increasing problems with glyphosate-resistant Palmer amaranth (Amaranthus palmeri) have renewed interest in preemergence (PRE) herbicides as part of an overall weed management system. Concerns about crop response to PRE applications exist, especially on coarse-textured soils. Outlook (dimethenamid-P) herbicide is now registered for postemergence (POST) applications in cotton. Field studies were conducted in 2017 to evaluate PRE use of Outlook in cotton under weed-free conditions. The objective of these studies was to determine cotton response to Outlook herbicide applied PRE at varying rates, alone or in combination with Prowl H2O at four locations in the Texas High Plains with varying soil textures and irrigation methods. The Lamesa location was an Amarillo fine sandy loam soil and irrigated by center pivot, while the Lubbock location was an Acuff loam soil and furrow irrigated. Both the New Deal and Halfway locations were Pullman clay loam soils and irrigated by subsurface drip and center pivot, respectively. Treatments included Warrant at 48 and 96 oz/A, Outlook at 10, 20, and 30 oz/A, and a tank-mix of Outlook + Prowl H2O at 10 + 32 oz/A. Treatments were applied at planting at a volume of 15 gallons per acre with Turbo TeeJet 11002 nozzles. At Lamesa, Outlook at rates above 10 oz/A injured cotton 20-30% (stand loss, stunting) at 21 days after planting (DAP). This injury declined as the season progressed, but was still evident at 42 DAP. At Lubbock, no treatment affected plant stand, but some stunting was observed with Outlook at 30 oz/A and Warrant at 96 oz/A (2X rate). At the New Deal and Halfway locations, no stand loss or visual injury was observed with any rate of Outlook or Warrant. Cotton lint yield was not reduced by any treatment at any location. Although injury was not seen at all locations, other trials would suggest that because of crop response concerns, Outlook can more effectively and safely be used POST in combination with glyphosate, glufosinate, or approved dicamba or 2,4-D formulations.
2,4-D AND DICAMBA RESIDUE RETENTION IN COMMERCIAL SPRAYERS FOLLOWING FOUR TANK CLEANING METHODS. F.B. Browne*, S. Li, K.J. Price; Auburn University, Auburn, AL (87)

ABSTRACT

Commercial release of 2,4-D and dicamba-tolerant crops has led to increasing concerns of tank contamination causing non-target exposure of sensitive crops to harmful herbicide residues. To test retention of 2,4-D and dicamba in commercial sprayers following common tank cleaning procedures, field and laboratory experiments were conducted in 2017. Hagie STS 10, John Deere 6700, and SpraCoupe 4660 with tank capacities of 3570 L, 1590 L, and 1580 L respectively, were used to apply 2,4-D at 1.06 kg ai ha⁻¹ and dicamba at 1.12 kg ai ha⁻¹. Following applications, sprayer tanks were cleaned using four triple-rinse protocols. One cleaning method was triple rinse with water and the remaining three included a first rinse of 3% v/v ammonium and third rinse of water and the second rinses were either glyphosate, Fimco, or Protank detergent at 5.11 kg ai, 0.90 kg, and 0.95 L per 378 L water, respectively. For each rinse, 378 L of water and assigned cleaning agent were added. Half of the cleaning solution was sprayed out of the tank before rinsate samples were collected from the left, middle, and right sections of the boom simultaneously for each individual rinse. A fourth rinse using only water was conducted to demonstrate the cleaning efficacy of each triple-rinse protocol. All cleaning protocols were repeated three times in field. Herbicide residues were evaluated using HPLC with a detection limit of 0.05 ppm. Higher 2,4-D and dicamba concentrations were detected in the Hagie Upfront STS 10; however, herbicide residual concentrations after the completion of any cleaning protocols tested ranged from 1-2 ppm and did not result in cotton and soybean yield loss in field bioassay after actual rinsates from last rinse were sprayed. Sprayers with large tanks may retain more herbicide residues and additional measures may be required for removal. Cleaning performance of triple rinse with water is sufficient to prevent crop injury and comparable to protocols with glyphosate and commercial cleaning agents.
Crop residue and soil moisture effects on preemergence herbicide efficacy in soybeans. P.H. Urach Ferreira*1, D.B. Reynolds2, G. Kruger3, M.T. Wesley1, J. Ferguson1; 1Mississippi State University, Mississippi State, MS, 2Mississippi State University, Mississippi State, MS, 3University of Nebraska-Lincoln, North Platte, NE (89)

ABSTRACT

Herbicide breakdown pathways in the environment is complex and can include several variables. Crop residues can negatively affect residual herbicide movement into the soil to target the weed seed bank. Rainfall is another factor that affects herbicide activity due to changes in soil moisture by affecting the availability of a herbicide for plant uptake. This study evaluated crop residue and rainfall effects on weed control with preemergence herbicides based on its physical/chemical properties like adsorption, solubility and volatility and how droplet size may impact this interaction. Greenhouse studies were conducted at the Rodney Foil Plant Science Research Center in Miss. State, MS, in December 2017. The first study compared two corn residues: 2500 and 5000 kg ha⁻¹. The second study compared three rainfall timings: 2, 4 and 8 days after application (DAA) with a 10 mm rainfall. For both studies five herbicides were used: pendimethalin, metribuzin, clomazone, imazethapyr and pyroxasulfone. Four nozzles were used to apply herbicides: XR11002, ULD12002, TTI6011002 and TTI11002 though the TTI6011002 was excluded in the rainfall timing study. A two-nozzle research track sprayer (Generation III Sprayer, DeVries Manufacturing Hollandale, MN) was used to apply herbicides at 140 L ha⁻¹ and 276 kPa. The sprayer also includes a rainfall simulator that was used to apply rainfall treatments at the 2, 4, and 8 DAA timings. Neither metribuzin nor imazethapyr resulted in weed control differences for either corn residue levels. Clomazone and pyroxasulfone had greater weed control at 2500 than at 5000 kg ha⁻¹. Pendimethalin had higher weed control at the 5000 kg ha⁻¹ corn residue treatment. No control differences by nozzle type were observed for herbicides except metribuzin where the XR11002 showed higher control (98 %) than the TTI11002 (89 %) for the corn residue study. Rain at 2 DAA showed increased weed control for imazethapyr, pyroxasulfone and metribuzin when compared to rain at 8 DAA. No significant weed control differences were observed across rain periods for clomazone and pendimethalin. No nozzle effect by herbicide interaction for weed control was observed for all herbicides at all rainfall periods.
RICE CULTIVAR TOLERANCE TO FLORPYRAUXIFEN-BENZYL. N.G. Corban*1, J. Bond2, B. Golden2, T.L. Sanders1, B. Lawrence3, H.M. Edwards3; 1Mississippi State University, Greenville, MS, 2Delta Research and Extension Center, Stoneville, MS, 3Mississippi State University, Stoneville, MS (90)

ABSTRACT

Florpyrauxifen-benzyl, which is a new postemergence rice (Oryza sativa L.) herbicide developed by Dow Agrosciences, LLC, received registration in late 2017. It will be sold under the tradename Loyant™ with Rinskor™ and will offer a new herbicide mode of action for control of herbicide-resistant weeds in rice. The inconsistent response of rice cultivars to herbicides can be an issue for producers. An understanding of rice cultivar tolerance to florpyrauxifen-benzyl is essential for integrating this herbicide into southern U.S. rice production. Therefore, research was conducted to characterize the response of commercial rice cultivars to sequential POST applications of florpyrauxifen-benzyl applied at different rates.

The study was conducted from 2015 through 2017 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS. Treatments were arranged as a two-factor factorial within a randomized complete block experimental design with four replications. Factor A was rice cultivar and included ‘Caffey’, ‘CL151’, ‘CL163’, ‘CLXL745’, ‘Jupiter’, ‘Rex’. Factor B was florpyrauxifen-benzyl treatment and consisted of florpyrauxifen-benzyl at 0.026 and 0.053 lb ai/A applied to rice in the two- to three-leaf (EPOST) followed by four-leaf to one-tiller (LPOST) growth stages. A nontreated control was included for each cultivar. Visual estimates of rice injury were recorded at 7, 14, and 28 d after the LPOST application. The number of days to 50% heading was recorded as an estimate of rice maturity. Plant heights and rough rice yields were collected at maturity. Height and rough rice yield data were converted to a percent of the control for the respective cultivar in each replication. All data were subjected to ANOVA and estimates of the least square means were used for mean separation at α=0.05.

For all rice cultivars except CLXL745, injury 14 and 28 d after the LPOST application was similar with florpyrauxifen-benzyl at 0.026 and 0.053 lb/A. Injury to CLXL745 was 12 and 7% greater 14 and 28 d after LPOST application, respectively, when the florpyrauxifen-benzyl rate was increased from 0.026 to 0.053 lb/A. The higher application rate injured CL163 and CLXL745 more than other cultivars 14 and 28 d after the LPOST application.

Rice maturity, determined by the number of days to 50% heading, was delayed 2 to 3 d for CL151, CL163, and CLXL745 when the florpyrauxifen-benzyl rate was increased from 0.026 to 0.053 lb/A. Following applications of florpyrauxifen-benzyl at 0.026 lb/A, maturity was delayed for CL163 and CLXL745 compared with other cultivars. Maturity was delayed more for CL151, CL163, and CLXL745 than for Caffey, Jupiter, and Rex following applications of the higher florpyrauxifen-benzyl rate. Florpyrauxifen-benzyl application rate did not influence mature rice height. Pooled across florpyrauxifen-benzyl application rates, mature height was lower for Caffey and Rex than for CL151, CLXL745, and Jupiter. Additionally, CL163 mature height was greater than that for Caffey.
Pooled over rice cultivar, rough rice yield was reduced 6% following sequential applications of florpyrauxifen-benzyl at 0.053 compared with 0.026 lb/A. Rough rice yields for CL163 and CLXL745 were lower than for Caffey, CL151, Jupiter, and Rex regardless of florpyrauxifen-benzyl application rate. Although it was 96% of the nontreated control, rough rice yield of Rex was reduced compared with CL151 and Jupiter.

Current labeling only allows florpyrauxifen-benzyl to be applied at 0.026 lb/A. However, in commercial fields, variability in growth stages and irregularities in florpyrauxifen-benzyl application may occur that would make application rates exceed that specified on the label under some commercial field situations. Therefore, applications of florpyrauxifen-benzyl to CL163 and CLXL745 should be avoided, and caution should be exercised with applications to Rex.
QUANTIFYING NOZZLE COVERAGE USING ARTIFICIAL COLLECTORS FOR APPROVED NOZZLES IN THE ENGENIATM, ENLISTTM, AND XTENDIMAXTM SYSTEMS. M.T. Wesley*, P.H. Urach Ferreira, J. Ferguson; Mississippi State University, MS State, MS (91)

ABSTRACT

New dicamba and 2,4-D herbicides have created a greater level of interest in ensuring that these products are applied effectively. To use these products, websites have been implemented which show the most up-to-date adjuvant and herbicide tank-mix partners as well as the nozzles and pressures labeled for use with these herbicides. Selecting a nozzle at a pressure within the range is not difficult, but offering sound advice to the best of these combinations is less well-known. A study was conducted at the Rodney Foil Plant Science Research Center in Miss. State, MS to measure coverage produced by nozzles labeled for use with new dicamba and 2,4-D herbicides. Seven nozzles (ID 11003, ID 11004, TDXL-D 11003, TDXL-D 11004, TTI 11003, TTI 11004, and ULD 12004) which are labeled for use with at least two of the herbicides were applied at two of three application volumes (140, 187, 281 L ha⁻¹) at pressures of 207 and 276 kPa. The 03 nozzles were applied at 140 and 187 L ha⁻¹, and the 04 nozzles were applied at 187 and 281 L ha⁻¹. Treatments were applied using a two-nozzle research track sprayer (Generation III Sprayer, DeVries Manufacturing, Hollandale, MN). The 281 L ha⁻¹ application volume was included as the sprayer’s maximum travel speed is 10 km h⁻¹ which makes it unable to apply 04 nozzles at 140 L ha⁻¹, the recommended application volume for applying the new dicamba and 2,4-D products. The spray solution was comprised of water plus a 0.4 g L⁻¹ addition of Brilliant Blue dye (Flavors and Colors.com, Diamond Bar, CA). Applications were made to 5 by 7.5 cm Kromekote cards, a specialty type of photo paper that stains when droplets impact its surface. Percent coverage was measured using Image J for each card. Card coverage for each application volume was analyzed using PROC GLIMMIX in SAS 9.4 with means separations at α = 0.05. Nozzle and pressure were both significant (P < 0.001) for all 03 and 04 nozzles, where the higher pressure increased coverage at each of the three application volumes. Volume was significant for the 04 nozzles, which demonstrates that application volumes above 187 L ha⁻¹ would improve coverage even with a TTI, the largest droplet size producing nozzle labeled for use with all of these herbicides. Nozzle selection plays a crucial role in improving coverage made with nozzles labeled for Xtendimax™, Engenia™, and Enlist One™ applications. Selecting a pressure towards the upper end of the allowable pressures on these herbicide labels will improve coverage and should increase efficacy of these herbicides.
COMPARISON OF GAS EXCHANGE MEASURES BETWEEN COTTON
DEVELOPED FOR GLUFOSINATE TOLERANCE AND COTTON WITH INFERRED
TOLERANCE TO GLUFOSINATE & GLUFOSINATE CO-APPLIED WITH S-
METOLACHLOR. W. Greene*1, J.A. Tredaway2, B. Greer2, J. Jones1, A. Poncet1; 1Auburn
University, Auburn, AL, 2Auburn University, Auburn University, AL (92)

ABSTRACT

A Greenhouse study was conducted at the Plant Science Research Center in Auburn, AL in 2017
to determine the effect of early-postemergence (EPOST) applications of glufosinate, when
applied alone and in combination with S-metolachlor, on cotton growth and yield. The study
consisted of three varieties of cotton including LibertyLink, WIdeStrike, and Dicamba tolerant
varieties and two nozzle types, an XR flat fan nozzle and a TTI nozzle. Herbicide applications
consisted of glufosinate applied alone at 0.6 kg ha\(^{-1}\), and in combination with S-metolachlor
applied at 1.39 kg ha\(^{-1}\). The experimental design was a randomized complete block design with a
factorial treatment arrangement with 4 replications. Treatments were applied to 4 leaf cotton, and
measurements of photosynthesis and leaf conductance were collected thereafter using a LiCor
Li-6400 portable photosynthesis device. Nozzle type had no effect on gas exchange
measurements. WideStrike cotton was more sensitive to herbicide application, however there
was no difference between the two herbicide applications. By fitting photosynthesis and leaf
conductance measurements to a polynomial model it was determined that plant recovery began
on day 3 and by seven days after application gas exchange measurements returned to normal.
PALMER AMARANTH (AMARANTHUS PALMERI) CONTROL WITH DICAMBA-BASED HERBICIDE PROGRAMS IN SOYBEANS. L. Rector*, M. Flessner, S. Beam, K. Pittman, K. Bamber; Virginia Polytechnic Institute and State University, Blacksburg, VA (93)

ABSTRACT

Increasing cases of herbicide resistance has made Palmer amaranth (Amaranthus palmeri) control in glyphosate-based systems more difficult, prompting the need for alternatives. Palmer amaranth has been shown to reduce soybean yield. Research was conducted to assess weed control in dicamba-based herbicide programs.

The trial was conducted in South Hill, Virginia as a randomized complete block design with four replications. The study consisted of 10 treatments including a non-treated check. Four treatments consisted of a PRE followed by (fb) a POST: pyroxasulfone (0.08 kg ha⁻¹) + dicamba (0.56 kg ae ha⁻¹) + glyphosate (1.27 kg ae ha⁻¹) + Induce (0.25% v v⁻¹) (DIG) fb pyroxasulfone + DIG, S-metolachlor (1.1 kg ha⁻¹) + DIG fb S-metolachlor + DIG, acetochlor (1.26 kg ha⁻¹) + DIG fb acetochlor + DIG, and dimethenamid-P (0.63 kg ha⁻¹) + DIG fb dimethenamid-P + DIG. Five treatments consisted of a POST only: pyroxasulfone + DIG, S-metolachlor + DIG, acetochlor + DIG, dicamba + glyphosate + Induce (DIG), and dimethenamid-P + DIG. Soybeans were planted on 76 cm rows in a no-tillage system. PRE treatments were applied on May 8, 2017, directly after planting. POST treatments were applied on June 8, 2017 when weeds were approximately 7.6 cm tall. Treatments were applied with a handboom at 140 L ha⁻¹. Plots were 4 rows wide by 7.6 m. Soybeans were planted on 76 cm rows. Visible weed control was evaluated on a 0 (no control) to 100% (complete necrosis) scale 17 and 31 days after PRE (DA-A) and 6, 13, and 34 days after POST (DA-B). Visible crop injury was rated on a 0 (no injury) to 100% (complete crop death) scale 13 and 34 DA-B. Palmer amaranth (Amaranthus palmeri) was the only weed rated. Data were subject to ANOVA followed by means separation using Fishers Protected LSD(0.05).

Acetochlor + DIG fb acetochlor + DIG resulted in the best control of Palmer amaranth 17 DA-A (64%) and 31 DA-A (55%). Pyroxasulfone + DIG fb pyroxasulfone + DIG, acetochlor + DIG fb acetochlor + DIG, dimethenamid-P + DIG fb dimethenamid-P + DIG, dicamba + glyphosate + Induce (DIG), and dimethenamid-P + DIG resulted in greater than 92% Palmer amaranth control 6 DA-B. Pyroxasulfone + DIG fb pyroxasulfone + DIG, acetochlor + DIG fb acetochlor + DIG, and dimethenamid-P + DIG fb dimethenamid-P + DIG resulted in greater than 93% weed control 13 DA-B. All treatments resulted in greater than 90% Palmer amaranth 34 DA-B with no differences observed among treatments. Treatments containing acetochlor resulted in 4% crop injury 13 DA-B. There was no difference in yield among all treatments. The average yield was 4100 kg ha⁻¹. Future research is needed to corroborate results across multiple locations and years.
ABSTRACT

Bermudagrass (*Cynodon dactylon*) is a prominent C4, warm-season perennial forage choice for hay production in the southeastern region of the United States. Several hybrid bermudagrass varieties are suitable for various growing conditions and are associated with high yield and animal weight gain. 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 bermudagrass hayfields in Florida is the control of perennial weedy grasses such as bahiagrass (*Paspalum notatum*), vaseygrass (*Paspalum urvillei*) and guineagrass (*Megathyrsus maximus*). The current recommendation is to only use glyphosate for spot treatment of bahiagrass in bermudagrass hayfields as glyphosate is generally considered to be non-selective. However, bermudagrass cultivars have been reported to tolerate low application rates of glyphosate, allowing for the possibility of broadcast application. ‘Coastal’ and ‘Jiggs’ are two popular cultivars for hay production in Florida, but the level of tolerance to glyphosate of these two varieties is not well understood. 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 ‘Jiggs’ bermudagrass at the Range Cattle Research and Education Center in Ona, FL in 2017. Both studies were conducted using a randomized complete block design with a factorial treatment arrangement of glyphosate rate (0, 0.32, 0.64, 0.95, and 1.25 kg ae ha⁻¹) and treatment timing (3, 7, and 14 d after clipping (DAC)). Plot size measured 3 x 9 m. 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 28, 35, and 42 DAC were utilized to evaluate forage quality. There was a significant difference in biomass in both varieties in relation to application rate and application timing. ‘Coastal’ bermudagrass was tolerant at all rates except at 1.25 kg ha⁻¹ with a 25% decrease in yield. ‘Jiggs’ bermudagrass showed tolerance up to 0.95 kg ha⁻¹. The response of application timing was different among the two varieties. Biomass of ‘Coastal’ bermudagrass was 17% lower when glyphosate was applied at 14 versus 7 DAC, whereas delaying applications of glyphosate from 3 to 7 DAC onto ‘Jiggs’ bermudagrass resulted in a 25% reduction in biomass. Delaying glyphosate application an additional 7 d (14 DAC) resulted in an additional 25% reduction in ‘Jiggs’ biomass. Our data revealed that ‘Coastal’ may be more tolerant to glyphosate than ‘Jiggs’ bermudagrass. However, the response of ‘Jiggs’ to glyphosate may have been confounded by the presence of bermudagrass stem maggot (*Atherigona reversura*) at the Ona location in 2017. Glyphosate had no negative impacts on bermudagrass forage quality in either variety. These studies will be repeated in 2018 on both varieties. Findings from this research will aid in determining proper recommendations for broadcast applications of glyphosate to help reduce weedy grass populations in bermudagrass hayfields.
SOYBEAN RESPONSE TO COMBINATIONS OF POST-APPLIED PPO-AND ALS-INHIBITING HERBICIDES. M.C. Castner*1, G.L. Priess1, J.T. Richburg1, R.C. Scott2, J. Norsworthy1; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas - Extension Service, Lonoke, AR (95)

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 g ai ha⁻¹ 3 days after planting (DAP) to provide preemergent weed control. 21 DAP both trials were exposed to low rates of dicamba from neighboring production fields, all with an unknown, but uniform rate. At 28 DAP, PPO herbicides alone and 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). Injury from dicamba was also measured 14 DAT to determine if any of the treatments influenced the presence of dicamba symptomology. Acifluorfen exhibited the greatest amount of injury from the initial treatments at 14% 7 DAT and 20% 14 DAT, but experienced 12.5% dicamba injury 14 DAT, which was significantly lower compared to other stand-alone treatments. S-metolachlor plus fomesafen was the only treatment in which dicamba symptomology was greater than injury from initial stand-alone treatments at 21%. Despite a low dose exposure from dicamba, the addition of glufosinate with PPO herbicides and PPO herbicides plus chlorimuron only demonstrated a slight significant reduction in canopy development in comparison to treatments without glufosinate.
MODELING REGULATION OF ULTRADWARF BERMUDAGRASS CLIPPING YIELD FOLLOWING TRINEXAPAC-ETHYL AND PROHEXADIONE-CALCIUM TREATMENT. D.R. Taylor*1, J.T. Brosnan1, J. Vargas2, G. Breeden1, E.H. Reasor3, W.J. Hutchens4, J.P. Kerns4, W.C. Kreuser5; 1University of Tennessee, Knoxville, TN, 2U of TN 252 Ellington Bldg, Knoxville, TN, 3Mississippi State University, Mississippi State, MS, 4North Carolina State University, Raleigh, NC, 5University of Nebraska, Lincoln, NE (96)

ABSTRACT

Ultradwarf cultivars of hybrid bermudagrass [C. dactyloides (L.) Pers. x C. transvaalensis Burtt-Davy] are frequently used on golf course putting greens throughout the southern United States. Trinexapac-ethyl (TE) and prohexadione-calcium (PH) are plant growth regulators that inhibit gibberillic acid biosynthesis in ultradwarf bermudagrass leading to reductions in clipping yield. Use of growing degree-day (GDD) models has allowed turfgrass managers to optimally apply plant growth regulators to creeping bentgrass (Agrostis stolonifera L.) putting greens to suppress clipping production; however, limited information is available regarding the optimal frequency for applying TE or PH to ultradwarf bermudagrass putting greens. Multi-state research was conducted in 2017 with the objective of modeling regulation of ultradwarf bermudagrass clipping yield in response to TE and PH treatment and GDD accumulation.

Identical field trials were conducted in Tennessee (East Tennessee AgResearch & Education Center, Knoxville, TN), Mississippi (R.R. Foil Plant Science Research Center, Starkville, MS), and North Carolina (Hope Valley Country Club, Durham, NC) on ‘MiniVerde’, ‘TifEagle’, and ‘Champion’ ultradwarf bermudagrass, respectively. Plots (1 x 3 m) were arranged in randomized complete block designs with three replications. Nitrogen was applied (10 kg ha⁻¹) every 14 days and sand topdressing was withheld during these studies. Treatments included TE (35 g ha⁻¹), PH (154 g ha⁻¹), and two non-treated controls per replication. Treatments were applied once during June, July, and August at all locations using CO₂-pressurized backpack sprayers equipped with 8002 nozzles. Separate experimental areas (with no previous PGR use history) were used for each timing at all locations. On-site weather stations at each location were used to quantify GDD accumulation using a 10 C base temperature. Accumulation was tracked after treatment application for a minimum of 800 GDD thereafter.

Plots were mowed 3 to 7 days per week at 3.1 mm using walk-behind reel mowers. Clippings were collected from each plot 3x per week from 0 to 600 GDD, then 1x per week from 600 to at least 800 GDD. Harvested clipping samples were dried in a forced air oven, cleaned via the vibrating pan method, and weighed. Daily mean clipping yields were plotted relative to GDD accumulation and fit to a four-parameter, amplitude-dampened, sinewave regression model by minimizing sums-of-squares. Models were used to calculate peak clipping yield suppression following TE or PH treatment, and the GDDs accumulated until reach peak clipping yield suppression was reached. Suggested re-application timings for optimal clipping yield suppression with TE and PH were calculated by multiplying the GDDs accumulated to reach peak clipping yield suppression by a factor of 1.3. All statistical analysis was conducted in Microsoft Excel using the solver package.
Models fit data from all locations well as standard error for relative clipping yield suppression measured $\leq 0.025 \text{ g g}^{-1}$ and $R^2$ values ranged from 0.60 to 0.89. In Tennessee and Mississippi, peak clipping yield suppression with TE (0.47 to 0.75 g g$^{-1}$) exceeded that observed with PH (0.32 to 0.64 g g$^{-1}$). The opposite response was observed in North Carolina with TE maximally suppressing clipping yield 0.49 g g$^{-1}$ compared to 0.63 g g$^{-1}$ for PH. GDDs accumulated to reach peak suppression were similar across all locations with TE requiring 144 to 166 GDD compared to 90 to 97 GDD for PH. This response suggests that optimal re-application timings to maintain consistent clipping yield suppression would be 187 to 215 GDD for TE and 117 to 126 GDD for PH. Interestingly, minimal rebound was observed after clipping yield suppression subsided. Overall, GDD accumulation can be used to model clipping yield suppression on ultradwarf bermudagrass putting greens following treatment with TE and PH.
CONTROLLING WILD GARLIC (ALLIUM VINEALE) IN MAINTAINED TURFGRASS. Z.D. Small*1, E. Begitschke2, J. McCurdy2, M.P. Richard2; 1Mississippi State University, Mississippi State, MS, 2Mississippi State University, Starkville, MS (97)

ABSTRACT

Wild garlic (Allium vineale) is a common turfgrass weed. It is a cool-season perennial that sprouts from underground bulbs late in the summer and into the early fall. Wild garlic has leaves that are cylindrical and hollow. When crushed, it releases a distinctive garlic or “alliaceous” odor. Traditional chemical control strategies include applications of auxin mimicking herbicides, such as 2,4-D, dicamba, mecoprop, quinclorac, and others. These herbicides provide only modest control of wild garlic when applied alone but are more effective when applied as combination products. Combination products vary in concentration and must be applied with caution to avoid injury to sensitive southern turf species, such as St. Augustine, centipede, and carpet grasses. Research was conducted to evaluate other potential chemical control strategies compared to those already commonly in practice.

A field study was conducted at Mississippi State University R.R. Foil Plant Science Research Center as a randomized complete block design. The study was repeated twice in time, with herbicide treatments applied 2 March, 2016 and 1 January, 2017. Treatments included: a non-treated check, Trimec Classic (2,4-D, mecoprop, dicamba; 1.5 kg ai ha⁻¹), Speedzone Southern (2,4-D, mecoprop, dicamba, carfentrazone-ethyl; 0.45 kg ai ha⁻¹), Avenue South (2,4-D, dicamba, penoxsulam, sulfentrazone; 0.45 kg ai ha⁻¹), Blindside (sulfentrazone, metsulfuron-methyl; 0.30 kg ai ha⁻¹), metsulfuron-methyl (0.021 kg ai ha⁻¹), trifloxysulfuron (0.028 kg ai ha⁻¹), imazaquin (0.56 kg ai ha⁻¹), sulfosulfuron (0.11 kg ai ha⁻¹), and halosulfuron (0.070 kg ai ha⁻¹). Herbicide treatments included a non-ionic surfactant (0.25% v v⁻¹). Herbicides were applied using a CO₂ pressurized backpack sprayer in a water carrier volume of 187 L ha⁻¹. Wild garlic control was visually evaluated three and seven weeks after treatment (WAT). All data were subject to analysis of variance (α = 0.05) within SAS procedure GLIMMIX using mixed model methodology. Means were separated based upon adjusted 95% confidence intervals, which allows for multiple comparisons by protecting family-wise error rate. A year by treatment interaction was significant for both assessment timings, thus results are presented by year. In 2016, all herbicides controlled wild garlic greater than 50% relative to the non-treated, 20 days after application (DAA). When assessed 49 DAA, all herbicides controlled wild garlic greater than 61%, with Blindside, metsulfuron, sulfosulfuron, trifloxysulfuron, and imazaquin having controlled wild garlic greater than 80%. Control was slower to manifest in 2017, with only Trimec Classic, Speedzone Southern, and Avenue South having controlled wild garlic greater than the non-treated, 20 DAA (≥68% control). However, by 49 DAA, only Blindside, metsulfuron, sulfosulfuron, trifloxysulfuron, and imazaquin controlled wild garlic greater than 80%. Despite interaction effects, trends suggest that commercial combinations of auxin-mimicking herbicides provide faster wild garlic control; however, Blindside and the ALS inhibiting herbicides metsulfuron, sulfosulfuron, trifloxysulfuron, and imazaquin, provide superior long-term control of wild garlic. Future research should evaluate mixtures of auxin-mimicking and ALS inhibiting herbicides for faster acting, long-term control of this troublesome weed.
EFFECTS OF GPA AND NOZZLE TYPE ON PPO-RESISTANT PALMER AMARANTH CONTROL WHEN USING ENGENIA®. W. Coffman*1, T. Barber2, J. Norsworthy1; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas, Lonoke, AR

ABSTRACT

Palmer amaranth’s (Amaranthus palmeri) evolution of resistance to protoporphyrinogen oxidase (PPO) inhibiting herbicides and the release of dicamba-tolerant (Xtend) crops occurred almost simultaneously. The release of Xtend varieties can potentially give growers new options to control broadleaf weeds like Palmer amaranth postemergence (POST) as a replacement for PPO-inhibiting herbicides, which have been staples in cotton and soybean weed control programs. Previous research has shown that tank-mixed combinations of the dicamba product Engenia and glyphosate more effectively control PPO-susceptible Palmer amaranth when they are applied at higher volumes and with nozzles that produce finer droplet sizes. To test the effectiveness of dicamba labeled for use in new Xtend cotton and soybean varieties on PPO-resistant Palmer amaranth, field trials were conducted on-farm in Marion, Arkansas and at the Lon Mann Cotton Research Station near Marianna, Arkansas in 2017. Treatments were arranged in a three-factor factorial, with the first being spray volume (70 L/ha or 140 L/ha), the second being nozzle type (AIXR or TTI) and the third being dicamba rate (Engenia at 0.56 or 1.12 g ae/ha). Applications were made to non-crop plots infested with 5- to 10-cm PPO-resistant Palmer amaranth. Weed control ratings and counts to assess Palmer amaranth density were collected 14 days after treatment. There were no interactions between factors, only main effect of nozzle type and spray volume for both Palmer amaranth control and density. When applications were made with AIXR nozzles, which produce coarse droplets, control levels were greater (91%) than when ultra-coarse droplets were produced by TTI nozzles (88%). A spray volume of 140 L/ha provided 92% control of PPO-resistant Palmer amaranth, which was significantly greater than the 87% control by a spray volume of 70 L/ha. If physical drift of dicamba could be minimized, AIXR nozzles and spray volumes of 140 L/ha would offer greater control of PPO-resistant Palmer amaranth.
IMPACT OF MOWING FREQUENCY AND TIMING ON GREEN ANTELOPEHORN MILKWEED (ASCLEPIAS VIRIDIS) POPULATIONS. N. Thorne*1, J. Byrd2, D. Russell2; 1Mississippi State University, Mississippi State University, MS, 2Mississippi State University, Mississippi State, MS (99)

ABSTRACT

Timing and frequency of mowing green antelopehorn (Asclepias viridis) was evaluated at two locations between May and August, 2017. Treatments were arranged in a randomized complete block design with 4 replications at two locations near Starkville, MS. The number of green antelopehorn stems were counted prior to and 1 MAT to determine the impact of treatments. Variance in data was analyzed and means separated by Fisher’s LSD (α=0.05). One MAT the number of green antelopehorn plants increased in plots mowed in May or June compared to those mowed later in the year. Although the number of green antelopehorn plants increased in plots mowed in May and June 1 MAT compared to later mowing treatments, these were no different than the nonmowed treatment. The majority of green antelopehorn milkweed populations produced mature seed pods and senesced by August. Plots will be evaluated May 2018 to determine the impact of mowing the year after treatment.
EVALUATION OF WEED CONTROL PROGRAMS USING XTENDFLEX TECHNOLOGY. B. Wilson*, D. Dodds, A. Mills; 1Mississippi State, Mississippi State, MS, 2Mississippi State University, Mississippi State, MS, 3Monsanto Company, Collierville, TN

ABSTRACT

Roundup Ready cotton was introduced in 1997 by Monsanto Company which allowed POST application of glyphosate to be made over the top of cotton. Monsanto Company released XtendFlex™ varieties for commercial production in 2015. XtendFlex™ cotton cultivars are tolerant to glyphosate, glufosinate, and dicamba. Insertion of the Bialaphos resistance (BAR) gene confers tolerance to glufosinate, and insertion of the dicamba monoxygenase gene confers tolerance to dicamba in XtendFlex™ cotton. Mississippi cotton growers planted over 70% of cotton hectares with XtendFlex™ in 2017. Due to the popularity of this technology, a study was conducted to evaluate weed control programs using XtendFlex™ technology.

The experiment was conducted in 2017 at Hood Farms in Dundee, MS to evaluate the efficacy of weed control options using XtendFlex™ technology. Deltapine 1646 B2XF was planted on 10 May 2017 in 4 row plots that were 3.9 meters wide x 12.2 meters in length. Application of fluometuron (Cotoran® 4L) at 1.1 kg ai ha⁻¹ was made PRE application, followed by POST applications of dicamba (Xtendimax® with VaporGrip®) at 0.56 kg ae ha⁻¹, glufosinate (Liberty® 280 SL) at 0.88 kg ai ha⁻¹ plus glyphosate (Roundup PowerMAX®) at 1.3 kg ae ha⁻¹, acetochlor (Warrant®) at 1.3 kg ai ha⁻¹, and S-metolachlor (Dual MAGNUM®) at 1.1 kg ai ha⁻¹. Layby applications included glyphosate (Roundup PowerMAX®) at 1.3 kg ae ha⁻¹ plus diuron (Direx® 4L) at 0.84 kg ai ha⁻¹. Visual Palmer amaranth control and visual cotton injury ratings were taken 3, 7, and 14, days after application. Data were subjected to analysis of variance using PROC Glimmix procedure in SAS 9.4 and means were separated using Fisher’s protected LSD at p = 0.05.

The greatest visual Palmer amaranth control 14 days after initial POST application was from dicamba + glyphosate (97.3%). The treatment with the lowest visual Palmer amaranth control 14 days after initial POST application was glufosinate + glyphosate (87%). Visual cotton injury 14 days after initial POST application was greatest when dicamba + glyphosate + acetochlor (8%) was applied. The lowest visual cotton injury 14 days after initial POST application contained dicamba + glyphosate (2%). The overall greatest Palmer amaranth control 14 days after layby application occurred from treatments that received dicamba + glyphosate followed by (fb) dicamba + glyphosate; dicamba + glyphosate fb glufosinate + glyphosate; and dicamba + glyphosate + acetochlor fb glufosinate + glyphosate, regardless of receiving a layby application. The lowest visual Palmer amaranth control 14 days after layby application was observed with glufosinate + glyphosate fb glufosinate + glyphosate without a layby application.
COMPARISON OF FLORPYRAUXIFEN-BENZYL- AND 2,4-D-CONTAINING LEVEE WEED CONTROL PROGRAMS IN RICE. H.E. Wright*1, J. Norsworthy1, Z.D. Lancaster1, M. Fogleman1, C. Meyer1, R.C. Scott2, J. Ellis3; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas - Extension Service, Lonoke, AR, 3Dow AgroSciences, Sterlington, LA (101)

ABSTRACT

Weed control on rice levees has become more challenging in recent years due to the increased presence of broadleaf weeds, specifically Palmer amaranth (*Amaranthus palmeri*). Levees are also generally sprayed only once per season, allowing time for new weeds to emerge. The standard treatment for controlling broadleaf weeds on levees is 2,4-D (WSSA group 4) alone or with another herbicide, however 2,4-D use is restricted in certain areas of Arkansas where cotton production is also common, and a permit must be obtained before spraying. Florpyrauxifen-benzyl is a recently labeled, broad-spectrum synthetic auxin (WSSA group 4) herbicide for rice from DowDuPont. A field experiment was conducted in summer 2017 at the Pine Tree Research Station near Colt, AR to compare florpyrauxifen-benzyl- and 2,4-D-containing weed control programs. This experiment was a randomized complete block design with a two-factor factorial. Factor A consisted of six commonly used rice herbicides; saflufenacil, propanil, propanil plus thiobencarb, triclopyr, quinclorac, and penoxsulam applied at the standard field rate. Factor B was the addition of florpyrauxifen-benzyl at 30 g ai ha⁻¹, 2,4-D at 1600 g ae ha⁻¹, or no herbicide in a mixture with each of the herbicides in factor A. Palmer amaranth control for almost all herbicides was improved by the addition of florpyrauxifen-benzyl or 2,4-D when compared to the herbicide alone. Additionally, orthogonal contrasts conducted showed no statistical difference between 2,4-D- or florpyrauxifen-benzyl-containing treatments. These results indicate florpyrauxifen-benzyl will control troublesome weeds on rice levees and provide a viable control option in areas where 2,4-D is restricted.
WEED MANAGEMENT SYSTEMS IN CONVENTIONAL AND CONSERVATION TILLAGE IN BOLLGARD II XTENDFLEX COTTON. C.D. White*1, W. Keeling2, J. Spradley2, J. Everitt3; 1Texas A&M Agrilife Research, Lubbock, TX, 2Texas A&M AgriLife Research, Lubbock, TX, 3Monsanto Company, Shallowater, TX (102)

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 at Lubbock 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 the study 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 CO₂-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 90% 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 88% 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.
INTERACTIONS OF RICEONE AND INDIVIDUAL HERBICIDE COMPONENTS MIXED WITH RICEBEAUX. M.J. Osterholt*1, B. McKnight1, E.P. Webster2, G.M. Telo1, L.C. Webster1, S.Y. Rustom1; 1Louisiana State University AgCenter, Baton Rouge, LA, 2Louisiana State University, Baton Rouge, LA (103)

ABSTRACT

Over the past several years, dry-seeded rice production in the state of Louisiana has risen to approximately 65% of the planted rice area. With more hectares going to dry-seeded planting, farmers are relying more on preemergence (PRE), delayed preemergence (DPRE), and postemergence (POST) residual herbicides to suppress weeds until the permanent flood is established. RiceOne is a pre-packaged mixture of pendimethalin (Group 3) and clomazone (Group 13) at 307 and 128 g ai per liter, respectively. RiceBeaux is a pre-packaged mixture of propanil (Group 7) and thiobencarb (Group 8) at 360 and 360 g ai per liter, respectively. Because of the residual activity of both RiceOne and RiceBeaux, the two products could greatly benefit dry-seeded rice production by providing extended residual control of troublesome early-season weeds and provide a combined herbicide mixture with four different sites of action (SOA). The objective of this research was to evaluate early season grass control between early post (EPOST) applications of RiceOne, clomazone, and pendimethalin mixed with RiceBeaux.

A field study was conducted in the 2017 growing season at the LSU AgCenter H. Rouse Caffey Rice Research Station (RRS) near Crowley, Louisiana. Treatments were arranged as a two factor factorial in a randomized complete block design with four replications. Factor A consisted of EPOST applications at the two-to three-leaf stage of RiceBeaux at 0, 2520, or 5040 g ai ha⁻¹. Factor B consisted of EPOST applications at the two-to three-leaf stage of clomazone at 223 or 336 g ai ha⁻¹, pendimethalin at 537 or 807 g ai ha⁻¹, or RiceOne at 760 or 1020 g ai ha⁻¹. ‘CL 111’ IR rice was planted at 84 kg ha⁻¹ in eight, 19-cm rows. Herbicide applications were applied using a CO₂-pressurized backpack sprayer calibrated to deliver 140 L ha⁻¹ at 190 kPa. Visual weed control ratings were recorded at 35 and 49 Days after treatment (DAT). Rough rice yield was obtained for the primary crop with a small plot combine harvesting the center four rows of each plot. Grain yield was adjusted to 12% moisture and calculated based on kilogram per hectare.

At 35 DAT, barnyardgrass treated with clomazone at 223 or 336 g ha⁻¹ or RiceOne at 760 or 1020 g ha⁻¹ mixed with RiceBeaux at 2520 or 5040 g ha⁻¹ was controlled 86 to 93%. An increase in control of barnyardgrass was observed when treated with a single application with multiple SOA compared with the herbicides applied alone. Data indicates that pendimethalin applied with either rate of RiceBeaux provided less control of barnyardgrass than any other herbicide mixed with RiceBeaux. At 49 DAT, both the high and low rates of clomazone and RiceOne mixed with RiceBeaux at 2540 g ha⁻¹ resulted in 76 to 83% control of barnyardgrass. Increased rates of clomazone, RiceOne, and RiceBeaux controlled barnyardgrass 90 to 95%. Rice treated with RiceOne at 760 g ha⁻¹ mixed with RiceBeaux at 5020 g ha⁻¹ yielded 7260 Kg ha⁻¹. No differences were observed with rice treated with RiceOne at 760 or 1020 g ha⁻¹ mixed with both rates of RiceBeaux or rice treated with clomazone at 336 g ha⁻¹ mixed with 5040 g ha⁻¹ of RiceBeaux. The addition of clomazone, pendimethalin, or RiceOne mixed with thiobencarb plus propanil
(RiceBeaux) provides both residual and POST activity on barnyardgrass. The application of multiple SOA herbicide mixtures can be a useful tool to help manage and delay resistance.
PRELIMINARY FINDINGS ON THE IMPACT OF DIFFERENT DESICCANTS/DEFOLIANTS ON SEED VIABILITY OF PALMER AMARANTH. K. Werner*1, V. Singh1, P.A. Dotray2, M. Bagavathiannan3; 1Texas A&M University, College Station, TX, 2Texas Tech University, Texas A&M AgriLife Research and Extension Service, Lubbock, TX, 3Texas A&M AgriLife Research, College Station, TX (104)

ABSTRACT

A field study was conducted to evaluate the impact of different desiccants/defoliants commonly used in cotton on the seed viability of Palmer amaranth (*Amaranthus palmeri* S. Wats.) at Texas A&M Research farm, College Station, TX during spring 2017. The experiment was arranged in split-plot, with desiccants as the main factor (10 levels) and application stage (4 seed development stages: white, green, brown and black) as the sub-plot factor. Each desiccant was applied at the recommended (1X) rate and the plants were harvested at 28 days after treatment. Harvested samples (50 seeds each) were evaluated for germination in Petri-dishes containing moistened filter paper and incubated in a growth chamber at a day/night temperature regime of 30/28 C. Seed germination was recorded two weeks after incubation and the viability of remaining non-germinated seeds was determined using the tetrazolium test. Seed embryos were cut, immersed in 1% tetrazolium chloride solution, and incubated at 30 C for 48 hours. Seeds with pink or red embryos were considered alive and dormant. Preliminary results have indicated the interaction effect of desiccant and seed developmental stage on the seed viability of Palmer amaranth. Lower seed viabilities were observed when Palmer amaranth was treated with glyphosate, 2,4-D or pyraflufen-ethyl compared with other desiccants across all the seed developmental stages. Higher seed dormancy was observed when the desiccants were applied at the black seed stage (16%) compared with the white (9%), green (5%) or brown (7%) stages. Multi-environmental field trials are currently underway to confirm these preliminary findings.
RESPONSE OF GRAIN SORGHUM TO LOW RATES OF GLUFOSINATE. H.D. Bowman*¹, T. Barber², J. Norsworthy³, W. Coffman³; ¹Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, ²University of Arkansas Research and Extension Service, Lonoke, AR, ³University of Arkansas, Fayetteville, AR (105)

ABSTRACT

In 2015, 546,000 acres of row crops were treated with glufosinate in Arkansas. With the frequent use of aerial application for herbicides, off-target movement can be a common issue in the state. Previous research has shown that glufosinate at low rates can cause yield loss to rice and grain sorghum. However, research has not been conducted to evaluate the effect glufosinate at low rates has on grain sorghum. Therefore, tests were conducted at Lon Mann Cotton Research Station near Marianna, AR, the Arkansas Agricultural Research & Extension Center in Fayetteville, AR, the Rohwer Agricultural Research Station near Rohwer, AR, and Northeast Research and Extension Center in Keiser, AR. The tests were set up as a two-factor factorial with factor A being timing of application, where glufosinate was applied at the V3, V8, flagleaf, heading, and soft dough stages. Factor B was glufosinate rate where a proportional rate of 656 g ai ha⁻¹ was applied at 1/10X, 1/50X, and 1/250X. At the flagleaf stage, the 1/10X rate caused 28% visible injury, which resulted in a 22% yield reduction. At the heading stage, the 1/10X and 1/50X rate caused comparable injury of up to 12%, which resulted in 15% yield loss. These results show that if grain sorghum is exposed to low rates of glufosinate at the flagleaf or heading stage yield loss is likely to occur.
EVALUATION OF INTEGRATED WEED MANAGEMENT PRACTICES FOR JOHNSONGRASS CONTROL IN INZEN™ SORGHUM. B. Young*1, L.M. Lazaro2, M.J. Walsh3, J. Norsworthy4, M. Bagavathiannan5; 1Texas A&M University, College Station, TX, 2Louisiana State University AgCenter, Baton Rouge, LA, 3University of Sydney, Sydney, Australia, 4University of Arkansas, Fayetteville, AR, 5Texas A&M AgriLife Research, College Station, TX (106)

ABSTRACT

Sorghum with non-transgenic herbicide resistance (Inzen™ sorghum) to nicosulforon, an acetolactate-synthase (ALS)-inhibitor, will soon be available for production. This trait will provide a valuable grass weed management tool for the management of johnsongrass and other grasses in sorghum. Development of best management practices and stewardship protocols have been shown to be beneficial in similar situations. The objective of this experiment was to understand the value of integrated tactics for managing johnsongrass in Inzen™ sorghum production systems. Large-scale experiments were initiated in May 2016 in College Station, TX and Keiser, AR in areas with high densities of johnsongrass infestation. The treatments include 1) Dual II Magnum® PRE (1071 g a.i./ha) fb Atrazine (1122 g a.i./ha +1% COC) at 30 cm sorghum (standard practice in conventional sorghum), 2) Dual II Magnum® PRE (1071 g a.i./ha) fb Atrazine (1122 g a.i./ha +1% COC)+Zest® (35.1 g a.i./ha) at 30 cm sorghum (standard Inzen™ program), 3) Program #2 fb Roundup Weathermax® (1262 g a.e./ha) desiccant prior to harvest, 4) Program #3 fb chaff removal (removal of johnsongrass seedhead) at harvest, 5) Program #4 fb shred/disk the field after harvest and treat the regrowth with Select® (140 g a.i./ha) at 30 cm height, and 6) Program #5, except no chaff removal at harvest. Results showed that application of Zest® and Atrazine (standard Inzen™ program) alone may not be sufficient for sustaining johnsongrass control as substantial regrowth was observed during sorghum harvest. Application of glyphosate harvest aid, chaff removal and tillage followed by treating the regrowth with Select® were all effective in reducing the population sizes of johnsongrass. Moreover, the treatments that included at- and post-harvest tactics had the greatest impact on the seedbank size of johnsongrass. This long-term study is providing a greater understanding of the impact of integrated tactics on the management of johnsongrass within Inzen™ sorghum production systems.
CAN ADJUVANTS OVERCOME ANTAGONISM OF QUIZALOFOP WHEN MIXED WITH ALS HERBICIDES? L.C. Webster*, B. McKnight1, E.P. Webster2, G.M. Telo1, M.J. Osterholt1, S.Y. Rustom1; 1Louisiana State University AgCenter, Baton Rouge, LA, 2Louisiana State University, Baton Rouge, LA (107)

ABSTRACT

Imidazolinone resistant (IR) weedy rice (Oryza sativa L.) and barnyardgrass [Echinochloa crus-galli (L.) P. Beauv.] resistance prompted BASF to develop an acetyl Co-enzyme A carboxylase (ACCase) resistant (ACCase-R) rice (O. sativa L.) to be sold under the tradename of Provisia. Quizalofop, a group 1 herbicide, is the herbicide to be used in Provisia rice with a single application rate of 92 to 155 g ai ha⁻¹, not to exceed 240 g ha⁻¹ per year. ACCase-R rice will allow quizalofop to be applied postemergence (POST) in cultivated rice for control of annual and perennial grasses including IR weedy rice and barnyardgrass.

Herbicides are often applied in a mixture to broaden the weed control spectrum, to save time, and to save application costs. Herbicide interactions may result in one of three responses: synergistic, antagonistic, or additive/neutral. ACCase herbicide antagonism is commonly observed when applied in a mixture with a broadleaf or sedge herbicide. Quizalofop is often antagonized for control of weedy rice and barnyardgrass by many ALS herbicides that are labeled for use in rice production. In research conducted in Louisiana, bispyribac has been shown to be one of the least compatible ALS herbicides in a mixture with quizalofop. Adjuvants may have the ability to overcome this antagonism due to their ability to alter the physical and chemical properties of herbicides and modify herbicide activity. The objective of this study was to evaluate the influence of different adjuvants in overcoming the antagonism of quizalofop when mixed with ALS herbicides. A BASF supplied crop oil concentrate (COC-BASF) (Dash, BASF, Research Triangle Park, NC), a crop oil concentrate (COC-Helena) (Agri-Dex, Helena Chemical Company, Collierville, TN), and a silicon based adjuvant (SBA) (Dyne-A-Pak, Helena Chemical Company, Collierville, TN) were evaluated for their potential to overcome antagonism of quizalofop.

A study was conducted in 2017 at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana. Plot size was 1.5 by 5.1 m with eight, 19.5 cm drill-seeded rows of ACCase-R ‘PVL01-B’ long grain rice. In addition to PVL01-B, eight, 19.5 cm drill-seeded rows of IR ‘CLXL-745’ and ‘CL-111’ were planted perpendicular to the PVL01-B at 84 kg ha⁻¹. Awnless red rice was broadcasted at 50 kg ha⁻¹ across the research area, and the area was naturally infested with barnyardgrass.

The study was a randomized complete block with a two-factor factorial arrangement of treatments with four replications. Factor A consisted of POST applications of quizalofop at 0 and 120 g ha⁻¹, bispyribac at 0 and 34 g ai ha⁻¹, or a mixture of quizalofop at 120 g ha⁻¹ plus bispyribac at 34 g ha⁻¹. Factor B consisted of no adjuvant, COC-Helena, COC-BASF, or a SBA. All adjuvants were applied at a rate of 1% v v⁻¹. All herbicide applications were applied when the rice was at the three- to four-leaf rice growth stage. Visual evaluations for this study included barnyardgrass, red rice, CL-111, and CLXL-745 control at 14 and 28 days after the treatment.
(DAT). A second application of quizalofop was applied after the 28 DAT rating at a rate of 120 g ha\(^{-1}\). Rice yield was obtained and adjusted to 12% moisture.

At 14 DAT, quizalofop plus COC-Helena controlled barnyardgrass 91% at 14 DAT and 94% at 28 DAT. At 14 DAT, barnyardgrass treated with quizalofop plus bispyribac with COC-Helena or SBA was controlled 25 and 54%, respectively, and control increased to 33 and 64% at 28 DAT for the same mixtures. However, by substituting COC-BASF as the adjuvant, the quizalofop plus bispyribac mixture controlled barnyardgrass 80 and 88% at 14 and 28 DAT, respectively. No reduction in control was observed for red rice, CL-111, and CLXL-745 control when bispyribac was mixed with quizalofop plus all adjuvants evaluated at 14 and 28 DAT. ACCase-R rice treated with bispyribac mixed with quizalofop plus COC-BASF yielded 4790 kg ha\(^{-1}\), which did not differ from the ACCase-R rice treated with bispyribac mixed with quizalofop plus COC-Helena or SBA.

In conclusion, antagonism of quizalofop activity on barnyardgrass was observed when applied in a mixture with bispyribac plus COC-Helena or SBA; however, a neutral response was observed for red rice, CL-111, and CLXL-745 control when bispyribac was mixed with quizalofop plus all adjuvants evaluated. Preliminary results indicate that COC-BASF can reduce antagonism to a neutral response when bispyribac is mixed with quizalofop for control of barnyardgrass. Yield data for ACCase-R rice and control data for barnyardgrass, red rice, CL-111, and CLXL-745 treated with bispyribac mixed with quizalofop plus COC-BASF indicate a potential herbicide plus adjuvant combination to be used in ACCase-R rice.
TOLERANCE OF CORN TO POSTEMERGENCE PSII HERBICIDES. J.T. Richburg*,1, J. Norsworthy1, T. Barber2, G.L. Priess1; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas, Lonoke, AR (108)

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 postemergence-applied, 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. Seven days after application (DAA) linuron applied with either mesotrione or S-metolachlor caused the most damage (48% and 50%, respectively) while ametryn, propazine, and simazine caused the least amount of damage (<10%). Yield followed the general trend of injury. Prometryn-, linuron-, and metribuzin-containing treatments significantly lowered yield compared to standard atrazine-containing programs. From a yield reduction standpoint, diuron-containing treatments, followed by simazine- and fluometuron-containing treatments, are the most cost-effective alternatives to atrazine-containing treatments. More research is needed to assess the actual cost-effectiveness, which should factor in a combination of injury, yield reduction, and efficacy. In the future, this study should be conducted across multiple site years to further evaluate crop tolerance and efficacy comparable to atrazine.
IMPRESSIONS ON THE USE OF CHLAMYDOMONAS REINHARDTII AS A MODEL ORGANISM FOR STUDYING THE EVOLUTION OF HERBICIDE RESISTANCE IN WEED POPULATIONS. J.C. Argenta*1, S. Ohadi1, Q. Ruchel2, S. Finlayson1, T.J. Gentry1, M. Bagavathiannan3; 1Texas A&M University, College Station, TX, 2Federal University of Pelotas, Pelotas, Brazil, 3Texas A&M AgriLife Research, College Station, TX (109)

ABSTRACT

The unicellular green alga *Chlamydomonas reinhardtii* has been commonly used as a model organism for studying many plant biological processes due to its physiological, morphological, and molecular characteristics comparable to higher plants. This organism is particularly preferred in herbicide resistance evolution research due to its short life cycle, susceptibility to several commercial herbicides, and an ability to work with millions of individuals in a relatively small space. However, there exist some ambiguities in published literature on how the studies involving the interactions between *C. reinhardtii* and herbicides were conducted and interpreted. The overall objective of this study was to better understand herbicide resistance evolution using *C. reinhardtii* as a model system. Laboratory experiments were carried out to first validate some conventional approaches to study herbicide resistance evolution using *C. reinhardtii*. The majority of studies used optical density (OD) value at 750 nm wavelength for estimating algae cell densities, by developing a correlation between the OD values and corresponding cell counting under a microscope using a hemocytometer. We developed a much robust correlation curve using about 2000 samples and validated the results with an advanced cellometer unit, indicating that OD measurement is a simple, yet reliable method to estimate algae cell numbers. However, we did find that OD values are not sufficient to confirm complete death of a population following a herbicide application. In this scenario, plating the culture in an agar medium and counting the resulting colony forming units (CFU) was found to be an effective alternative. This approach also allows the verification of possible contaminations from bacteria and fungi, which would be impossible to distinguish by the OD value or through a naked eye. For the same reasons described above, any positive confirmation of resistant *C. reinhardtii* mutants following a herbicide application will require reculturing the surviving CFUs in a medium containing a lethal dose of the test herbicide, perhaps followed by a molecular verification. Further, our findings suggested that dose-response assays require optimization for each experimental condition and previously suggested doses may not be applicable across all studies. For example, a lethal dose of glyphosate (576 µM) identified earlier for *C. reinhardtii* didn’t provide complete death of the algae population in our experiments, and an effective lethal dose under our experimental conditions was in the neighborhoods of 7500 µM of glyphosate. More detailed characterizations are underway to elucidate the influence of these and other factors such as algae strains on alga-herbicide interactions. Results will be helpful for improving the effectiveness of the *C. reinhardtii* system in understanding the evolution of herbicide resistance in weed populations.
EFFECTS OF TIMING OF WEED REMOVAL IN XTENDFLEX COTTON ON YIELD AND ECONOMIC RETURN. M. Inman*, D. Jordan1, A. Hare1, A.C. York2, M. Vann1; 1North Carolina State University, Raleigh, NC, 2North Carolina State University, Cary, NC (110)

ABSTRACT

Early season management of Palmer amaranth (*Amaranthus palmeri* S. Wats) is critical for cotton production in fields where this weed is present. Timely application of herbicides can be difficult to accomplish which can result in inadequate weed control and greater interference of this weed with cotton. Palmer amaranth plants that escape applications of herbicides early in the season can significantly reduce cotton yields. The objective of this study was to evaluate Palmer amaranth control, cotton yield, and economic return associated with various timing sequences of postemergence (POST) herbicides including dicamba, glufosinate, and glyphosate with and without preemergence (PRE) herbicides.

Research was conducted during 2016 and 2017 in North Carolina across three environments near Clayton and Rocky Mount. Treatments consisted of herbicides applied 2, 3, 4, and 5 weeks after planting (WAP); 3, 4, and 5 WAP; 4 and 5 WAP; and 5 WAP only. Additional treatments included herbicides applied 2 WAP only, 2 and 3 WAP; and 2, 3, and 4 WAP. Glufosinate was applied 2 and 3 WAP at 543 g ai ha⁻¹. At 4 and 5 WAP, glyphosate plus dicamba (946 g ae ha⁻¹ + 560 g ae ha⁻¹) were applied. Postemergence treatments were applied with and without PRE herbicides. The PRE herbicide program consisted of fomesafen (160 g ai ha⁻¹) plus acetochlor (740 g ai ha⁻¹) plus diuron (455 g ai ha⁻¹). A non-treated control was also included. Cotton was planted in a conventional-tillage system. Visible estimates of percent weed control were recorded 3, 4, 5, 6, 7, and 8 WAP using a scale of 0 to 100 where 0 = no control and 100 = complete control. Fresh weight of weeds from 1 m² area of each plot was determined within 4 weeks prior to harvest. Cotton was machined harvested with a spindle picker and seedcotton weight was recorded. Estimated economic return was calculated based on the North Carolina Cooperative Extension Service budget for cotton with a total production cost, excluding seed, ginning, and herbicide costs, set at $1,268 ha⁻¹. Seed cost was set at $250 ha⁻¹, to reflect specific seeding rate and seed type used for the study. Ginning cost was based on seed cotton yield for each plot at a price of $0.24 kg⁻¹. Herbicide costs were based on local, chemical retailer prices in 2017. Economic net return was calculated as the difference between the product of yield (45% lint at $1.65 kg⁻¹ and 55% seed at $0.26 kg⁻¹) and total production cost.

Palmer amaranth was controlled 96% or greater 8 WAP when three or more POST herbicide applications were made regardless of timing sequence or when the 4,5 and 5 WAP application timings included a PRE. In general, when the number of herbicide applications were reduced Palmer amaranth control suffered. As the number of POST applications decreased, cotton yield decreased. Treatments where PRE herbicides were applied produced higher yields compared to those without a PRE. No difference in cotton yield was observed in treatments where PRE herbicides were used with three or more POST applications and the 4,5 WAP timing. In general, little differences were noticed in net returns when three or more POST applications were used. Similar to cotton yields, when a PRE was applied with the 4,5 and 5 WAP no difference in net return was observed compared to those with three or more application timings. This research
demonstrates that even when adequate weed control is obtained with larger weeds, early season weed interference can still adversely affect cotton yield and the use of PRE herbicides can offset missed early season weed control efforts.
IMPACT OF FLOODING ON THE GERMINATION AND GROWTH OF DIFFERENT WEED SPECIES INFESTING RICE PRODUCTION SYSTEMS. S. Abugho*1, R. Liu1, X. Zhou2, M. Bagavathiannan3; 1Texas A&M University, College Station, TX, 2Texas A&M AgriLife Research, Beaumont, TX, 3Texas A&M AgriLife Research, College Station, TX (111)

ABSTRACT

Flooding is an important cultural practice in rice production, which has long been used as a weed management tool. However, information on the effect of flooding on the germination and growth of weed species prominent in rice production systems in Texas is limited. To understand this, two greenhouse experiments were conducted at Texas A&M University, College Station, TX. The first experiment was aimed at assessing the impact of flooding on the germination and emergence pattern of Amazon sprangletop, barnyardgrass, hemp sesbania, Nealley’s sprangletop, Palmer amaranth and weedy rice, whereas the second experiment was focused on the impact of flooding on continued growth and development of these weeds when flooding was established at different seedling growth stages. The first experiment was arranged in a randomized complete block design with four replications. Exactly 250 seeds each of the study species were planted in plastic containers (35 x 21 x 12 cm) filled with a 1:1 ratio of field soil and potting soil mix and flooded at three depths: 0, 2.5 and 7.5 cm. Emerged seedlings were counted and removed once every four days for a month period. For the second experiment, a completely randomized design with eight replications was implemented. Seeds were planted in a styrofoam cup (17 cm tall x 15 cm dia) filled with the soil mix described above and flooded (two depths: 0 and 10 cm) at five different seedling growth stages: just emerged, 1, 2, 5, and 10 cm tall. Severe reduction in seed germination was observed at the 7.5 cm flooding depth for all weed species. Weedy rice exhibited the greatest germination of 40 and 6% under 2.5 and 7.5 cm flooding, respectively. Moreover, flooding delayed the emergence of hemp sesbania and barnyardgrass by 12 and 8 days, respectively. All tested species did not survive when flooding occurred prior to the 1 cm seedling stage, except weedy rice. Plant height and above-ground biomass production of the weeds showed a positive trend with every delay in flooding. Further, there was a significant increase in root biomass when hemp sesbania was flooded at later seedling growth stages; this trend was not observed for the other weed species tested. Results show that flooding has a tremendous impact on the germination and continued growth and development of weeds, but with differential response across species. Findings also highlight the potential for weed species adaptations and shifts if flooding is relied upon as a major weed management tool in organic as well as conventional rice production systems.
WEED POPULATION DIVERSITY AND DYNAMICS IN A 36-YEAR OLD TILLAGE EXPERIMENT IN SOUTHEAST TEXAS. P. Govindasamy*1, J. Mowrer1, T. Provin1, F.M. Hons1, M. Bagavathiannan2; 1Texas A&M university, college station, Texas -77840, College Station, TX, 2Texas A&M AgriLife Research, College Station, TX (112)

ABSTRACT

No-till (NT) production practices are known to provide soil and ecosystem benefits over conventional tillage (CT) practices. Changes in tillage practices may also influence weed population dynamics, and consequently, the selection of appropriate weed management practices. Studies were conducted during 2016-17 in a 36-year old tillage experiment currently ongoing at Texas A&M University, College Station, TX on the influence of NT and CT practices on weed diversity and weed seedling emergence patterns in a continuous sorghum production system. Plots were arranged in a randomized complete block design with four replications. Results revealed that the NT system had greater weed diversity and evenness (Shannon-Weiner index) values compared to the CT system. Weed species composition and dynamics were also different between the two systems. Only 47 and 34% of the weed species were common between the two production systems (Steinhaus index) in 2016 and 2017, respectively, indicating a significant weed species shift when adopting continuous NT system. The NT system had greater johnsongrass (*Sorghum halepense*) (75% greater) and waterhemp (*Amaranthus tuberculatus*) (70% greater) infestations than that of the CT system, which were the dominant weeds in the system. Further, the NT system had a greater cumulative emergence of johnsongrass (112-215 seedlings m⁻² greater) and waterhemp (2-25 seedlings m⁻² greater) than CT. Moreover, time to 50% emergence of johnsongrass and waterhemp were delayed by 3-6 days and 16-22 days, respectively in the NT system. Weed seeds were more uniformly distributed across the soil profile in the CT system than in the NT system. The NT system also had greater (34% greater) number of germinable seeds at the soil surface compared to the CT system. Results from this study emphasize that growers moving to NT practices must consider potential shifts in weed communities and changes to weed population dynamics, and devise a suitable weed management program.
SURVEYING THE DISTRIBUTION OF HERBICIDE-RESISTANT WEEDS IN RICE PRODUCTION IN TEXAS. R. Liu*1, X. Zhou2, M. Bagavathiannan3; 1Texas A&M University, College Station, TX, 2Texas A&M AgriLife Research, Beaumont, TX, 3Texas A&M AgriLife Research, College Station, TX (113)

ABSTRACT

Rice is a significant commodity in Texas and the prevalence of herbicide-resistant weeds in rice production is ranked among the top production constraints. Our previous field surveys have indicated that barnyardgrass (*Echinochloa crus-galli*), weedy rice (*Oryza sativa*), and Nealley’s sprangletop (*Leptochloa nealleyi*) are the dominant species in Texas rice production, and that propanil (Riceshot®), quinclorac (Facet®), fenoxaprop (Ricestar®), and imazethapyr (Newpath®) are the frequently used post-emergence herbicides for weed management. To determine the current level of herbicide resistance in rice production in Texas, seeds of each weed species were collected during late-season field surveys conducted in 2015 and 2016. Herbicide resistance screening assays were conducted in a greenhouse for all the four herbicides, following a completely randomized design. Samples were planted in square trays and thinned to 10 seedlings per tray prior to treatment. Herbicide applications were made at the recommended field rate for each herbicide on 2-3 leaf weeds, using an automated spray chamber calibrated to deliver 15 GPA at 3 MPH. Observations (% survival and injury) were carried out 21 days after treatment. The herbicide assays consisted of three replications and two experimental runs. A total of 51 barnyardgrass populations, 11 weedy rice populations, and 30 Nealley’s sprangletop populations were evaluated so far. Results showed 43, 12, 11 and 14% of the barnyardgrass populations had individuals with high resistance (<25% injury) to propanil, imazethapyr, quinclorac and fenoxaprop, respectively. Among the 51 barnyardgrass populations tested, six had cross-resistance to all the four herbicides evaluated in this study. Seven weedy rice populations also showed resistance to imazethapyr with an injury level of <25%. Nealley’s sprangletop showed low to moderate resistance to both propanil and imazethapyr with injury levels between 26 and 90%. This is the first detailed report characterizing the level of herbicide resistance in weeds infesting rice fields in Texas. Findings will help create awareness among the stakeholders on the importance of this issue and also help identify alternative weed management strategies.
FACTORS THAT INFLUENCE ZOYSIAGRASS RESPONSE TO HERBICIDES. J. Craft*, S. Askew; Virginia Tech, Blacksburg, VA (114)

ABSTRACT

Zoysiagrass (Zoysia spp.) is a warm-season grass utilized in lawns and golf courses because of its density, visual quality, drought and wear tolerance, and reduced requirements for water, nutrients, and mowing. Turf managers typically exploit winter dormancy of related warm-season grasses (e.g., bermudagrass, Cynodon spp.) to utilize non-selective herbicides that reduce cost associated with weed control. This weed control strategy has been less adopted in zoysiagrass due to perceived sensitivity to herbicides and presence of green plant material in the zoysiagrass canopy during dormancy. Although researchers contend that application timing relative to the presumed dormancy state of zoysiagrass is a primary driver of its response to herbicides, no studies have described methods to measure dormancy state and factors influencing zoysiagrass response to herbicides during spring green-up. An experiment was designed to evaluate response of four zoysiagrass varieties to glyphosate applications made at three stages of spring green up assessed by carbon dioxide flux of zoysiagrass. Carbon dioxide (CO₂) flux was used to measure the physiological state of zoysiagrass and was measured by inclosing the turfgrass canopy in a custom transparent plexi-glass chamber connected to a portable gas exchange system (LI-8100; LI-Core Inc). The portable chamber was placed on a 10.7 cm diameter PVC collar that was inserted 7.6 cm deep in each plot. A separate study was conducted in the spring of 2016 and 2017 in various locations across Virginia to evaluate several herbicides and application timings based on growing degree-day (GDD) accumulation for response of three zoysiagrass varieties. All experiments were randomized complete blocks with three replications and data was subjected to ANOVA and means were separated using fishers protected LSD at the 0.05 level of significance.

Although we successfully developed methods to measure carbon dioxide flux in the field, sporadic winterkill of zoysiagrass and flooding of the soil-to-chamber, interface curtailed treatment separation. Experimental error related to small plots and techniques to measure CO₂ flux have thus far precluded ability to draw conclusions relative. Data collected evaluating herbicides and application timings indicated glyphosate at 700 g ai/ha and glufosinate at 1680 g ai/ha did not cause unacceptable turf injury to ‘Zeon’ zoysiagrass at the 200 GDD₃₂ application timing. Similar results were observed when glyphosate at 700 g ai/ha was applied to ‘Meyer’ and ‘Companion’/‘Zenith’ zoysiagrass at the 400 GDD₃₂ timing but when applied to ‘Companion’/‘Zenith’ at 600 GDD₃₂ timing caused 72% injury. Glufosinate at 1680 g ai/ha applied at the 400 and 600 GDD₃₂ timing was the most injurious treatment to ‘Meyer’ and ‘Companion’/‘Zenith’ zoysiagrass. Glyphosate appears less injurious to zoysiagrass than glufosinate, although both herbicides generally cause more injury when applied at later timings. Data also suggest that zoysiagrass varieties vary in response to herbicide applications during spring green-up.
COMPARING ENLIST AND XTEND SYSTEMS FOR WEED CONTROL IN COTTON.
B. Greer*1, J.A. Tredaway1, G. Stapleton2, J. Richburg3; 1Auburn University, Auburn University, AL, 2BASF Corporation, Dyersburg, TN, 3Dow AgroSciences, Headland, AL (115)

ABSTRACT

Field Studies were conducted at the Tennessee Valley Research and Extension Center (TVREC) in Belle Mina, Alabama for the 2017 growing season. There were two studies conducted to compare the Enlist and Xtend cotton systems for weed control and yield differences. In the first study, 1/100th x and 1/1000th x drift rates of auxin herbicides (Enlist Duo or Engenia) were applied over the top of the opposite traited cotton plants. For example, Enlist Duo was sprayed over Xtend Cotton and Engenia was sprayed over the top of Enlist cotton. This was done to evaluate the yield impact of simulated drift rates of auxin herbicides on cotton. These two treatments were done at three different times throughout the year to see if time of year had an effect on yield. In this study we found that the most detrimental yield impact was seen in the 1/100th x rate of Enlist Duo at the bloom timing, followed by the 1/100th x rate at the V8 timing. These two treatments showed a much lower yield than the others. The yields at 1/1000th x rate at all three timings, and the 1/100th x rate at 3 weeks after bloom were not affected by the Enlist Duo drift. In the Engenia drift trial, regardless of timing or drift rate applied Enlist cotton yields were not affected by dicamba drift. In the second study, Enlist and Xtend systems were compared for Palmer Amaranth control and yield. In this study, Enlist Duo or Engenia + Outlook + glyphosate was applied alone at an early timing, a late timing, or in a sequential system with Liberty + Dual Magnum where one of the auxin systems was applied early followed by Liberty or Liberty was applied early followed by one of the auxin systems. For the 14 and 42 day after application timings we see that good to excellent control was achieved for all of the treatments that were sprayed. The 6-8 leaf cotton timings had not been sprayed yet therefore they have no weed control ratings. The 72 day rating was included to show what weed control was provided by the 6-8 leaf application. Although you can see a difference of around 20% in rating evaluations these numbers were not significant. As far as yield is concerned, the Enlist Cotton yielded higher for all three treatments that received an early post application. The highest yields for the Xtend Cotton were in the Liberty followed by Engenia, or the Engenia followed by Liberty treatments. The two 6-8 leaf cotton treatments for each auxin system yielded the lowest due to competition by Palmer amaranth throughout the season. These studies show that Enlist and Xtend systems are very similar in weed control performance. However, differences in yield were observed. In the weed control trial, Enlist cotton treatments with early post herbicide applications yielded around 3000 seed lb/A, with the two sequential systems of Engenia yielding the highest for Xtend cotton at around 2500 seed lb/A. No yield differences were observed from Engenia drift on Enlist cotton. Yield differences were seen in the 1/100th x drift rate of Enlist Duo on Xtend cotton at the V8 & Bloom timings. No yield decreases were observed at the 1/1000th x drift rate.
ELEVATED CO₂ EFFECT ON TOLERANCE OF ERAGROSTIS PLANÀ TO GLYPHOSATE AND DROUGHT STRESS. M.O. Bastiani*¹, F.P. Lamego², L. Benedetti³, F.C. Caratti³, G.M. Souza³, N. Roma-Burgos¹; ¹University of Arkansas, Fayetteville, AR, ²Embrapa Pecuário Sul, Bagé, Brazil, ³Universidade Federal de Pelotas, Pelotas, Brazil (116)

ABSTRACT

Climate changes are expected to impact the sustainability of native grasslands as well as the success of invasion by invasive weeds. Increase in atmospheric CO₂ levels and occurrence of drought periods could influence the growth of many invasive plant species, and therefore may affect herbicide efficacy. Eragrostis plana (tough lovegrass) is an invasive weedy grass in several native pasture areas in South America and is adapted to a wide range of environment conditions including areas with water limitation. Based on current and predicted global climate changes, we performed an experiment to determine whether rising CO₂ concentration would increase Eragrostis plana tolerance to glyphosate under drought conditions. The experiment was conducted in Open Top Chambers (OTCs) under two levels of atmospheric CO₂ concentration (400 and 700 ppm), two water treatments (well-watered and drought stress conditions) and with and without glyphosate treatment. The water stress was initiated 30 days before glyphosate treatment and terminated 60 days after herbicide treatment (DAT) when plants were harvested. Elevated CO₂ (700 ppm) reduced stomatal conductance (gs) under well-watered conditions, but not under drought conditions. At 7 DAT, the control of E. plana was higher at 700 ppm CO₂, however there was no CO₂ effect at 60 DAT. Water stress reduced glyphosate efficacy at 7 and 60 DAT, regardless of CO₂ level. Shoot biomass reduction by glyphosate treatment was 61% and 43%, while root biomass reduction was 94% and 65% for well-watered and drought conditions, respectively. Under drought stress without glyphosate treatment, physiological variables (RWC and gs) or growth variables (shoot and root biomass) were significantly reduced compared to well-watered condition regardless of CO₂ levels. Overall elevated CO₂ does not stimulate growth and does not increase tolerance to glyphosate or drought stress in E. plana.
IDENTIFICATION OF CROSS- AND MULTIPLE-RESISTANCE IN AMBROSIA ARTEMISIIFOLIA IN NORTH CAROLINA. B. Schrage*, W. Everman, J. Sanders, T.N. OQuinn; North Carolina State University, Raleigh, NC (117)

ABSTRACT

Control of herbicide-resistant dicotyledonous weed species is one of the greatest obstacles to securing optimum soybean yields in North Carolina. From 2013 to 2015 growers from Northeastern counties reported increasing difficulty controlling common ragweed with diphenylethers and N-phenylphthalimides-many of which are labeled for Ambrosia control in soybeans. A common ragweed biotype was confirmed to be resistant to ALS-inhibitors, PPO-inhibitors and glyphosate in 2015. A bioassay was warranted in order to determine if common ragweed had developed cross-resistance across herbicide families within the respective herbicide mechanisms of action.

In 2017, a resistant population from Currituck County and two susceptible populations from Edgecombe County and Leeland, Mississippi were screened against glyphosate and several rates of PPO- and ALS-inhibiting herbicides. PPO-Inhibiting herbicides included fomesafen, carfentrazone, and flumiclorac which belong to the chemical families diphenylether, aryl triazinone, and N-phenylphthalimide, respectively. ALS-Inhibiting herbicides included chlorimuron, cloransulam, and imazamox which are members of the sulfonylurea, triazolopyrimidine, and imidazolinone chemical families, respectively. A log scale of eight rates was applied to common ragweed biotypes centering on the current labeled rate for each product. Log-logistic analysis was used to identify LD50 values and derive a level of resistance ratio. A lethal dose of glyphosate was unable to be attained for the resistant population whereas the susceptible populations from Edgecombe County and Mississippi experienced 50% mortality with 1.88 and 3.75 kg ae, respectively. The resistant population was also found to be 26 to 71-fold more resistant than the susceptible populations when treated with three families of ALS- and PPO-inhibiting herbicides.

In December of 2017, molecular characterization experiments were conducted at the BASF facility in Research Triangle Park, NC. Fifteen resistant plants and four susceptible plants underwent total RNA isolation in which cDNA was produced using reverse transcriptase. The products were subjected to gel electrophoresis and Sanger sequencing for the comparison of codons through trace files. Heterozygous substitutions for leucine were found within the EPSPS and AHAS gene. A novel mutation (arginine>glutamine) was observed in two plants at the 98 codon in the PPX2 gene.

Results from this study indicate the multiple-resistant common ragweed biotype displays cross-resistance to three families of ALS-inhibitors and three families of PPO-inhibitors, further reducing the number of viable control options available to North Carolina farmers. Additionally, there may be multiple resistance mechanisms contributing to the Moyock populations survivability.
QUIZALOFOP-P-ETHYL MIXTURE INTERACTIONS WITH ACETOLACTATE SYNTHASE (ALS) INHIBITING HERBICIDES IN ACCASE-RESISTANT RICE PRODUCTION. S.Y. Rustom*1, B. McKnight1, E.P. Webster2, G.M. Telo1, L.C. Webster1, M.J. Osterholt1; 1Louisiana State University AgCenter, Baton Rouge, LA, 2Louisiana State University, Baton Rouge, LA (118)

ABSTRACT

The introduction of imidazolinone-resistant (IR) rice (*Oryza sativa* L.) in 2002 allowed producers to control red rice (*O. sativa* L.) with a postemergence herbicide for the first time. However, IR rice has naturally outcrossed with its weedy and wild relatives resulting in IR red rice. Additionally, IR hybrid rice seed has a history of dormancy and can become weedy when allowed to establish in following growing seasons as a volunteer. These IR volunteers, red rice, and outcrosses will be referred to as weedy rice. Weedy rice can compete for nutrients and light at a higher rate than cultivated rice, and can result in many different phenotypic characteristics such as plant height, dark to light green vegetative color, various grain color, presence of awns, medium to long grain size, and pubescent to glabrous leaves.

Another weed management concern in rice production is barnyardgrass (*Echinochloa crus-galli* (L.) P. Beauv.). Barnyardgrass resistant to propanil, quinclorac, imazethapyr, or imazamox is a common problem throughout rice producing regions in the southern United States, and the potential exists for the spread of these resistant biotypes.

In response to IR weedy rice and barnyardgrass resistant to several different modes of action, BASF developed a new herbicide resistant rice called Provisia™. Quizalofop is the herbicide targeted for use and will also be called Provisia™. Quizalofop is a Group 1 herbicide that inhibits the acetyl coenzyme A carboxylase (ACCase) enzyme, and provides POST control of annual and perennial grasses with little to no activity on broadleaf or sedge weeds. Historically, quizalofop has been used to reduce red rice and grass infestations in soybean production applied at rates of 35 to 85 g ai ha⁻¹.

Herbicide mixtures have proven to benefit producers with regards to broadening the weed control spectrum and maximizing economic returns. However, ACCase herbicide activity is often antagonized when applied mixed with other herbicides. Herbicide mixtures can indicate one of three responses: synergistic, antagonistic, or neutral. The focus of this research was to determine antagonistic, synergistic, or neutral responses of barnyardgrass and weedy rice treated with quizalofop mixed with various ALS-inhibiting herbicides used in rice production.

A field study was conducted in 2015 and 2016 and the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate quizalofop activity when applied alone or mixed with ALS-inhibiting herbicides. Plot size was 5.1 by 1.5 m with eight, 19.5 cm drill-seeded rows planted as follows: 4 rows of ACCase-resistant ‘PVL024B’ rice, 2 rows of IR ‘CL-111’ rice, and 2 rows of IR-hybrid ‘CLXL-745’ rice. In addition, awnless red rice was broadcast in the research area at 50 kg ha⁻¹. The CL-111, CLXL-745, and red rice were planted to represent a weedy rice population. The research area was also naturally infested with barnyardgrass. Each herbicide application was
applied when the rice was at the three- to four-leaf growth stage with a CO2-pressurized backpack sprayer calibrated to deliver 140 L ha\(^{-1}\).

The study was a randomized complete block with a factorial arrangement of treatments with four replications. Factor A consisted of quizalofop applied at 120 g ha\(^{-1}\) or no quizalofop. Factor B consisted of penoxsulam at 40 g ai ha\(^{-1}\), penoxsulam plus triclopyr at 352 g ai ha\(^{-1}\), halosulfuron at 53 g ai ha\(^{-1}\), bispyribac at 34 g ai ha\(^{-1}\), orthosulam plus halosulfuron at 94 g ai ha\(^{-1}\), orthosulfuron plus quinclorac at 491 g ai ha\(^{-1}\), imazosulfuron at 211 g ai ha\(^{-1}\), bensulfuron at 43 g ai ha\(^{-1}\), or no mixture herbicide. A second quizalofop application was applied to all treatments at a rate of 120 g ha\(^{-1}\) at 28 days after the initial quizalofop treatment (DAT). A crop oil concentrate was added to each herbicide application at a rate of 1% v v\(^{-1}\). Antagonistic, synergistic, or neutral responses were determined using Blouin’s modified Colby’s analysis by comparing an expected control calculated based on the activity of each herbicide applied alone to an observed control.

All ALS herbicides mixed with quizalofop indicated antagonistic responses for red rice, CL-111, CLXL 745, or barnyardgrass control at either 14 or 28 DAT. At 28 DAT, quizalofop mixed with penoxsulam or bispyribac controlled barnyardgrass 33 to 38%, compared with an expected control of 91 to 92%. In addition, these same mixtures controlled red rice, CL-111, and CLXL-745 59 to 67% at 28 DAT compared with an expected control of 96 to 97%. A second independent application of quizalofop at 120 g ha\(^{-1}\) was applied at 28 DAT. At 42 DAT, neutral responses were observed for all mixtures except with quizalofop mixed with penoxsulam containing products, which indicated an antagonistic response despite the second independent application of quizalofop. These data indicate penoxsulam should be avoided in ACCase-resistant rice production. Furthermore, these data can aid in the development of weed management strategies for ACCase-resistant rice production.
PEANUT VARIETY TOLERANCE TO FLUMIOXAZIN AND PARAQUAT TANK MIXES. K.J. Price*, S. Li; Auburn University, Auburn, AL (120)

ABSTRACT

Flumioxazin and paraquat are vital herbicides commonly used in peanut production throughout the southeast. Tank-mixes with paraquat are often used to reduce peanut injury caused by paraquat and broaden the spectrum of postemergence (POST) weed control. Flumioxazin is used as a preemergence (PRE) herbicide in peanuts for residual weed control. However, little research has been conducted to evaluate these herbicides on newer peanut varieties for tolerance. The objective was to conduct multi-location (Macon, Henry and Baldwin County AL) and multi-year (2016-2017) studies to evaluate newer peanut variety tolerance to flumioxazin and paraquat based herbicide programs and determine if the stunting and injury observed led to yield losses. In the first study, paraquat was evaluated on its own at various rates and in six different tank combinations with bentazon + acifluorfen, S- metolachlor, pyroxasulfone, acetochlor, pyroxasulfone + carfentrazone, or 2, 4-DB. The second study evaluated the effects of flumioxazin at 2/3 rate, 1X, 2X labeled rates as well as tank mixed with diclosulam at 1X and 2X labeled rates. Four peanut varieties evaluated in both studies were Georgia 06G, Georgia 12Y, Georgia 14N, TufRunner 511, and Georgia 09B was only included in the flumioxazin study as a fifth variety. Peanut growth parameters including stand count, plant height and widths were collected 3 and 7 weeks after treatment. No variety reacted differently to the herbicide treatments in both studies thus varieties were combined during data analysis. In 2016, paraquat alone and two of the tank mixes caused significant plant height reductions of 4-15% at 50-55 days after planting (DAP). By 72-78 DAP the tank mix with pyroxasulfone 122 g ai ha\(^{-1}\) + carfentrazone 9 g ai ha\(^{-1}\) and paraquat alone at 2X the labeled rate reduced heights by 6 and 10% respectively. Only paraquat at 2X labeled rate had a significant yield loss of 9% at harvest among all treatments in 2016. In 2017, all treatments had plant width reductions by 11-27% at 45-48 DAP and by 66-68 DAP, all but one tank mix, paraquat 280 g ai ha\(^{-1}\) + bentazon 560 g ai ha\(^{-1}\) + acifluorfen 280 g ai ha\(^{-1}\), had significantly reduced plant widths by 8-13%. Paraquat tank mix treatments caused a plant height reduction of 5-8% at 45-48 DAP however they recovered by 66-68 DAP. There was no significant yield loss observed in 2017. In 2016 Macon County trial, flumioxazin treatments caused 6-17% stand loss and 5-25% plant height reductions but no other location had significant growth stunting. In 2017, height reduction was observed as 7-17% at 22-29 DAP in Macon and Henry County. There was no significant yield loss caused by flumioxazin treatments observed for either year. Overall, the newer peanut varieties are tolerant to frequently used flumioxazin and paraquat based treatments. Some observable stunting and injury may occur, however, our data suggests significant peanut yield loss at end of the season is not likely to happen.
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 trifloxysulfuron to topramezone plus triclopyr 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 topramezone 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*, 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.
A. Post*, K. Edmisten, E. Overbaugh; North Carolina State University, Raleigh, NC (126)

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 (Gly210deletion and Arg128Gly/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 GR₅₀ 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 (\textit{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. Sasaki2, 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-dichloroaniline 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.
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 G210 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 G210 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 R128, which could be either R128G or R128M. Besides these, we found yet other novel TS mutations in the *PPX2* gene of Palmer amaranth. Populations harboring the G210 deletion mutation were 8- to 15-fold more resistant than the susceptible standard; those without the G210 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 G210 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 oxadiazion 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.
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, requirement 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.
EVALUATION OF TOPRAMEZONE IN MID-SOUTHERN RICE CROPPING SYSTEMS. M.H. Moore*1, R.C. Scott2, J. Norsworthy1, B. Davis1, Z.D. Lancaster1; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas - Extension Service, Lonoke, AR (136)

ABSTRACT

Rice production in the southern United States makes up approximately 80% of total US production annually. Weed control accounts for a significant percentage of input costs in rice production. Out of all rice weeds, barnyardgrass (Echinochloa crus-galli) is one of the most problematic, particularly due to current levels of herbicide resistance and extreme competitiveness. Barnyardgrass biotypes have become resistant to five herbicide modes of action (MOA) used in rice production, including WSSA Groups 1 (graminicides), 2 (ALS inhibitors), 4 (synthetic auxins), 7 (PSII inhibitors), and 11 (clomazone). Therefore, new MOAs are needed for barnyardgrass control in rice. Field studies were conducted in the summer of 2016 and 2017 at the University of Arkansas-Pine Bluff Research Farm near Lonoke, Arkansas and the University of Arkansas Rice Research and Extension Center near Stuttgart, Arkansas to assess rice tolerance and weed control using topramezone, a Group 27 herbicide. There are currently no group 27 herbicides labeled for rice in the Midsouth, although work on going for the registration of benzobicyclon. In the weed control study, topramezone (Armezon®) was applied alone at 0.5 and 1.0 fl oz/acre (1/2X and 1X of the proposed rates for rice) and in combination with quinclorac, propanil, saflufenacil, fenoxaprop, clomazone, and florpypyruxifen-benzyl at the 2- to 3-leaf stage. After application, herbicide tank-mixtures were evaluated 2 and 4 weeks after treatment to assess the amount of barnyardgrass control. At the 4 week after treatment evaluation, the most effective treatment was florpypyruxifen-benzyl + topramezone (1X), which controlled barnyardgrass 95%, which was significantly greater control than either topramezone (71%) or florpypyruxifen-benzyl (70%) alone. However, when topramezone (1X) was tank-mixed with propanil, the mixture only provided 45% control, which was lower than when topramezone (71%) was applied alone. Crop injury trials were also conducted that contained the same treatments as the weed control test. These trials showed minimal injury (10% or lower) for all tank-mixes. However, in other rice tolerance tests conducted where topramezone was sprayed at the same 2- to 3-leaf stage, severe damage was observed posing serious questions on whether topramezone may be safely used in rice-cropping systems. Further research on crop safety is needed to determine whether topramezone can be used for postemergence weed control in rice.
SOIL-BORNE PATHOGEN PRESENCE IN SOYBEAN DUE TO EFFECTS OF FLUMIOXAZIN ACTIVATION. G.L. Priess*1, J.K. Norsworthy1, T.N. Spurlock1, Z.D. Lancaster1, M.E. Fogleman1, R.C. Scott2; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas - Extension Service, Lonoke, AR (137)

ABSTRACT

Flumioxazin, a protoporphyrinogen oxidase (PPO)-inhibiting herbicide, can cause substantial injury to soybean when the first rainfall occurs near the time of emergence. Due to the spread of PPO-resistant Palmer amaranth, the total effects of flumioxazin injury to soybean should be determined. Some evidence suggests herbicide injury could predispose soybean to diseases caused by fungal plant pathogens. A field experiment was conducted in 2017 at the Arkansas Agricultural Research and Extension Center located in Fayetteville, to determine if a relationship between flumioxazin injury and plant pathogen presence existed. The trial was a two factor factorial, with the factors being rate of flumioxazin (0, 70, 105 g ai/ha), and variety (CDZ 4748LL, CDZ 4814LL). Injury ratings and digital images were taken weekly, for three weeks after application (WAA). Fungal isolations were performed when soybean reached the V1 growth stage using standard procedures. Incidence of *Macrophomina phaeoliana*, the suspected casual fungus of charcoal rot, decreased with an application of flumioxazin (P = 0.0131). Herbicide injury levels differed by variety and by flumioxazin rate (P <0.0001). CDZ 4748LL showed an average injury of 20%, while CDZ 4814LL showed an average of 10% injury, indicating differences in varietal tolerance to flumioxazin. There was no significant difference in plant populations or yield due to flumioxazin rate or variety.
COMPARISON OF SOYBEAN TECHNOLOGIES FOR CONTROL OF PPO-RESISTANT PALMER AMARANTH

Michael M. Houston*, Tom Barber, Jason K. Norsworthy, Hunter D. Bowman;1University of Arkansas, Fayetteville, AR, 2University of Arkansas, Lonoke, AR (138)

ABSTRACT

The confirmation of acetolactate synthase (ALS)- and 5-enilpyruvyl-shikimate-3-phosphate synthase (EPSPS)-resistant Palmer amaranth (Amaranthus palmeri) limited postemergence (POST) options in soybean. In response to this shortage of effective POST programs and herbicides, applications of preemergence (PRE) and residual POST protoporphyrinogen oxidase (PPO)-inhibiting herbicides became the backbone of weed control for herbicide-resistant Palmer amaranth. This reliance on a single mode of action created intense selection pressure and in 2016, PPO-resistant Palmer amaranth populations were identified in eastern Arkansas and eventually confirmed in six other states. To evaluate PPO-resistant Palmer amaranth control, on-farm field trials were established in Crawfordsville and Marion, AR in 2017. The trials were conducted to compare the efficacy of several soybean POST herbicide technologies in combination with PRE herbicide programs on PPO-resistant Palmer amaranth using marginal, good, and excellent soil-residual herbicide programs at planting. Roundup Ready, LibertyLink, Enlist, and Roundup Ready 2 Xtend soybean were planted in blocks with the three PRE programs along with an untreated check inside each technology. PRE programs evaluated 28 days after planting (DAP) averaged 43, 68, and 82% Palmer amaranth control, establishing different levels of weed infestation for the POST treatments. POST herbicides, consisting of (glyphosate 706 g ae ha\(^{-1}\) + fomesafen 266 g ai ha\(^{-1}\) + S-metolachlor 1,212 g ai ha\(^{-1}\)), (glufosinate 594 g ai ha\(^{-1}\) + fomesafen 266 g ha\(^{-1}\) + S-metolachlor 1212 g ha\(^{-1}\)), (dicamba 560 g ae ha\(^{-1}\)), and (2,4-D 1,064 g ae ha\(^{-1}\) + glyphosate 1,009 g ha\(^{-1}\) + S-metolachlor 1,064 g ha\(^{-1}\)), were applied 28 DAP and evaluated 14 days later. Dicamba-, 2,4-D-, and glufosinate-containing treatments provided above 90% control, all significantly similar. The glyphosate-containing treatment was significantly worse and provided only 70% control averaged across all PRE herbicide programs. POST treatments containing dicamba, glufosinate, or 2,4-D still provided above 90% control 56 DAP, with the glyphosate-containing treatments being the only significantly different treatment averaging 19% control across PRE programs. This research indicates effective and comparable levels of PPO-resistant Palmer amaranth control are obtainable when a PRE followed by POST herbicide program is used in Xtend, Enlist, or LibertyLink soybean.
THE EFFECT OF GRASP (PENOXSULAM) AND REGIMENT (BISPYRIBAC) APPLICATION TIMING ON BOLT SOYBEAN (GLYCINE MAX) GROWTH AND YIELD. D.C. Walker*, D.B. Reynolds2, J. Bond3; 1Mississippi State University, Starkville, MS, 2Mississippi State University, Mississippi State, MS, 3Delta Research and Extension Center, Stoneville, MS (139)

ABSTRACT

DuPont Pioneer’s new herbicide-tolerant soybean, BOLT™ is a further development of their sulfonylurea tolerant soybean line. This technology allows producers to spray LeadOff® (rimsulfuron, thifensulfuron-methyl) and Basis® Blend (rimsulfuron, thifensulfuron-methyl) at burndown with no soybean plantback interval. Off-target deposition of ALS inhibiting herbicides used in rice can result in severe soybean injury and yield loss. The increased tolerance to ALS herbicides by BOLT soybean may provide protection to these off-target herbicides. Therefore, an overall evaluation of soybean with BOLT technology as a drift mitigation tool for off-target deposition of Grasp and Regiment herbicides on rice is necessary. If successful, BOLT soybean use could be widely adopted by local growers to provide a means of mitigating off-target herbicides. The two main objectives of this study were to determine the effect of application timing of penoxsulam and bispyribac-sodium on BOLT soybean growth and yield. Experiments were conducted in 2016 and 2017 in Brooksville and Starkville, MS. A single rate of penoxsulam (10.1 g ai ha⁻¹) or bispyribac-sodium (8.4 g ai ha⁻¹) was applied at weekly intervals ranging from preemergence to 14 weeks after emergence (WAE). The rates for each herbicide are 1/4X of the full labeled rate (penoxsulam = 40.3 g ai ha⁻¹; bispyribac-sodium = 33.6 g ai ha⁻¹). Each application included a surfactant (penoxsulam including MSO – premium blend at 2.33 L ha⁻¹ and bispyribac-sodium including Dyne-a-Pack at 1% v/v). All applications were made at 140 L ha⁻¹ using Teejet AIXR 110015 nozzles. Visual injury ratings were recorded 7, 14, 21, and 28 DAT and soybean yield were recorded at the conclusion of the growing season. Results indicate that BOLT soybean are most susceptible to penoxsulam deposition at 5 (R1) or 7-9 WAE (R3-R4) with 12, 16, 18, and 17 percent yield reductions respectively. BOLT soybean were most susceptible to bispyribac-sodium deposition at 2 (V3) or 7-8 WAE (R3-R4) with 17, 17, and 19 percent yield reductions respectively.
EFFECT OF EARLY APPLICATIONS OF ACETOCHLOR ON RICE TOLERANCE. M. Fogleman*, J. Norsworthy, Z.D. Lancaster, M.H. Moore; University of Arkansas, Fayetteville, AR (140)

ABSTRACT

Continued evolution of herbicide resistance has led to few effective options for controlling herbicide-resistant barnyardgrass (Echinochloa crus-galli) in Arkansas rice. A lack of new herbicide discovery in recent years has led to exploration of current herbicides which are not labeled for use in rice, targeting alternative sites of action (SOA). Very long-chain fatty acid (VLCFA)-inhibiting herbicides such as acetochlor have relatively low risk of resistance, and provide residual control of grassy weeds in many row crops, indicating potential value in rice. Field experiments were conducted in eastern Arkansas in 2016 and 2017 on silt loam soils to determine the effects of acetochlor formulation and rate on rice tolerance. Experiments were designed as a three-factor randomized complete block with factors being A) formulation (microencapsulated as Warrant; emulsifiable concentrate as Harness), B) rate (1X and 2X, at 1050 and 2100 g ai ha⁻¹, respectively), and C) application timing (preemergence – PRE, delayed preemergence – DPRE, and early postemergence – EPOST). Differences in rainfall between locations and years caused variation in acetochlor activation and affected crop damage. Overall, rice displayed greater tolerance to applications of Warrant than to Harness, likely due to the gradual release of acetochlor in Warrant, and the immediate availability of acetochlor in Harness upon activation by rainfall. Applications made at the EPOST timing caused marginal crop injury, while applications made at the PRE or DPRE timing caused unacceptable injury, regardless of formulation. Warrant, even at the higher rate, resulted in <10% crop injury four weeks after flooding when applied at the EPOST timing, indicating that applications should be delayed until this stage to minimize crop damage.
AVOIDING PPO-RESISTANT PALMER AMARANTH IN SOYBEAN. H.B. Blake*,1, C. Cahoon2, M. Flessner3, C. Askew4, J.H. Ferebee IV4, T. Hines4; 1Graduate Research Assistant (Dr. Cahoon), Painter, VA, 2Eastern Shore ARC Virginia Tech, Painter, VA, 3Virginia Tech, Blacksburg, VA, 4Virginia Tech, Painter, VA (141)

ABSTRACT

Glyphosate- and ALS-resistant Palmer amaranth (Amaranthus palmeri) is one of the most troublesome weeds plaguing Virginia soybeans. Soybean growers now rely on PPO-inhibiting herbicides to control the weed. In Virginia, soybean growers routinely apply a residual product containing flumioxazin preemergence (PRE) followed by fomesafen postemergence (POST); both of these products are PPO-inhibiting herbicides. Although PPO-inhibiting herbicides provide excellent control of Palmer amaranth, there has been an overreliance on this mode of action. PPO-resistant biotypes of Palmer amaranth now exist in many states. The objective of this project is to evaluate residual control of Palmer amaranth by PPO, non-PPO, and PPO + non-PPO tank mixtures applied PRE with the overall goal of reducing PPO selection pressure. Studies were conducted near Painter and Suffolk, VA. Glufosinate resistant soybean cultivar DYNA GRO S49LL34 was planted in Painter, VA on May 19, 2017 whereas glyphosate tolerant cultivar AG 48X7 RR2XF was planted in Suffolk, VA on May 17, 2017. Treatments were replicated 4 times and organized in a randomized complete block design. Preemergence herbicide treatments were applied immediately following planting and consisted of flumioxazin (107 g ai/ha), sulfentrazone (210 g ai/ha), metribuzin (280 g ai/ha), pyroxasulfone (119 g ai/ha), pendimethalin (799 g ai/ha) flumioxazin + pyroxasulfone (88 + 112 g ai/ha), and sulfentrazone + metribuzin (176 + 265 g ai/ha). Glufosinate (656 g ai/ha) and glyphosate (1,262 g ae/ha) were applied POST approximately 4 weeks after planting at Painter and Suffolk, respectively. Just before POST in Suffolk, flumioxazin, pyroxasulfone, flumioxazin + metribuzin, flumioxazin + pyroxasulfone, flumioxazin + pendimethalin, carfentrazone + sulfentrazone + pyroxasulfone, carfentrazone + sulfentrazone + pendimethalin, metribuzin + pyroxasulfone, and pyroxasulfone + pendimethalin controlled Palmer amaranth 94 to 100%. Carfentrazone + sulfentrazone and sulfentrazone + metribuzin both provided ~85% control. Metribuzin + pendimethalin controlled Palmer amaranth 73%, while metribuzin and pendimethalin both provided less than 50% control. Control in Painter, VA was similar to that in Suffolk; all treatments other than metribuzin and pyroxasulfone controlled Palmer amaranth 90%; metribuzin controlled 74% and pendimethalin 78%. Although excellent control was accomplished by several PREs, there were herbicides that caused damage to soybeans. Flumioxazin and flumioxazin mixtures caused necrosis on leaves and stems; pyroxasulfone caused stunting to plots that were treated by pyroxasulfone alone or in mixture applications. To decrease PPO-selection pressure, it would be wise for soybean growers to incorporate a non-PPO PRE, either in substitution for or in combination with a PPO.
GROWTH CHARACTERISTICS AND CONTROL OF NEALLEY'S SPRANGLETOP (LEPTOCHLOA NEALLEYIVASEY). T. Buck*1, D.O. Stephenson2, B. Woolam2, J. McKibben3; 1LSU Ag Center, Gates, NC, 2LSU Ag Center, Alexandria, LA, 3LSU AgCenter, Baton Rouge, LA (142)

ABSTRACT

Research was conducted at the LSU AgCenter Dean Lee Research and Extension Center near Alexandria, LA in 2016 and 2017 to evaluate the growth characteristics and control of Nealley’s sprangletop. Growth characteristics were evaluated utilizing a factorial arranged in a completely random design with 12 replications. Factors included Nealley’s and Amazon sprangletop [Diplachne panicoides (J. Presl) McNeill] plants and destructive harvest intervals of 2, 4, and 6 wk after emergence (WAE). Amazon sprangletop was included for comparison. Harvest intervals were based upon soybean critical weed-free period. Individual plants were considered an experimental unit. Prior to each destructive harvest, total height, canopy width, tiller number, and leaf number were recorded for 12 Nealley’s and Amazon sprangletop plants. After harvest, leaves were separated from the stem and total leaf area (cm²) was determined photometrically using a leaf area meter. Leaves and stems were dried for 7 d then weights recorded. Data was utilized to calculate multiple plant growth characteristic measurements; however, only leaf area ratio (LAR) and net assimilation rate (NAR) are presented. To evaluate control strategies, herbicide treatments were evaluated in a randomized complete block design with 6 replications in a greenhouse and was repeated. Herbicide treatments included a non-selective herbicide, glyphosate at 1120 g ae ha⁻¹ or glufosinate at 594 g ai ha⁻¹, applied alone or in combination with clethodim at 102 g ai ha⁻¹ or quizalfop at 93 g ai ha⁻¹. All herbicide treatments were applied once or sequentially with second application occurring 28 d after initial application. Initial applications of all treatments were applied to either 10 or 31 cm Nealley’s sprangletop. All glyphosate or glufosinate treatments were evaluated in separate studies. For all control studies, visual control was evaluated 7, 14, 21, and 28 d after treatment (DAT). Only 28 DAT control data are presented. After final evaluation, plants were clipped at soil surface, dried for 7 d, and dry weight recorded.

Amazon sprangletop LAR was greater than Nealley’s sprangletop at 2 and 4 WAE. Amazon and Nealley’s sprangletop LAR was 63.2 and 32.6 cm² g⁻¹, respectively, 2 WAE and 91.5 and 52.2 cm² g⁻¹, respectively, 4 WAE. LAR was similar 6 WAE (48.1 to 53.8 cm² g⁻¹). Due to higher LAR, Amazon sprangletop has a higher photosynthetic capacity than Nealley’s sprangletop making it a larger more vigorous plant. Amazon and Nealley’s sprangletop NAR was similar 2 and 4 WAE and ranged -0.19 to 1.5 g cm⁻² d⁻¹. However, at 6 WAE, Amazon sprangletop NAR was 30.2 g cm⁻² d⁻¹ while Nealley’s sprangletop was 12.9 g cm⁻² d⁻¹. The higher NAR observed with Amazon compared to Nealley’s sprangletop indicates a higher leaf photosynthetic activity giving it the ability to utilize sunlight more efficiently for rapid growth.

In the glyphosate-focused control study, all treatments provided at least 92% Nealley’s sprangletop control 28 DAT except single or sequential applications of glyphosate applied to 31 cm Nealley’s sprangletop which provided 45 or 62% control, respectively. Without a graminicide, single and sequential glyphosate applications controlled Nealley’s sprangletop
greater when the initial application was at 10 cm (94 to 97%) compared to when initial application was at 31 cm (45 and 62%), indicating an inverse relationship between glyphosate efficacy and Nealley’s sprangletop height at application. Biomass was 2.31 g following a single application of glyphosate when applied to 31 cm Nealley’s sprangletop. However, biomass following sequential glyphosate applications whose initial application was to 31 cm Nealley’s sprangletop was not different than all other treatments whose initial application was to 31 cm (0.41 to 1.97 g). All treatments, regardless of Nealley’s sprangletop size at initial application, reduced biomass compared to the nontreated (10.97 g). In the glufosinate-focused control study, all applications whose initial application was at 10 cm Nealley’s sprangletop provided better control than when the initial application was to 31 cm Nealley’s sprangletop at 28 DAT. Sequential applications of glufosinate + quizalfop, regardless of Nealley’s sprangletop height at initial application, provided at least 95% control. Glufosinate + clethodim alone or sequentially provided similar control. Nealley’s sprangletop biomass following all treatments, except glufosinate alone applied to 31 cm Nealley’s sprangletop, was similar (0.08 to 1.56 g). All glufosinate-focused treatments, regardless of Nealley’s sprangletop size at initial application, reduced biomass compared to the nontreated (10.66 g). Glyphosate, with and without clethodim or quizalfop, provided excellent Nealley’s sprangletop control at 28 DAT. However, sequential applications of glufosinate and a graminicide were needed to control Nealley’s sprangletop at least 90% at 28 DAT. Nealley’s sprangletop management would be maximized utilizing herbicide programs in glyphosate-resistant soybean.
EFFECT OF DELAYED DICAMBA PLUS PPOS ON SOYBEAN YIELD AND PALMER AMARANTH CONTROL. J.H. Ferebee IV*1, C. Cahoon2, M. Flessner3, T. Hines1, C. Askew1, H.B. Blake4; 1Virginia Tech, Painter, VA, 2Eastern Shore ARC Virginia Tech, Painter, VA, 3Virginia Tech, Blacksburg, VA, 4Graduate Research Assistant (Dr. Cahoon), Painter, VA

ABSTRACT

Palmer amaranth (Amaranthus palmeri) is one of the most economically damaging weeds in the southern United States, developing resistance to six different herbicide modes of action. Timely postemergence (POST) control (< 10 cm height) is critical to consistent control of the weed. However, soybean growers routinely face larger Palmer amaranth due to escapes from earlier POST applications or weather delays. Experiments were initiated near Painter and Suffolk, VA to evaluate effectiveness of two applications of dicamba + a PPO-inhibiting herbicide for Palmer amaranth control when initial POST application is delayed. A Roundup Ready 2 Extend soybean cultivar was planted on May 17, 2017 at Suffolk and June 12, 2017 at Painter. All treatments were applied using a CO2-pressurized backpack sprayer. Treatments consisted of dicamba (561 g ae/ha) + fomesafen (423 g ai/ha) applied timely to small Palmer amaranth (< 5 cm; Day 0) and at simulated delays of 7, 14, 21, and 28 days after the initial application. All treatments received dicamba (561 g ae/ha) + lactofen (219 g ai/ha) 14 days after the first POST application. By the 28-day delay, Palmer amaranth was 94 cm tall. Soybean injury and Palmer amaranth control were evaluated periodically throughout the season. Palmer amaranth fresh weights were collected in September and soybean heights were collected 56 days after the 1st postemergence application. Dicamba plus fomesafen easily controlled small Palmer amaranth. This combination was less effective against larger Palmer amaranth. Surprisingly, Palmer amaranth, up to heights of 94 cm, was controlled 100% late in the season by dicamba + fomesafen followed by dicamba + lactofen 14 days later. Dicamba + fomesafen and dicamba + lactofen injured soybeans 7 days after POST applications, however, injury was transient and no injury was observed late in the season. Similarly, soybean height was only slightly reduced by dicamba + PPO inhibiting herbicides applied twice. Differences in soybean height were primarily due to prolonged competition with Palmer amaranth. Despite effective Palmer amaranth control late in the season, soybean yields in Painter, VA were reduced in plots where the initial POST application was delayed 28 days. Based on 2017 research, we can conclude that dicamba plus PPO inhibitors applied twice effectively controls Palmer amaranth up to heights of up to 94 cm. Growers will find utility in dicamba + PPO inhibiting herbicide applied sequentially for salvage control of Palmer amaranth. However, these applications should be viewed as a “last resort”. Timely control of small Palmer amaranth (< 4”) remains critical to avoiding PPO- or dicamba-resistance and preserving soybean yield.
PEANUT & WEED RESPONSE TO POSTEMERGENCE HERBICIDE TANK-MIXTURES & ELE-MAX NUTRIENT CONCENTRATE. K. Eason*1, R. Tubbs2, T. Grey2, S. Li3, E.P. Prostko2, O. Carter2; 1The University of Georgia, Tifton, GA, 2University of Georgia, Tifton, GA, 3Auburn University, Auburn, AL (144)

ABSTRACT

Weed control is an integral part of ensuring that peanuts achieve the largest yields possible. Paraquat is a key component of postemergence (POST) weed control programs in peanut. Producers typically include bentazon in paraquat tank-mixtures to reduce injury and increase the flexibility of application timings. Recently, some producers in Georgia are using Ele-Max Nutrient Concentrate (ENC) instead of bentazon. ENC is 11-8-5 fertilizer with EDTA chelated minor elements. Little data is available on the specific interactions between ENC and paraquat. Research was conducted in the greenhouse to determine the phytotoxic effects and efficacy of POST paraquat tank-mixtures containing ENC on multiple weed species. Injury (% chlorosis/necrosis) was measured on smallflower morningglory (Jacquemontia tamnifolia [L.]). Field trials were completed in 2016 and 2017 to determine peanut injury and yield effects of ENC and POST herbicide tank-mixtures containing paraquat on peanut. Peanut foliage injury (%chlorosis/necrosis & % stunting), yield (kg/ha), and grade (% total sound mature kernel [tsmk]) were measured at Plains, GA and Attapulgus, GA. The greenhouse experiments were a split-plot design while the field experiments were a randomized complete block design. Field applications were applied at 15 days after cracking (DAC). The greenhouse and field trials used the following treatments: control, paraquat, paraquat + S-metolachlor, paraquat + S-metolachlor + acifluorfen + bentazon, ENC, ENC + paraquat, ENC + paraquat + S-metolachlor, and ENC + paraquat + S-metolachlor + acifluorfen + bentazon. In the greenhouse, ENC + paraquat + S-metolachlor + acifluorfen + bentazon treatment resulted in the greatest amount of injury to smallflower morningglory (85%). Generally, the amount of chlorosis/necrosis on the peanut leaf was reduced when ENC was added to the tank-mixture. However, there were no differences between ENC treatments after 4 days after treatment (DAT). There was a downward trend over time for the amount of stunting over all herbicide treatments. Paraquat + S-metolachlor had the greatest amount of stunting at 4, 7, 11, and 14 DAT (25, 15, 13, 3%). ENC had no effect on yield or grade (p=0.66 & p=0.14). The use of ENC as a replacement for bentazon lessens the amount of control of smallflower morningglory when compared to the established paraquat and bentazon tank-mixture. While ENC does reduce injury of POST tank-mixtures containing paraquat immediately after application, there are no long term positive effects on yield or grade.
SOYBEAN RESPONSE TO SUB-LETHAL RATES OF DICAMBA. N.G. Corban*1, J. Bond2, B. Lawrence3, T.L. Sanders1, B.K. Pieralisi1, B. Golden2; 1Mississippi State University, Greenville, MS, 2Delta Research and Extension Center, Stoneville, MS, 3Mississippi State University, Stoneville, MS (145)

ABSTRACT

Dicamba formulations received labeling in 2017 in the U.S. 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 to exposure to sub-lethal rates of different dicamba formulations and evaluate the performance of soybean cultivars representing different soybean maturity groups following multiple exposures to a sub-lethal rate of dicamba.

Two studies were conducted in 2017 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate the influence of dicamba formulation and maturity group on soybean performance following exposure to a sub-lethal rate of dicamba. The experimental design for both studies was a randomized complete block design with four replications. The dicamba formulation study evaluated Rifle [dimethylamine salt (DMA)], Clarity [diglycolamine salt (DGA)], Engenia [N, N-Bis-(aminopropyl) methylamine (BAPMA)], FeXapan plus Vapor Grip (DGA), and Xtendimax with Vaporgrip (DGA) at 0.0039 lb ae/A (1/128th of labeled rate) applied at the R1 soybean growth stage. A nontreated control was included for comparison. Treatments in the maturity group study were arranged as a two-factor factorial. Factor A was maturity group and consisted of cultivars representing maturity groups IV ('Asgrow 4632') and V ('Asgrow 5332'). Factor B was timings of dicamba exposure and included no dicamba and dicamba at V3 followed by (fb) R1 (V3/R1), V3 fb R3 (V3/R3), and R1 fb R3 (R1/R3) soybean growth stages. Dicamba was applied as Clarity at 0.0039 lb/A. In both studies, visual estimates of soybean injury were recorded 7, 14, 21, 28 and 48 d after treatment (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 by Duncan’s new multiple range test at p≤0.05.

No differences in soybean injury or height were detected among dicamba formulations 14 DAT. Soybean injury 28 DAT was greater with Clarity than with Xtendimax plus Vaporgrip; however, injury with all treatments was ≥56%. Rifle, FeXapan with VaporGrip, and Engenia injured soybean similar to both Clarity and Xtendimax with VaporGrip. Soybean yield following exposure to Engenia and FeXapan plus VaporGrip was lower than that following exposure to Rifle and Xtendimax plus Vaporgrip, but all dicamba formulations reduced soybean yield to ≤ 59% of the nontreated control.

At 28 and 48 d after the last application, soybean injury exhibited by cultivars representing maturity groups IV and V was similar for each dicamba exposure timing. Within each maturity group, differences in injury were detected among the dicamba exposure timings. For example,
injury 28 d after the last application was similar for V3/R1 and V3/R3 dicamba exposure timings on maturity group IV soybean; however, dicamba at V3/R3 injured maturity group V soybean more than dicamba at V3/R1. For both maturity groups, injury 28 d after the last application was greatest with R1/R3 dicamba exposure timings. Mature soybean height for each maturity group was reduced to ≤65% of the nontreated control for all dicamba exposure timings. Additionally, mature soybean height was ≤46% of the nontreated control for any dicamba exposure timing including the R3 growth stage. Yields of maturity group V soybean were greater than those for maturity group IV soybean following dicamba at V3/R1 and V3/R3. For both maturity groups, greatest yield reduction was caused by dicamba at R1/R3.

Although differences in soybean injury 28 DAT and yield were observed following exposure to a sub-lethal rate of different formulations of dicamba, no clear pattern in response was detected. Furthermore, soybean injury and yield reductions were severe with all formulations. Although injury was similar between soybean cultivars representing maturity groups IV and V for each dicamba exposure timing, agronomic performance varied between the cultivars. Yield reductions were greater for maturity group IV compared with V for two (V3/R1 and V3/R3) of the dicamba exposure timings. Exposing both cultivars to dicamba multiple times during reproductive growth stages (R1/R3) produced the most severe yield reductions.
WEED CONTROL AND SUGARCANE RESPONSE TO TOPRAMEZONE ALONE OR IN TANK-MIXING WITH TRIAZINES. R. Negrisoli*, D. Odero, G. MacDonald, B. Sellers, D.H. Laughinghouse; 1University of Florida, Belle Glade, FL, 2University of Florida, Gainesville, FL, 3University of Florida, Ona, FL, 4University of Florida, Fort Lauderdale, FL

ABSTRACT

There are limited herbicide options for weed control in sugarcane making evaluation of new herbicides for the crop critical. Topramezone was recently registered for use in sugarcane for postemergence control of annual and perennial weeds. The key to successful use of topramezone in Florida sugarcane will depend on its efficacy on weed control and crop safety. Field studies were conducted on organic soils in Belle Glade, FL in 2016 to 2017 to evaluate sugarcane tolerance to topramezone applied alone or in combination with triazine herbicides (atrazine, metribuzin, ametryn) currently used in sugarcane, and to determine their efficacy on weed control. Tolerance of new plant cane sugarcane varieties (‘CPCL 05-1201’, ‘CP96-1252’, ‘CPCL 02-0926’, ‘CPCL 00-4111’) to topramezone (25 and 50 g/ha) applied alone or in combination with atrazine (2240 g/ha), metribuzin (2240 g/ha), and ametryn (440 g/ha) was evaluated using a randomized complete block design with a split-plot arrangement and replicated four times. Whole plots consisted of the four sugarcane varieties and sub-plots consisted of 11 herbicide treatments and a weed-free control. Sugarcane tolerance to topramezone and triazine combinations was evaluated by determining chlorophyll fluorescence (Fv/Fm), chlorophyll content, and carotenoid content using the top visible dewlap leaf at 7, 14, 21, and 28 days after treatment (DAT). The herbicide efficacy study set up as a randomized complete block design with four replications was conducted on first ratoon sugarcane variety ‘CP96-1252’ using similar herbicide treatments as the tolerance study. Asulam at 3740 g/ha and an untreated control were included. Weed control was evaluated at 14, 28, 42, 56, and 70 DAT. All data were subjected to ANOVA using a mixed linear model and treatment means were separated using Tukey’s test at the 0.05 level of significance. Chlorophyll fluorescence for ‘CPCL 05-1201’ and ‘CPCL 00-4111’ were affected by topramezone (50 g/ha) + ametryn at 7 DAT while that of ‘CP96-1252’ was affected by the tank-mix with atrazine compared to the untreated control. At 14 DAT, all herbicide treatments across all varieties had no effect on chlorophyll fluorescence with the exception of topramezone (50 g/ha) + ametryn. Herbicide effect on chlorophyll fluorescence was not observed 21 DAT. Carotenoid content of all varieties were affected by topramezone (25 and 50 g/ha) + metribuzin or topramezone (50 g/ha) + ametryn at 7 and 14 DAT compared to the untreated control. No herbicide effect on carotenoid content was observed 21 DAT. Similarly, topramezone (50 g/ha) + atrazine or ametryn affected chlorophyll a and b contents compared to the untreated control at 7 and 14 DAT with no effect observed at 21 DAT. Sugarcane was able to fully recover by 21 DAT indicating that it was probably able to metabolize the herbicides after this time period. Fall panicum, the predominant weed species at the study sites was controlled 85 to 94% by topramezone and triazine tank-mixes compared to 34% by asulam at 14 DAT. At 28 DAT, topramezone at 25 and 50 g/ha + metribuzin provided 78 and 88% fall panicum control, respectively compared to other topramezone treatments that provided 50 to 68% control, and 87% control by asulam. By canopy closure (56 to 70 DAT), fall panicum control was 84% and 89% by topramezone (50 g/ha) + metribuzin and asulam, respectively indicating that the tank-
mix provided fall panicum control that was not significantly different from asulam which is commonly used for grass control in Florida sugarcane. More studies are ongoing to evaluate effect of timing of application on the efficacy of topramezone and triazine tank-mixes on fall panicum and control of other weed species in Florida sugarcane.
EFFECT OF DROPLET SIZE, VOLATILITY, SOLUBILITY AND ADSORPTION ON HERBICIDE EFFICACY OF PRE-EMERGENCE HERBICIDES IN SOYBEANS. P.H. Urach Ferreira*, D.B. Reynolds2, G. Kruger3, J. C. Ferguson1; 1Mississippi State University, MS State, MS, 2Mississippi State University, Mississippi State, MS, 3University of Nebraska-Lincoln, North Platte, NE (147)

ABSTRACT

Studies have shown that droplet size and spray coverage significantly impacts post-emergence herbicide control. Very little is known about droplet size effects for pre-emergence herbicides, especially when considering herbicide physical/chemical properties like adsorption, solubility and volatility. This study evaluated droplet size influence on pre-emergence herbicide weed control focused on adsorption, solubility and volatility characteristics. Studies were conducted at four field locations in three counties in northwest Missouri, in June 2017. Herbicides selected for the study were: pendimethalin, metribuzin, clomazone, imazethapyr and pyroxasulfone using four nozzles: XR11002, ULD12002, TTI6011002 and TTI11002. Spray applications were made at 276 kPa and 140 L ha⁻¹ using a four boom CO₂ sprayer. Droplet size was measured in a wind tunnel at the PAT Lab at the University of Nebraska West Central Research and Extension Center in North Platte, NE. Spray coverage was collected at each field location using water-sensitive paper. The nozzle with the greatest spray coverage was the XR11002 at 34%, while the lowest was the TTI6011002 at 19.3%. No weed control differences were observed for the nozzles studied except when comparing the herbicides by adsorption. The TTI6011002 had lower weed control (82%) for the high adsorptive herbicide, pendimethalin compared to the low adsorptive herbicide, metribuzin (96%). Studies will be repeated in field studies in four locations in Mississippi and greenhouse studies will be added to measure the effect of crop residue, rainfall timing, and soil organic matter effects with these herbicides and nozzle treatments.
OPTIMIZING CHLOROACETAMIDE PLACEMENT IN COTTON PRODUCTION SYSTEMS. S. Davis*1, D. Dodds1, A. Mills2, B. Wilson3; 1Mississippi State University, Mississippi State, MS, 2Monsanto Company, Collierville, TN, 3Mississippi State, Mississippi State, MS (148)

ABSTRACT

An experiment was conducted at Hood Farms in Dundee, MS in 2017 to determine the optimal placement of chloroacetamide herbicides in a cotton production system. The location selected for this experiment was naturally infested with glyphosate-resistant Palmer amaranth. Treatments were arranged in a randomized complete block design. Delta Pine 1646 B2XF was seeded in this study on 10 May 2017. An untreated control utilized for comparison purposes. Preemergence applications were made on 11 May 2017 and included: acetochlor (1.3 kg ai ha⁻¹), dicamba (0.56 kg ae ha⁻¹), and acetochlor + dicamba. When cotton reached 3 – 4 true leaves, an early POST application was made (06 June 2017) which included glyphosate (1.1 kg ae ha⁻¹), MON 76981 (1.7 kg ae ha⁻¹; a pre-mix of dicamba and glyphosate), as well as acetochlor in combination with both herbicides. A late POST application was made when cotton reached 6 – 8 true leaves (27 June 2017) and the same herbicides were used at this time as the early POST application. All applications were made using a CO₂ – powered backpack sprayer. Data collected throughout the season included visual Palmer amaranth control and seed cotton yield. These data were analyzed in SAS v9.4 using the PROC GLIMMIX procedure. Data were subjected to analysis of variance (ANOVA) and means were separated using Fisher’s Protected LSD at a 95% confidence level.

Preemergence herbicide applications provided significantly greater Palmer amaranth control (>87%) at the time of the early POST application than untreated control plots. The combination of acetochlor + dicamba applied early POST resulted in significantly greater control (90%) than acetochlor (40%) and dicamba (47%) applied alone. At the end of the season, applications of dicamba (PRE) followed by (fb) acetochlor + glyphosate fb acetochlor + MON 76981 and dicamba (PRE) fb glyphosate fb MON 76981 provided significantly less Palmer amaranth control (84%, 84%; respectively) than other treatments. There were no significant differences due to POST herbicide treatments in terms of cotton yield.
DROPLET SIZE EFFECTS ON PREEMERGENCE HERBICIDE EFFICACY FOR ITALIAN RYEGRASS (LOLIUM PERENNE SSP. MULTIFLORUM LAM. HUSNOT) CONTROL IN CORN. M.T. Wesley*1, D.B. Reynolds2, J. Bond3, E.J. Larson1, P.H. Urach Ferreira1, J. Ferguson1; 1Mississippi State University, MS State, MS, 2Mississippi State University, Mississippi State, MS, 3Delta Research and Extension Center, Stoneville, MS (149)

ABSTRACT

Research was conducted to examine effects of droplet size on the efficacy of preemergent herbicides for Italian ryegrass (Lolium perenne ssp. multiflorum) in November of 2017. A field study was conducted at the Black Belt Research Station in Brooksville, Mississippi and a greenhouse study was conducted at the Rodney Foil Plant Science Research Center in MS State, Mississippi. Nozzles used in this study included: TT110015, AIXR110015, and TTI110015. Two preemergent herbicides were included: s-metolachlor (Dual II Magnum) at 1606 g ai ha⁻¹ and pyroxasulfone (Zidua SC) at 183 g ai ha⁻¹. Nineteen treatments were arranged in a Randomized Complete Block Design (RCBD) with four replications. Treatments were applied with a four nozzle boom sprayer at 4.3 km h⁻¹ with three by nine meter plots, bedded to 97 cm rows and seeded with L. multiflorum at 112 kg ha⁻¹. The greenhouse study was applied with a two-nozzle track sprayer over 25 centimeter square trays seeded with L. multiflorum at 112 kg ha⁻¹. All treatments were applied with a carrier volume of 140 L ha⁻¹ and a pressure of 276 kPa. Treatments of each study were rated 7, 14, 28, and 56 DAT for L. multiflorum emergence. These ratings were then converted to suppression. Initial results indicated a nozzle effect in the field study, but not the greenhouse study. Further research will be conducted in 2018 to repeat the study to better parse out differences for nozzle type and preemergent herbicide efficacy for control of L. multiflorum.
EVALUATION OF FLURIDONE FOR PREEMERGENCE COMMON RAGWEED CONTROL IN COTTON. C. Askew*1, C. Cahoon2, D. Jordan3, M. Flessner4, H.B. Blake5, J.H. Ferebee IV1, A. Hare3, T. Hines1; 1Virginia Tech, Painter, VA, 2Eastern Shore ARC Virginia Tech, Painter, VA, 3North Carolina State University, Raleigh, NC, 4Virginia Tech, Blacksburg, VA, 5Graduate Research Assistant (Dr. Cahoon), Painter, VA (150)

ABSTRACT

Glyphosate- and ALS-resistant common ragweed is commonplace in Virginia and can be difficult to control in cotton. Cotton producers have turned to fluometuron and fomesafen applied preemergence (PRE) and glufosinate applied postemergence (POST) to effectively control common ragweed. However, fluometuron and fomesafen are capable of injuring cotton grown on coarse-textured soils typical of Tidewater Virginia. Therefore, cotton growers are interested in residual options for common ragweed control with less potential for crop injury. The objective of this study was to evaluate common ragweed control by fluridone and fluridone combinations compared to current standards. Field experiments were conducted on a Bojac sandy loam soil near Painter, VA at the Eastern Shore Agriculture Research and Extension Center (AREC) and on a Suffolk loamy sand near Suffolk, VA at the Tidewater AREC during 2016 and 2017. Deltapine 1538BG2XF was planted at the Painter, VA location, and Deltapine 1522BG2XF was planted at the Suffolk, VA location during the 2016 growing season. During 2017, Deltapine 1538BG2XF was planted at Painter, VA, and Phytogen 330W3FE was planted at Suffolk, VA. Preemergence herbicides were applied immediately after planting. Herbicide treatments (rates in parenthesis) included fluridone (0.168 kg ai ha\(^{-1}\)), fluometuron (0.84 kg ai ha\(^{-1}\)), prometryn (0.84 kg ai ha\(^{-1}\)), fomesafen (0.28 kg ai ha\(^{-1}\)), fluridone + fomesafen premix (0.518 kg ai ha\(^{-1}\)), fluridone + fluometuron premix (1.008 kg ai ha\(^{-1}\)), fluridone + prometryn (0.168 kg ai ha\(^{-1}\) + 0.84 kg ai ha\(^{-1}\)), fluometuron + prometryn (0.84 kg ai ha\(^{-1}\) + 0.84 kg ai ha\(^{-1}\)), fluometuron + fomesafen (0.84 kg ai ha\(^{-1}\) + 0.21 kg ai ha\(^{-1}\)), fomesafen + prometryn (0.21 kg ai ha\(^{-1}\) + 0.84 kg ai ha\(^{-1}\)), fluridone + fomesafen premix + fluometuron (0.518 kg ai ha\(^{-1}\) + 0.84 kg ai ha\(^{-1}\)), fluridone + fomesafen premix + prometryn (0.518 kg ai ha\(^{-1}\) + 0.84 kg ai ha\(^{-1}\)), and fluridone + fomesafen premix + prometryn (1.008 kg ai ha\(^{-1}\) + 0.84 kg ai ha\(^{-1}\)). A non-treated check was included for comparison. Postemergence applications of glyphosate (1.26 kg ae ha\(^{-1}\)) + glufosinate (0.655 kg ai ha\(^{-1}\)) was applied POST 8 weeks after planting (WAP) to clean up treatments and condition plots for harvest. Visual estimates of common ragweed control and cotton injury were collected 2, 4, 6, and 8 WAP. Plots were harvested and weighed at the conclusion of the season to determine seedcotton yield. Data were subjected to ANOVA using JMP Pro 13 and means separated using Student’s T test (Fisher’s Protected LSD) at \(p \leq 0.05\). Common ragweed was controlled 93 to 100% by all treatments except fluometuron and prometryn 2 WAP. At that time, fluometuron and prometryn controlled common ragweed 88 and 82%, respectively. Similar results were observed 4 WAP. At this time, all treatments except prometryn (54%) controlled common ragweed 88 to 100%. Treatments including fluridone controlled common ragweed well (89 to 100%), while the industry standard, fluometuron, controlled the weed 88%. At 8 WAP, prometryn alone, fluometuron alone, fomesafen alone, and fluridone alone controlled common ragweed 44, 79, 83, and 92% respectively. Combinations that included fluridone controlled common ragweed 91 to 98% at the same timing, while combinations that did not include fluridone were less effective (85 to 95%). Early season injury was transient and likely did not impact seedcotton yield. Seedcotton
yield ranged from 1,760 kg/ha\(^{-1}\) to 2,734 kg/ha\(^{-1}\). Plot receiving fluridone alone or in combination with another residual herbicide yielded more seedcotton than plots receiving prometryn, fomesafen, and fomesafen + prometryn.
COTTON RESPONSE TO GLUFOSINATE & GLUFOSINATE CO-APPLIED WITH S-METOLACHLOR WITH TWO NOZZLE TYPES. W. Greene*1, J.A. Tredaway2, B. Greer2, J. Jones1, A. Poncet1; 1Auburn University, Auburn, AL, 2Auburn University, Auburn University, AL (151)

ABSTRACT

Field studies were conducted at the Prattville Agricultural Research Unit in Prattville, AL in 2017 and greenhouse studies were conducted at the Plant Science Research Center in Auburn, AL in 2017 to determine the effect of early-postemergence (EPOST) and mid-postemergence (MPOST) applications of glufosinate, when applied alone and in combination with S-metolachlor, on cotton growth and yield. Each study consisted of three varieties of cotton including LibertyLink, WIdeStrike, and Dicamba tolerant varieties and two nozzle types, an XR flat fan nozzle and a TTI nozzle. Herbicide applications consisted of glufosinate applied alone at 0.6 kg ha⁻¹, and in combination with S-metolachlor applied at 1.39 kg ha⁻¹. The experimental design was a randomized complete block design with a factorial treatment arrangement with 4 replications. In the field study, identical treatments were applied to 4 and 8 leaf cotton and visual injury data, evaluated on a scale of 0-100%, was collected at 7 and 14 days after application as well as cotton lint yields. In the greenhouse study, treatments were applied to 4 leaf cotton, and measurements of photosynthesis and leaf conductance were collected thereafter. Although WideStrike cotton was more sensitive to treatments in both trials, yields were not affected and measurements of photosynthesis and leaf conductance returned to normal 7 days after application. On average, S-metolachlor combined with glufosinate caused greater visual injury than glufosinate applied alone and TTI nozzles resulted in higher visual injury ratings than XR nozzles, but as evidenced by yield results, this injury was transient.
WEED MANAGEMENT SYSTEMS IN XTENDFLEX AND ENLIST COTTON IN THE TEXAS HIGH PLAINS. K.R. Russell*1, P.A. Dotray2, W. Keeling3; 1Texas Tech University, Lubbock, TX, 2Texas Tech University, Texas A&M AgriLife Research and Extension Service, Lubbock, TX, 3Texas A&M AgriLife Research, Lubbock, TX (152)

ABSTRACT

Herbicide resistant weeds are a problem that likely every cotton (Gossypium hirsutum) producer encounters in the Texas High Plains. Heavy reliance of a single herbicide mode of action applied postemergence to control common and troublesome weeds in previous years has led to the development of glyphosate-resistant Palmer amaranth (Amaranthus palmeri S. Wats). 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 some counties have calendar restrictions. To minimize the impact of the development of herbicide resistance to group O herbicides, 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 variety of herbicides at different application timings. All treatments include bed listing followed by rod weeding to ensure no weeds were emerged 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 ai/A + glyphosate at 1.0 lb ai/A, 2,4-D choline at 0.95 lb ai/A + glyphosate at 1.0 lb ai/A applied early and mid-postemergence; and interrow cultivation. The greatest end-of-season Palmer amaranth control was observed from systems that included two applications of dicamba + glyphosate plus one additional weed management input, either tillage or a residual herbicide in the XtendFlex™ cotton. No differences were observed in the Enlist™ cotton with the addition of weed management inputs beyond the 2,4-D Choline + glyphosate applied early and mid-postemergence. Palmer amaranth control ranged from 91% following dicamba + glyphosate applied early and mid-postemergence with no additional inputs to 99% when dicamba + glyphosate was applied early and mid-postemergence and included two or more additional weed management inputs.
EVALUATING THE SEQUENCE OF TANK CLEANER AND WATER RINSES FOR EFFECTIVE SPRAYER CLEANOUT AFTER DICAMBA CONTAMINATION. J. Calhoun*1, Z.A. Carpenter2, D.B. Reynolds2, A.B. Johnson2, A. Meredith2, M. Green2; 1Mississippi State University, Starkville, MS, 2Mississippi State University, Mississippi State, MS (153)

ABSTRACT

Recent release of dicamba tolerant crops will provide benefits in the form of another herbicide mode of action to use for effective in-season control of herbicide resistant weeds. Though beneficial, this technology is also associated with some disadvantages. One disadvantage to this technology is the removal of dicamba residue from spray equipment, which if present may cause crop injury to non-tolerant crops in minimal concentrations during subsequent applications. Current tank cleaning recommendations involve using a three rinse system with water (W) and some sort of tank cleaner (C) in the second rinse. Multiple experiments were conducted in Mississippi to evaluate multiple water/cleaner sequences for effective removal of dicamba residue. A 1X rate of dicamba (560 g ae ha⁻¹) was mixed into solution in a small scale sprayer designed to replicate the cleaning and use of a full size sprayer. Once the entire system was contaminated with dicamba residue, the solution was drained. After contamination a three-rinse cleanout was conducted. Samples from eight cleanout sequences were collected for field application onto actively growing soybeans and for HPLC analysis. Data reveal that C-W-W and W-W-W resulted in more visual injury of soybeans (24 and 23% respectively) 28 days after treatment (DAT) than other sequences that contain two or more cleaner rinses. Soybean height reduction data 28DAT reveal that all rinse sequences resulted in less than 10% height reduction when compared to treatments applied using a 1X rate of dicamba. Additionally, there is no difference among sequences in regards to crop height reduction. Yield data from harvested plots reveal that sequences C-C-W and C-C-C resulted in less yield reductions (6 and 5% respectively) when compared to C-W-W (15%). Results from HPLC indicate that dicamba concentrations in parts per million (PPM) reduce notably after one rinse. During all rinses, there are no differences among rinse sequences in regards to PPM. Results of this study indicate that in a three rinse tank cleaning system, there are very little differences among the sequence of water or cleaner in the system. Future efforts will explore the use of different cleaners as well as the utilization of different rinse volumes when performing tank cleanouts.
ABSTRACT

Wheat production in Arkansas is relatively minor compared to that of surrounding states; however, it does account for a significant portion of acreage within the state. Primarily, weed control programs have relied on combinations of acetolactate synthase and acetyl-CoA carboxylase herbicides for control of major problematic weeds such as Italian ryegrass (*Lolium perenne ssp. multiflorum*). Glyphosate has also been used for preplant burndown to control this weed. Ultimately, repeated use has led to a build-up of herbicide-resistant weeds to all three of these herbicide modes-of-action, and several instances of cross- and multiple-resistance to these compounds. Pyroxasulfone was registered recently for use by Arkansas producers, but cases of high injury from the herbicide have been reported. The increased presence of resistant weeds in wheat fields, and the lack of understanding of the environmental considerations surrounding pyroxasulfone usage, required an investigation of the utility of pyroxasulfone in wheat production and identification of alternative measures for weed control. Two experiments were conducted in the winter to spring of 2015 to 2016 and 2016 to 2017 at the research stations in Fayetteville (AAREC) and Kibler (VRS), AR. In the first experiment (2015 to 2016) pyroxasulfone, flumioxazin, and a pre-mixture of both herbicides (Fierce®) were evaluated at low and high rates at 14-day pre-plant (PPL), preemergence, spiking, and 2- to 3-leaf stage. In the second experiment (2016 to 2017) similar application rates were used; however, the application timings were changed to preemergence, delayed preemergence (3 DAP), spiking, and 2- to 3-leaf stage. In experiment 1, at the AAREC, no significant injury nor yield effects were observed. At the VRS, pyroxasulfone (89 g ha⁻¹) applied PPL or PRE caused high levels of injury 3 WAP (>50%). However, by three months after treatment, all injury was below 25%. There was no effect on wheat yield. In 2016 (winter), early-season injury at the AAREC and VRS was low (<20%). Pyroxasulfone caused significant minor stunting, but the crop recovered by the 9 WAP evaluation. Foliar burn was evident from the spiking and 2- to 3-leaf applications of flumioxazin, but not enough to cause concern. Some treatments reduced yield, but only at the VRS. Yield losses did not exceed 20% and were primarily attributable to environmental conditions. The data indicate that both flumioxazin and pyroxasulfone are safe for winter wheat production when used at the correct rate. Phytotoxicity from pyroxasulfone applications are environmentally dependent. Growers should be careful with this herbicide. Despite occasional visible phytotoxicity, wheat yield should not be affected. Our data supports registration of flumioxazin for early-season application in wheat.
EVALUATING COMMERCIAL CULTIVARS AND FARM-COLLECTED BIOTYPES OF ITALIAN RYEGRASS FOR POTENTIAL HERBICIDE RESISTANCE ISSUES IN GEORGIA. D.B. Simmons*1, T. Grey1, W. Vencill2, A.S. Culpepper3; 1University of Georgia, Tifton, GA, 2University of Georgia, Athens, GA, 3University of Georgia, Tifton, GA (155)

ABSTRACT

Italian ryegrass [Lolium perenne ssp. multiflorum (Lam.) Husnot] is known for being the fourth most common and the most troublesome weed in small grains in Georgia. This Lolium species is also a highly recommended cool-season forage that becomes problematic when total control is never achieved in warm-season bermudagrass or tall-fescue hayfields. Concerns about the lack of control in Italian ryegrass require Georgia populations be evaluated. Therefore, the objectives of this research were to determine the response of farm-collected Italian ryegrass biotypes and commercial Italian ryegrass cultivars to small grain herbicides. Greenhouse experiments from 2015 to 2017 were conducted as a split-plot design with multiple treatment and experiment replications depending on the ryegrass population and experimental year. Twenty-six and fifty-nine commercially available Italian ryegrass cultivars were evaluated in 2015 and 2016, respectively. Thirty-four farm-collected biotypes were also evaluated. Herbicide treatments included a non-treated control (NTC), two PRE herbicides of flufenacet plus metribuzin or pyroxasulfone, and multiple POST herbicides of diclofop, glyphosate, pinoxaden (excluded from 2015 experiments), or pyroxsulam. Factors evaluated included initial shoot biomass, regrowth shoot emergence, regrowth shoot biomass, and regrowth root biomass. Experiments indicate that post-emergence use herbicides lack control of some Georgia commercialized Italian ryegrass cultivars and farm-collected biotypes. A continuation of these experiments within the field setting are needed to determine if the responses can be replicated. Further analyses on other ryegrass populations should be conducted to determine if these trends are developing in experimental seed lots and currently available populations.
ABSTRACT

Timing of weed control is important in determining crop yield. Research in this area of study is often conducted for a single crop. Research was conducted during 2016 and 2017 at two locations in North Carolina to determine weed control and yield of corn, cotton, and soybean in the same experiment when herbicides were applied postemergence within six weeks after planting. Commercially-available herbicides were applied to each crop at 2 or 6 weeks after planting (WAP) only; 2 and 4 WAP; 4 and 6 WAP; and 2, 4, and 6 WAP. A non-treated control was also included. No PRE herbicides were applied. To allow comparison across crops, the percentage of maximum yield was calculated based on the highest yield of each crop in each replication. In 2017, cotton was planted directly back into the same plots that corn, cotton, and soybean were planted in previously. Emerged weeds were counted 2, 6, and 18 WAP and included common ragweed and Texas panicum at Lewiston-Woodville and Palmer amaranth and large crabgrass at Rocky Mount. Cotton lint yield was also determined.

In absence of herbicides, percent yield was higher for corn than all other crops at both locations. At Lewiston-Woodville, where common ragweed was present, percent yield of cotton was similar to soybean. At Rocky Mount, where Palmer amaranth was present, percent yield of soybean exceeded yield of cotton. At Lewiston-Woodville, when only one herbicide application was made, yield for corn, cotton, and soybean ranged from 83-97%, 28-73%, and 67-74% of maximum yield, respectively. At Rocky Mount, for these respective crops, ranges were 72-93%, 7-38%, and 68-75%. When herbicides were applied twice, ranges in percent of maximum yield for these respective crops were 89-93%, 78-96%, and 88-94%. For the same crops at Rocky Mount, the ranges were 82-93%, 83-93%, and 88-90%. With the exception of corn, applying herbicides three times resulted in yields of at least 88% of maximum yield. Yield of corn was 91% at Lewiston-Woodville but only 71%, at Rocky Mount with three applications. Lower yields of corn most likely was caused by improper application of dicamba to older corn during the final application.

In some instances, a single herbicide application 2 WAP was more effective than a single application 6 WAP. This was noted at Lewiston-Woodville in corn and at Rocky Mount in both corn and cotton. The opposite occurred at Lewiston-Woodville where a single application made 6 WAP was more effective than a single application made 2 WAP in cotton. Likewise, for two applications beginning early (2 and 4 WAP) yields were similar to applications made 4 and 6 WAP to soybean at both at Lewiston-Woodville and Rocky Mount. Cotton yield at Lewiston-Woodville following applications at 4 and 6 WAP was higher than applications 2 and 4 WAP.

In 2017, there were noticeable differences in common ragweed densities at Lewiston-Woodville for the 2 WAP weed count with respect to crop and spray programs in 2016. Ragweed populations ranged from 90-239 per square meter. Corn had the least amount of ragweed present in the untreated plots. In cotton, weed densities were less when a single application was made 6
WAP, when two applications were made at either 2 and 4 WAP or 4 and 6 WAP, and when 3 applications were made 2, 4, and 6 WAP. In soybean, at least one herbicide application in 2016 decreased the ragweed density compared to the untreated check. In Rocky Mount there were only differences in Palmer densities 2 WAP with respect to the previous year’s spray program. Densities ranged from 46-93 palmer per square meter. In respect to spray program, densities were lower than that of the untreated check when at least two applications were made.

In 2017 cotton lint yield ranged from 1830 to 1940 kg/ha at Lewiston-Woodville with no noticeable differences with respect to spray programs in 2016. Lint yield at Rocky Mount ranged from 70 to 960 kg/ha with yield following corn greater than yield following cotton or soybean; yield following soybean was higher cotton. When comparing across spray programs, cotton yield ranged from 750-950 kg/ha with the highest yields observed following the 2 WAP, 2 and 4 WAP, and 2, 4, and 6 spray programs.

Although these experiments do not constitute a true time of weed removal or duration of weed interference study, results do inform practitioners of the relative importance of timing and duration of weed management for major agronomic crops in North Carolina.
DIFFERENTIAL SENSITIVITY OF WEEDY RICE ACCESSIONS TO GLYPHOSATE, GLUFOSINATE AND FLUMIOXAZIN. S. Shrestha*1, S. Stallworth2, N. Roma-Burgos3, T. Tseng2; 1Mississippi State University, Starkville, MS, 2Mississippi State University, Mississippi State, MS, 3University of Arkansas, Fayetteville, AR (157)

ABSTRACT

Weedy rice is one of the most troublesome weed in rice production system worldwide. Traits such as variable dormancy, rapid growth, high tillering, enhanced ability to uptake nutrients, asynchronous maturation, and seed shattering makes weedy rice more competitive than cultivated rice. Greenhouse studies were conducted to evaluate the tolerance of 54 diverse weedy rice accessions collected from Arkansas and two commonly grown rice cultivars (CL 163 and REX) to glyphosate, glufosinate and flumioxazin. Response of these accessions to glyphosate and flumioxazin applied at the rate of 1120 g ai/ha and 72 g ai/ha, respectively, was variable. Weedy rice accessions (B20, B2 and S11) and (B49, B51 and S59) were most tolerant to glyphosate and flumioxazin, respectively, with injury of less than 40%, 5 weeks after treatment (WAT). These potentially tolerant accessions recovered from 3 to 5 WAT, while all the other accessions, including rice cultivars, showed increase in injury with time. Both the rice cultivars were more sensitive to glyphosate and flumioxazin than the weedy rice accessions, thus confirming robust nature of weedy rice. All weedy rice accessions including rice cultivars were completely killed with glufosinate at 1093 g ai/ha, 3WAT. Differential tolerance of weedy rice accessions to herbicides should be kept in mind while developing improved weedy rice control strategies. On the bright side, the tolerant weedy rice accessions can be used as a source of raw genetic material for rice/crop improvement programs.
EVALUATION OF CONTROL OPTIONS FOR JUNCUS SPECIES IN MAINTAINED TURFGRASS. Z.D. Small*1, J. McCurdy2, J.T. Brosnan3, G. Breeden3, M.P. Richard2; 1Mississippi State University, Mississippi State, MS, 2Mississippi State University, Starkville, MS, 3University of Tennessee, Knoxville, TN (158)

ABSTRACT

Path rush (Juncus tenuis) and toad rush (J. bufonius) are troublesome weeds in maintained turfgrass throughout the southeastern United States. Chemical control options are limited. Historically, turfgrass managers have used auxin mimicking herbicides to control Juncus species with varied success. An ongoing research study is being conducted at Mississippi State University in cooperation with the University of Tennessee to determine potential chemical control options with the hypothesis that several common herbicides may provide acceptable control of Juncus species. Treatments include: halosulfuron (70.0 g ai ha⁻¹), flazasulfuron (52.7 g ai ha⁻¹), trifloxysulfuron (29.5 g ai ha⁻¹), Speedzone (carfentrazone, 2,4-D, mecoprop, dicamba; 1,230 g ai ha⁻¹), Strike 3 (2,4-D, MCPA, dicamba; 1,520 g ai ha⁻¹), Celsius (thiencarbazone, iodosulfuron, dicamba; 233 g ai ha⁻¹), Tribute Total (thiencarbazone, foramsulfuron, halosulfuron; 136 g ai ha⁻¹), foramsulfuron (58.6 g ai ha⁻¹), and Fahrenheit (dicamba and metsulfuron; 320 g ai ha⁻¹). Treatments were applied using a hand-held CO₂-pressurised backpack sprayer in a water carrier volume of 374 L ha⁻¹. Control was evaluated visually 12 weeks after treatment (WAT). Data was subject to analysis of variance (α = 0.05). Control varied due to species and location, therefore trials (2 per species) will be presented separately. Means were separated using Student-Newman-Keuls LSD (α = 0.05). In general, halosulfuron provided good to excellent control of path rush. Other ALS inhibiting herbicides, foramsulfuron and trifloxysulfuron, as well as auxin mimicking three and four way herbicide mixtures failed to adequately control path rush in most instances. Almost all herbicides failed to adequately control toad rush, possibly due to maturity of the stands tested. Both species appear to be easier to control when herbicides are applied prior to flower production. Future research will evaluate differential herbicide response and application timing. In addition, experiments will be conducted to examine the effects of compaction and soil moisture on path rush growth.
ABSTRACT

Torpedograss is a non-native, invasive grass abundant in freshwater systems of Florida. This perennial grass colonizes littoral areas, out-competes native species and aggressively spreads through rhizomes and extensive shoot growth in the water column. Torpedograss has been suggested to be more difficult to control where the majority of its shoot growth is submersed. However, there is limited data to support this idea. A greenhouse mesocosm study was conducted to assess the effect of water depth on torpedograss control with herbicides. Two non-selective herbicides, glyphosate and imazapyr, used widely for torpedograss control, and two selective graminicides, sethoxydim and fluazifop-p-butyl, which are currently being studied for use in aquatics, were selected for study. Torpedograss was grown in 100 L tubs and water depths included saturated soil conditions (0 cm depth) and 30 cm. All herbicide and water depth combinations were replicated in five tubs each and the experiment was conducted twice over the summer of 2017. Baseline measurements of above water biomass, below water biomass, and root/rhizome biomass were recorded. Above and below water shoot biomass and root plus rhizome biomass were harvested at 90 days after treatment (DAT). Fluazifop at 5.40 g/L, sethoxydim at 5.40 g/L, glyphosate at 14.4 g/L, and imazapyr at 2.40 g/L showed no difference in percent reduction of total shoots between treatments and all showed at least 76% reduction in biomass. There was a significant difference in root response after harvest at 90 days with respect to water depth. These results support the idea that greater above water biomass at the time of treatment results in better torpedograss control for all herbicides tested. These results also indicate that both graminicides demonstrated considerable impact on torpedograss and may be useful as a selective alternative to glyphosate and imazapyr in aquatic systems.
BERMUDAGRASS TOLERANCE OF INDAZIFLAM PREEMERGENCE APPLICATIONS. N.L. Hurdle*, T. Grey, P. McCullough; *University of Georgia, Tifton, GA, 1University of Georgia, Griffin, GA (160)

ABSTRACT

Bermudagrass (Cynodon spp.) is a major forage species throughout Georgia and the southeast. An essential part of achieving a high yielding and top quality crop is the ability to maintain a minimal weed population. One active ingredient that may be utilized is indaziflam. Indaziflam controls many broadleaf and grass species by inhibiting cellulose biosynthesis. A study was performed in Tift and Coulquitt Co., GA to determine the optimal preemergent rate at which indaziflam may be applied without causing bermudagrass injury. At both locations, a randomized complete block design comprising of 7 treatments with 4 replications was utilized. Treatments were applied at green up on Alicia bermudagrass at 37, 73, 147, and 220 grams of ai per hectare (g ai ha⁻¹). One treatment included a preemergent application of 37 g ai ha⁻¹ and a post application rate of 37 g ai ha⁻¹ after the first cutting. Pendimethalin was also applied at a 4480 g ai ha⁻¹ preemergent. The cuttings in Tift Co. occurred 47 days after treatment (DAT), followed by 110 DAT, and 168 DAT. Samples were taken 79 DAT, 107 DAT, and 154 DAT in Coulquitt Co.

Data from both locations were combined for data analysis. The harvest 1 data showed that the 37 g ai ha⁻¹ produced the highest amount of fresh weight biomass. The application of 4480 g ai ha⁻¹ of pendimethalin produced the highest amount of dry weight biomass. Harvest 2 indicated that 220 g ai ha⁻¹ yielded the highest amount of fresh weight, along with the highest amount of dry weight. Harvest 3 showed the 37 g ai ha⁻¹ rate yielded the most fresh and dry weight. Yields at each harvest were not different. The difference came in the form of bermudagrass stunting. The treatment of 220 g ai ha⁻¹ created 21% stunting and 147 g ai ha⁻¹ suffered 15% stunting at the 44 DAT mark. Indaziflam has the potential to control many troublesome weeds in bermudagrass forage and hay operations, without causing significant stunting or yield loss at the recommended application rates.
TOLERANCE OF SWEETPOTATO TO HERBICIDES APPLIED IN PLANT PROPAGATION BEDS. S. Smith*, K. Jennings, D. Monks; North Carolina State University, Raleigh, NC (161)

ABSTRACT

Few herbicides are registered for use in sweetpotato plant production beds. However, weeds can reduce quantity and quality of sweetpotato plants in plant production beds. Limited research has been conducted on the tolerance of sweetpotato plants produced in production beds to herbicides. Thus, field and greenhouse studies were conducted in 2016 and 2017 to determine sweetpotato tolerance to herbicide treatments applied to plant production beds and then transplanted. After plants were clipped just above the soil surface in the plant production bed, the non-rooted cuttings (slips) from the beds were transplanted to containers and then placed either in the greenhouse or on an outdoor pad to determine any affects from the herbicide treatments on sweetpotato growth. Herbicide treatments included PRE application (immediately after covering seed roots with soil) of flumioxazin (107 g ai ha⁻¹), S-metolachlor (800 g ai ha⁻¹), fomesafen (280 g ai ha⁻¹), flumioxazin plus S-metolachlor (107 g ai ha⁻¹ + 800 g ai ha⁻¹), fomesafen plus S-metolachlor at (280 g ai ha⁻¹ + 800 g ai ha⁻¹), fluridone (1120, 2240 g ai ha⁻¹), fluridone plus S-metolachlor (1120 g ai ha⁻¹ + 800 g ai ha⁻¹), napropamide (1120 g ai ha⁻¹), clomazone (420 g ai ha⁻¹), linuron (560 g ai ha⁻¹), linuron plus S-metolachlor (560 g ai ha⁻¹ + 800 g ai ha⁻¹), bicyclopyrone (38, 49.7 g ai ha⁻¹), pyroxasulfone (149 g ai ha⁻¹), pre-mix of flumioxazin plus pyroxasulfone (81.8 g ai ha⁻¹ + 104.2 g ai ha⁻¹), or metribuzin (294 g ai ha⁻¹). Paraquat plus non-ionic surfactant (280 g ai ha⁻¹ + 0.25% v/v) applied POST was also included as a treatment. Initial root growth of cuttings after transplanting was affected by fluridone (1120 g ai ha⁻¹) and fluridone plus S-metolachlor. However, by 5 weeks after transplanting few differences were observed between treatments. Fluridone with and without S-metolachlor and fomesafen plus S-metolachlor decreased sweetpotato plant quality at slip harvest in both years.
A STEP TOWARDS THE DEVELOPMENT OF HERBICIDE TOLERANT TOMATOES. G. Sharma*1, T. Tseng2, R. Snyder3, C. Barickman2; 1Mississippi State University, Starkville, MS, 2Mississippi State University, Mississippi State, MS, 3Mississippi State University, Crystal springs, MS (162)

ABSTRACT

The United States is one of the world's leading producers of tomatoes, third only to China and India. Fresh and processed tomatoes account for more than $2 billion in annual farm cash receipts. In terms of consumption, the tomato is the nation's fourth most popular fresh-market vegetable behind potato, lettuce, and onion. Unfortunately, its yield is reduced by 25% because of auxin herbicides and glyphosate drift. In this present study, wild germplasm of tomato was screened for herbicide tolerance. From the greenhouse study nine accessions for glyphosate and 2,4-D, eleven accessions for dicamba, five accessions for quinclorac, eight accessions for aminocyclopyrachlor, and two accessions for picloram and aminopyralid were identified to be tolerant. A few accessions were selected from each herbicide tolerant group for field trials at two locations in Mississippi in 2016 and 2017. Results indicated that TOM18 was most tolerant to dicamba herbicide, while TOM129 tolerant to quinclorac herbicide, based on yield and injury. These potential herbicide tolerant lines can be used in breeding programs to provide tomato growers access to tomato lines/varieties with improved herbicide tolerance compared to the current varieties used in Mississippi. These varieties, therefore, protect from herbicide injury and thus increasing the marketable yield and fruit quality.
CUCUMBER TOLERANCE TO GLUFOSINATE APPLIED JUST BEFORE TRANSPLANTING AND JUST AFTER SEEDING. T.M. Randell*, J. Smith1, A.S. Culpepper2; 1University of Georgia, Tifton, GA, 2University of Georgia, Tifton, GA (163)

ABSTRACT

The value of Georgia’s cucumber crop exceeds $70 million annually; ranking third nationally. With limited herbicide options available in bareground production, the addition of glufosinate for preplant or PRE use would improve weed control options and combat resistance. Transplant (two locations) and seeded (one location) cucumber experiments were conducted to determine crop tolerance to preplant (transplants) or PRE (seeded) glufosinate applications. For both production scenarios, a split-plot design was used and included glufosinate rate (0, 328, 656, 984 or 1640 g ai/ha) as the whole plot and irrigation (none or 1 cm) as the subplot. All combinations of rate and irrigation were replicated four times. Glufosinate was applied 1 d prior to transplanting or immediately following seeding. For treatments receiving irrigation, 1.0 cm of water was applied after the glufosinate applications, but prior to transplanting or seedling emergence. In the transplant study, when combined over locations, cucumber injury (10 DAT) was 13, 21, 42, and 53%, at the aforementioned rates in the absence of irrigation. Without irrigation, plant heights, biomass, and yield were reduced 3-26, 11-47, and 8-38% across all rates, respectively, when compared to no glufosinate. The addition of irrigation reduced cucumber injury, with 7 to 20% noted across all rates. Plant heights were not influenced by glufosinate if irrigation was implemented, however plant biomass and yield reductions of 4-18% occurred. In the seeded experiment, cucumber injury was at most 6% when irrigation was included and up to 22% without irrigation. Seeded cucumber heights, biomass, and yield were not negatively influenced by glufosinate when the application was followed by irrigation, but were reduced up to 16, 18 and 7% when glufosinate was applied in the absence of irrigation. Glufosinate control (12 DAT) of livid amaranth (Amaranthus blitum L.) ranged from 85 to 99% across all rates in both the seeded and transplant studies in the absence of irrigation; the addition of irrigation reduced control up to 32%. Large crabgrass (Digitaria sanguinalis (L.) Scop.) was controlled 85 to 97% by all rates of glufosinate when irrigation was avoided. Glufosinate at 328, 656, 984, or 1640 g ai/ha followed by irrigation controlled large crabgrass 46-53, 60-69, 73-81, and 83-86%, respectively, in both the seeded and transplant studies. Both sets of studies were maintained weed free from 12 DAT until harvest. Results suggest residual activity of glufosinate will cause unacceptable damage to transplant cucumber when applied 1 d before transplanting regardless of irrigation use. Seeded cucumber were more tolerant of a PRE glufosinate application, but irrigation is needed after the application. Glufosinate provided residual control of both livid amaranth and large crabgrass that would be beneficial in bareground cucumber production systems.
HEAVY RYE (*SECALE CEREALE* L.) COVER CROP EFFECTS ON COTTON STAND, WEED CONTROL, AND YIELD. L.C. Hand*1, A.S. Culpepper2, J.C. Vance1; 1University of Georgia, Tifton, GA, 2University of Georgia, Tifton, GA (165)

ABSTRACT

The use of cover crops may be critical to the sustainability of herbicides by reducing weed seed emergence as well as improving weed control. Six large acreage on farm field studies were conducted in 2012, 2013, and 2016 to observe the effects of a heavy rye cover crop (4,886-9,600 kg·ha⁻¹ dry biomass) on cotton stand, weed control, and yield. Treatments were arranged in a randomized complete block design with four replications. Treatments included four systems: (1) broadcasted rye and broadcast herbicide program, (2) rye drilled with a 20 cm rye-free zone in the cotton row and broadcast herbicide program, (3) rye drilled with a 20 cm rye-free zone and PPI and PRE banded herbicides, and (4) conventional no cover crop and broadcast herbicides. Rye was seeded the previous fall at a rate of 100 kg·ha⁻¹ and rolled at the time of burndown. Broadcast herbicide program included: paraquat (210 g ai·ha⁻¹) + flumioxazin (71 g ai·ha⁻¹) + COC at burndown; diuron (840 g ai·ha⁻¹) + fomesafen (280 g ai·ha⁻¹) + paraquat (210 g ai·ha⁻¹) + COC PRE; glyphosate (1260 g ae·ha⁻¹) + acetochlor (1260 g ai·ha⁻¹) POST 1; glyphosate (1260 g ae·ha⁻¹) + S-metolachlor (1070 g ai·ha⁻¹) POST 2; and diuron (1120 g ai·ha⁻¹) + MSMA (1681 g ai·ha⁻¹) + COC layby directed. The banded system included the same burndown, preplant, POST, and layby applications but included a 30 cm in the row banded PPI application of pendimethalin (1064 g ai·ha⁻¹) + fomesafen (210 g ai·ha⁻¹) and a banded PRE application of diuron (560 g ai·ha⁻¹) + fomesafen (175 g ai·ha⁻¹). Cotton was planted using a strip-till planter system placing two seeds every 23 cm. Stand counts during the first month after planting and weed counts throughout the season were made for each plot in its entirety; the entire plot was also harvested for yield comparison. Results indicated that at two of the six locations cotton stand was lowest in uniformity and plants/ha in the broadcast rye system. At one location, stand was the most uniform with the most plants/ha in the two rye-free zone systems compared to the broadcast rye but were similar to the conventional system. Stand count at one location was lower in the no cover crop plots due to dry conditions after planting. No differences in stand were noted at 2 locations. Palmer amaranth populations at harvest were similar at 3 of 6 locations where lighter infestations were present and herbicides were activated timely. However, at 3 locations, less Palmer amaranth was present in the broadcast rye and rye-free zone systems when herbicides were broadcast (538 to 695 plants/ha) when compared to the banded herbicide system (11,248 plants/ha) or the conventional system (3,784 plants/ha). Seed yield was greatest with the broadcast rye and rye-free zone systems at 3 of 6 locations following trends observed in Palmer amaranth control.
PREEMERGENCE HERBICIDE OPTIONS FOR COMMON RAGWEED CONTROL IN SOYBEANS. S. Beam*, M. Flessner, K. Bamber; Virginia Tech, Blacksburg, VA (166)

ABSTRACT

Common ragweed (*Ambrosia artemisiifolia* L.) has been reported to be resistant to glyphosate and ALS inhibiting herbicides in Virginia. Many producers are struggling to control common ragweed in their fields with glyphosate based postemergence herbicide programs. Preemergence herbicides provide the most options for different modes of action for weed control in soybeans. A field study was initiated to determine efficacy of various preemergence herbicides on suspected glyphosate and ALS resistant common ragweed in 2017 in Lawrenceville, VA. RoundupReady 2 Xtend soybeans were no-till planted on May 9, 2017. Treatments consisted of flumioxazin (71.4 g ai ha⁻¹), metribuzin (262.5 g ai ha⁻¹), linuron (700 g ai ha⁻¹), clomazone (558.6 and 840 g ai ha⁻¹), cloransulam-methyl (35.3 g ai ha⁻¹), imazethapyr (70 g ai ha⁻¹), pyroxasulfone (71.4 g ai ha⁻¹), sulfentrazone + cloransulam-methyl (280.4, + 35.7 g ai ha⁻¹), chlorimuron-ethyl + flumioxazin + thifensulfuron (22.5 + 71.5 + 7.1 g ai ha⁻¹), flumioxazin + metribuzin (71.4 + 262.5 g ai ha⁻¹), flumioxazin + clomazone (71.4 + 525 g ai ha⁻¹), flumioxazin + linuron (71.4 + 700 g ai ha⁻¹), flumioxazin + clomazone + metribuzin (71.4 + 558.6 + 262.5 g ai ha⁻¹), flumioxazin + clomazone + linuron (71.4 + 700 + 558.6 g ai ha⁻¹), clomazone + metribuzin (558.6 + 278.3 g ai ha⁻¹), clomazone + metribuzin (558.6 + 336 g ai ha⁻¹), cloransulam-methyl + flumioxazin (33.6 + 100.8 g ai ha⁻¹), and a nontreated check. Treatments were arranged in a randomized complete block design with 3 replications. Treatments were applied the same day as planting with a handheld spray boom calibrated to deliver 140 L ha⁻¹ of spray solution. Soybean plots were 4 rows wide on 76 cm centers measuring 3 m by 6 m. Plots were assessed for visible common ragweed control and soybean injury biweekly for 8 wks on a 0 (no control or injury) to 100% (complete control or crop death). Common ragweed control and soybean injury data were analyzed in JMP Pro 13 using ANOVA and means separated using Fisher’s Protected LSD (α=0.05). The nontreated check was excluded from statistical analysis. By 6 WAT the highest control was 96.7% which was in the chlorimuron-ethyl + flumioxazin + thifensulfuron, sulfentrazone + cloransulam-methyl, and cloransulam-methyl + flumioxazin treatments. Other treatments with 85 to 92% control included clomazone + metribuzin, flumioxazin + linuron + clomazone, and cloransulam-methyl alone. At 8 WAT the highest common ragweed control had dropped to 78% in the plots that received chlorimuron + flumioxazin + thifensulfuron, sulfentrazone + cloransulam-methyl, and cloransulam-methyl + flumioxazin. Two other treatments had common ragweed control above 70% and these were cloransulam-methyl (70%) and flumioxazin + clomazone + linuron (73%). Overall there are multiple preemergence herbicide options such as sulfentrazone + cloransulam-methyl, cloransulam-methyl + flumioxazin, chlorimuron-ethyl + flumioxazin + thifensulfuron, and flumioxazin + clomazone + linuron that are highly effective at controlling common ragweed early in the growing season. Using preemergence herbicides is an effective way to control common ragweed and allows for more modes of action to be used during the growing season to help combat herbicide resistance. Future research may evaluate the effectiveness of these preemergence herbicides to an ALS resistant common ragweed population.
EFFECT OF NOZZLE, CARRIER VOLUME, AND COVER CROP RESIDUE ON RESIDUAL HERBICIDE EFFICACY. B. Sperry*1, D.B. Reynolds1, J. Bond2, J. Ferguson3, G. Kruger4, A. Brown-Johnson5; 1Mississippi State University, Mississippi State, MS, 2Delta Research and Extension Center, Stoneville, MS, 3Mississippi State University, MS State, MS, 4University of Nebraska-Lincoln, North Platte, NE, 5Mississippi State Chemical Laboratory, Mississippi State, MS (167)

ABSTRACT

Many residual herbicides are strongly adsorbed to organic matter. This can cause reduced efficacy when residual herbicides are applied to cover crop residue resulting in reduced control. Multiple field experiments were conducted in 2017 at two locations in Mississippi to investigate the relationships of nozzle type, carrier volume, and cover crop residue on efficacy of various residual herbicides. Annual grass and common waterhemp control with pendimethalin was approximately 7 and 12% higher 28 DAT when applied to bare soil compared to wheat residue regardless of nozzle or carrier volume, respectively. Pendimethalin efficacy as affected by carrier volume alone was not reduced in either grass or waterhemp until volumes of 10 GPA or lower were used regardless of nozzle or wheat residue. Likewise, grass and waterhemp control 28 DAT with S-metolachlor applied to wheat residue was reduced by lower carrier volumes except for when at least 20 and 15 GPA was used, respectively. Residual flumioxazin efficacy was not influenced by nozzle, volume, or wheat residue. Grass control with acetochlor was reduced by approximately 10 and 45% when volumes of 10 GPA or less were used to apply to bare soil or wheat residue, respectively. Results of these studies indicate that carrier volumes of more than 10 GPA should be used when applying residual herbicides to wheat residue. Future research will investigate differential levels of residue and other techniques to overcome adsorption
EFFECT OF DICAMBA DRIFT ON SOYBEAN SEED QUALITY. M. Zaccaro*, J. Norsworthy, C. Brabham, C. Willett; University of Arkansas, Fayetteville, AR (168)

ABSTRACT

Selective control of broadleaf weeds, more specifically Palmer amaranth, at a low cost is key for synthetic auxins popularity today. However, the increase of air temperature may elevate the risk of volatility and movement of dicamba when herbicide applications are made later in the season, causing injury to surrounding non-dicamba-resistant crops. Previous research indicates dicamba may damage soybean offspring when the parent is exposed to the herbicide post-bloom. Two studies were developed with the objective to determine if dicamba could be detected in seed of non-dicamba-resistant soybean when applied at sublethal rates at R5 growth stage. The first experiment was established in 2017 at the Arkansas Agricultural Research and Extension Center in Fayetteville, AR where glufosinate-resistant soybean was treated with a range of dicamba rates ranging from 3/4X to 1/256X, with the labeled rate for dicamba-resistant soybean being 560 g ae ha⁻¹ (1X). Visible injury was observed at dicamba doses ≥1/16X, and an average of 6% of malformed pods were found at the lowest evaluated dose of 1/256X. In a second experiment, non-dicamba-resistant soybean was sprayed with 1/200X rate of dicamba and later spotted with radiolabeled dicamba at the rate of 5 kBq plant⁻¹. At 14 days after treatment, the plants were divided into the sections, then samples were dried and oxidized. Preliminary results show 24% and 5% of the radioactivity applied found in the pods and seeds, respectively.
DETERMINING THE EFFECTS OF INCREASED RINSE VOLUMES ON DICAMBA REMOVAL FROM CONTAMINATED SPRayers. Z.A. Carpenter*, D.B. Reynolds, A.B. Johnson, A. Meredith, M. Green; Mississippi State University, Mississippi State, MS (169)

ABSTRACT

While the release of dicamba tolerant soybeans by Monsanto will aid growers in weed control, it will also present several challenges. Glyphosate is very water soluble, allowing it to be easily removed from spray tanks through three rinses with water alone. Synthetic auxin herbicides however, are not as water soluble and 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 is to determine the effects of increasing rinse volumes during a triple rinse cleanout procedure, for the removal of dicamba from contaminated sprayers. Field experiments were conducted in 2017 in Brooksville and Starkville, MS. Four different rinse volumes, 10%, 20%, 40%, and 60% of the tanks volume, were evaluated. The addition of a tank cleaner (Wipeout, Helena Chemical®) during the second rinse was also evaluated at each rinse timing, compared to utilizing three water rinses alone. A no cleanout treatment was also included at each rinse volume. A small scale sprayer was designed to replicate the cleanout procedures used on commercial sprayers. This system was first contaminated with dicamba (590 kg ae / ha) (Xtendimax, Monsanto®) and rhodamineWT dye (0.2 % v/v). The sprayer then underwent a triple rinse cleanout, utilizing one of the four rinse volumes during each rinse step. During each rinse, the solution was recirculated through the system for 15 minutes and samples were collected for subsequent field and lab analysis. Once the sprayer was cleaned using the triple rinse procedure it was filled with a labeled rate of glyphosate, and another sample was collected. All samples were sprayed over actively growing soybeans at the R1 growth stage. Visual rating for phytotoxicity were taken 7, 14, 21, and 28 DAT (days after treatment) and plant heights were taken 14, 21, and 28 DAT. Samples collected during each rinse were also analyzed using HPLC to determine auxin herbicide concentrations as a means to evaluate cleaner efficacy. Plants were harvested at the end of the growing season for yields. Averaged over tank rinse volumes and rinse (1,2,3, glyphosate) WipeOut and water both resulted in less visual injury than when the tank was not cleaned but did not completely eliminate injury when compared to the untreated. Visual injury incrementally decreased with each rinse but all still resulted in detectable crop injury. Averaged over cleaner and rinse volume, applications of the second or third rinsates did not result in decreased soybean yields. HPLC analysis show that analyte concentrations contained in the second, third, and forth rinsates did not differ.
THE EFFECT OF SOYBEAN POPULATION AND HERBICIDE APPLICATION TIMING ON IN- AND SUBSEQUENT-SEASON WEED CONTROL. D.J. Mahoney*1, D. Jordan2, A. Hare2, N. Roma-Burgos3, K. Jennings2, R. Leon2, M. Vann2; 1NC State University, Cary, NC, 2North Carolina State University, Raleigh, NC, 3University of Arkansas, Fayetteville, AR (170)

ABSTRACT

Palmer amaranth (Amaranthus palmeri S. Wats.) is highly competitive with immense fecundity and its ability to replenish the soil seed bank in a single generation is a challenge that farm managers must combat constantly. Controlling this weed is crucial for maintaining crop yields; however, with increasing herbicide-resistant populations, chemistry options are becoming more limited. Consequently, comprehensive weed management strategies are needed to reduce pressure on any single component to improve overall control. Previous research has illustrated increasing soybean populations increases weed control; however, research also considering the interaction of soybean population and herbicide application timing is limited. Further, research is limited with respect to the impact of these factors on weed population dynamics and crop yield in subsequent years. Therefore, research was conducted to determine the effect of plant population and herbicide application timing on Palmer amaranth control and crop yield in soybean and the impact of these variables on weeds in cotton the following year. Soybean was planted in July 2016 in two fields at the Upper Coastal Plains Research Station (Rocky Mount, NC) using a grain drill (19-cm spacing). Soybean populations averaged 315,000 (low), 565,000 (medium) and 786,000 (high) plants ha⁻¹. Fomesafen (280 g a.i. ha⁻¹) plus clethodim (210 g a.i. ha⁻¹) was applied at 7, 11, or 19 days after planting (DAP) representing early, mid, and late application timings, respectively. A non-treated (NT) control was included for each soybean population. Palmer amaranth control was evaluated within 3 weeks prior to harvest (November). Cotton was planted the year following soybean in early May. Palmer amaranth density was recorded in cotton 28 DAP followed by an application of dicamba (561 g ha⁻¹) plus glyphosate (947 g ha⁻¹). Late season (September) weed counts and cotton lint yield were also recorded.

In soybean, the interaction of soybean population and timing of herbicide application was not significant for Palmer amaranth control. Late-season control with the low soybean population was 68% which was less than control with medium (79%) or high (83%) populations of soybean. When pooled over soybean populations, control with the early herbicide timing (91%) was greater than control with the mid (86%) or late (85%) timings. Control for the NT was only 7%. Trends for soybean yield and estimated economic return generally reflected differences in weed control. Yield under the low population (2,488 kg ha⁻¹) < medium (2,799 kg ha⁻¹) < high (3,044 kg ha⁻¹) while only NT soybean yielded different from herbicide-treated soybean regardless of timing. Palmer amaranth density and cotton yield was affected by the previous combination of soybean population and timing of herbicide application. Density 28 DAP cotton in NT plots (138 m⁻²) > early (75 m⁻²), mid (80 m⁻²), or late herbicide timing (87 m⁻²) when averaged over soybean populations. Late-season Palmer amaranth counts were affected by the previous soybean population as fewer weeds were present following the high population (44 plants m⁻²) compared to the low and medium populations (62 and 61 plants m⁻², respectively). Cotton lint yield reflected this trend as it was greater following the high soybean population compared to the low or medium populations (197 and 205 kg ha⁻¹ increase, respectively). Results
suggest increasing population along with a timely herbicide application will improve control during the season and reduce survivors that produce seed for the subsequent season without increasing weed management cost.
PALMER AMARANTH CONTROL USING VARIOUS DROPLET SIZES OF DICAMBA AND GLYPHOSATE. J. McNeal*, D. Dodds2, T. Butts3, G. Kruger3, C. Samples2; 1Mississippi, Mississippi State, Mississippi, MS, 2Mississippi State University, Mississippi State, MS, 3University of Nebraska-Lincoln, North Platte, NE (171)

ABSTRACT

A field experiment was conducted in 2016 and 2017 in Dundee, Mississippi, to evaluate droplet-size effects on the efficacy of dicamba and glyphosate combined in a single herbicide mixture to control Palmer amaranth (Amaranthus palmeri, S. Watts).

A single herbicide mixture of dicamba (Clarity, 480 g ae L⁻¹, BASF, Research Triangle Park, NC 27709) plus glyphosate (Roundup Weathermax, 540 g ae L⁻¹, Monsanto, St. Louis, MO 63167) 0.28 kg ae ha⁻¹) was applied post emergence to 10 – 15 cm⁻¹ Palmer amaranth using a PinPoint PWM Research Sprayer at labeled rates of 0.28 kg ae ha⁻¹ and 0.87 kg ae ha⁻¹, respectively. All applications were made at 93.5 L ha⁻¹.

Prior to herbicide application, nozzle type, orifice size, and application pressure required to create each droplet size treatment was determined using a Sympatec HELOS-VAROR/KR laser diffraction system with the R7 Lens (Sympatec Inc., Clausthal, Germany) in the low-speed wind tunnel at the Pesticide Application Technology (PAT) Laboratory in North Platte, Nebraska. Droplet sizes of 150, 300, 450, 600, 750, and 900 µm were determined from the Dv0.5 of the measured spray solution.

10 plants per plot were tagged prior to spray applications. At 28 days after treatment, visual injury estimates were recorded for each plot. Also at 28 days after treatment, marked plants were individually evaluated for mortality and the total number of deceased plants were divided by 10 to provide mortality proportion measurements for each plot. The individual plants were then clipped at the soil surface and dried at 55 C to constant mass. The dry plants were pooled into one dry biomass measurement per plot and were divided by 10 for average weed dry shoot biomass plant⁻¹ measurements.

Data were analyzed in SAS 9.4 using the General Linear Model, with statistical significance determined at $\alpha = 0.05$. The experiment was conducted as a factorial arrangement of treatments within a randomized complete block design with four replications of each treatment. A generalized additive model (GAM) analysis was also conducted in R 3.4.1 statistical software using the MGCV package to model spray droplet size with each respective response variable to provide an estimate of the optimum spray droplet size for Palmer amaranth control. To meet model assumptions, Palmer amaranth dry biomass plant⁻¹ data were subjected to natural log transformation and are presented as such.

Palmer amaranth visual injury ratings were found to vary due to year ($P = <.0001$). Across all droplet sizes, visual injury was observed to be significantly higher in 2017 (75.1%) relative to 2016 (47.4%). Palmer amaranth mortality ratings were found to vary due to year ($P = <.0001$). Across all droplet sizes, plant mortality was observed to be significantly higher in 2017
(70.8%) relative to 2016 (26.3%). Across both 2016 and 2017, droplet size was determined to have no effect on dry biomass of Palmer amaranth. Data from 2017 were also analyzed in R using GAM analysis. Effects on visual injury, mortality, and biomass ratings were determined to not vary due to droplet size.

These data indicate control of glyphosate-resistant Palmer amaranth does not vary due to droplet size. Coarse and ultra-coarse droplet sizes were observed to provide equal control to the control achieved with fine droplet sizes. Disparity between droplet size effects in 2016 and 2017 are attributed to differences in Palmer amaranth distribution uniformity in experimental plots. Distribution was visually observed to be more uniform in 2016, with uniformity varying across plots in 2017. Uniformity in droplet size effects on Palmer amaranth are attributed in part to the systemic activity of dicamba. We hypothesize that across all droplet sizes utilized, the amount of chemical deposited on the leaf surface was sufficient to impart the same level of herbicidal activity. These data indicate that when a systemic herbicide is used, coarse and ultra-coarse droplet sizes may be utilized and still achieve maximum control of glyphosate-resistant Palmer amaranth.

Therefore, the largest droplet size possible should be used while maintaining optimal weed control to reduce the incidence of drift and volatility. Further research is required to determine optimum droplet size for weed control across a more complete spectrum of weed species, geographic locations, herbicides, and carrier volumes utilized.
COMMON RAGWEED RESPONSE TO PREEMERGE HERBICIDES IN NORTH CAROLINA. B. Schrage*, W. Everman, J. Sanders, T.N. OQuinn; North Carolina State University, Raleigh, NC (172)

ABSTRACT

In 2016, multiple-resistant common ragweed (*Ambrosia artemisiifoia*) in northeastern North Carolina was confirmed to be cross-resistant to seven families of glyphosate, ALS-, and PPO-Inhibiting herbicides. This discovery serves as the first agronomic dicot exhibiting resistance to three modes of action in North Carolina and prompted an evaluation into possible management options for growers in Camden, Chowan, Currituck, Gates, Hertford, Pasquotank and Perquimans counties.

In 2016 and 2017 experiments were conducted to evaluate the efficacy of various PRE herbicides on common ragweed control and soybean safety in Moyock, NC. A randomized complete block design was employed that included four replications of 15 m² treatment plots. Metribuzin, flumioxazin, fomesafen, and pyroxasulfone provided the best control on the high organic matter soil with minimal injury to soybean.

In 2017, a field study was conducted in Moyock, NC to determine the optimum application rate for common ragweed control and soybean safety for both early and late planting dates. The soybean variety (AG5535) had been documented to tolerate metribuzin at higher application rates and dose response data revealed that rates beyond 280 g ai ha⁻¹ did result in visible injury. At that same rate, common ragweed was controlled until 7 WAP.
SIMULATED DICAMBA TANK CONTAMINATION IN NON ROUNDUP READY XTEND HERBICIDE PROGRAMS. B.K. Pieralisi*1, J. Bond2, B. Golden2, N.G. Corban1, J. Peeples Jr.3; 1Mississippi State University, Greenville, MS, 2Delta Research and Extension Center, Stoneville, MS, 3Delta Research and Extension Center, Stoneville, MS (173)

ABSTRACT

Several species of herbicide-resistant weeds have been identified in Mississippi; however, the rapid spread of glyphosate-resistant Palmer amaranth (Amaranthus palmeri S. Wats.) has caused soybean [Glycine max (L.) Merr.] growers to seek new technologies to manage herbicide-resistant weeds. Currently, there are three herbicide technologies to manage weeds in soybeans. These include Roundup Ready, Roundup Ready Xtend, and LibertyLink, and all three are utilized in Mississippi. As a result, multiple cropping systems within a single farming operation could increase the likelihood of sprayer contamination. During the growing season, herbicides are usually applied PRE, POST at early vegetative stages such as V3, and late-POST at vegetative stages such as V6. Roundup Ready Xtend soybeans are tolerant to both glyphosate and dicamba. Dicamba is difficult to remove from sprayer components during rinsing procedures; therefore, LibertyLink and Roundup Ready cropping systems are susceptible to injury from dicamba if spray equipment is not thoroughly sanitized. Low doses of dicamba can result in yield reductions; however, it is unclear to what extent exposure to dicamba in a contaminated tank influences soybean growth and yield. Therefore, research was conducted to characterize the effects of dicamba as simulated tank contamination in Roundup Ready 2 and LibertyLink herbicide programs.

Two studies were conducted in 2017 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate simulated dicamba tank contamination in non-Roundup Ready Xtend herbicide programs. Roundup Ready ‘Asgrow 4632’ and Liberty Link ‘Credenz 4748’ were utilized in the research. The experimental design for both studies was a split plot with four replications. Whole plots were herbicide programs and included no herbicide program and Boundary PRE followed by (fb) Roundup PowerMax or Liberty (depending on study) plus Prefix fb Roundup PowerMax or Liberty plus Zidua. For both studies, the herbicides were applied at their labeled use rates. Subplots were dicamba contamination timings and included no dicamba, PRE, V3, V6, PRE fb V3, PRE fb V6, V3 fb V6, and PRE fb V3 fb V6. Dicamba was applied as the diglycolamine salt formulation at 0.0039 lb ae A⁻¹ (1/128 labeled use rate). All data was analyzed using Fisher’s protected LSD (p ≤ 0.05).

In both studies, soybean injury 14 and 28 d after the last herbicide application was greatest with dicamba contamination timings that included V3 and V6 growth stages (V3 fb V6 and PRE fb V3 fb V6). Dicamba contamination in V6 only and PRE fb V6 herbicide applications injured soybean more than that in V3 and PRE fb V3 herbicide applications in both non-Roundup Ready Xtend systems. Pooled over dicamba contamination timings, soybean heights in both studies were lower following the full herbicide program. Soybean yield was not influenced by herbicide program in either study, and the yield response to dicamba contamination timing reflected injury data. Soybean yield was lowest with dicamba contamination timings that included both V3 and V6 growth stages. Although soybean yields following dicamba contamination at V3 or PRE fb
V3 were greater than those with any timing that included V6 growth stage, dicamba contamination at V3 or PRE fb V3 reduced yield ≥17% compared with the no dicamba treatment.

Injury from simulated dicamba tank contamination was less severe when soybean were exposed once at V3 compared with V6. Dicamba contamination in PRE applications at the rate evaluated did not influence soybean growth and yield. Soybean were most negatively affected when exposed to dicamba contamination in both POST herbicide applications. Extreme caution should be exercised to sanitize spray equipment that is utilized in both Roundup Ready Xtend and non-Roundup Ready Xtend soybean systems to avoid crop injury and reductions in yield.
SEQUENTIAL SYSTEMS IN ENLIST SOYBEANS FOR GLYPHOSATE RESISTANT HORSEWEED CONTROL. B. Greer*1, J.A. Tredaway1, J. Richburg2, W. Greene3, J. Jones3; 1Auburn University, Auburn University, AL, 2Dow AgroSciences, Headland, AL, 3Auburn University, Auburn, AL (174)

ABSTRACT

Field Studies were conducted at the Sand Mountain Research and Extension Center (SMREC) in Crossville, Alabama for the 2016 and 2017 growing seasons. These studies were conducted to evaluate a new auxin herbicide for preemergence burndown control of glyphosate resistant horseweed in soybeans. As well as in a sequential system with Enlist Duo applied as a post over the top of Enlist soybeans. Arylex, active ingredient halaxifen-methyl, is a new herbicide developed by Dow Agrosciences and is found in the picolinate family of the auxin inhibiting herbicide group. A preemergence burndown of Arylex alone, along with Arylex tank mixed with other residual herbicides was evaluated against an untreated check, 2,4-D ester, Liberty, Clarity, and Sharpen treatments to determine if this product could compete with the common industry standards used for glyphosate resistant horseweed control. These burndown treatments were applied 14 days prior to planting and weed control ratings were taken throughout the season to evaluate horseweed control. Although it took 7-14 more days for the Arylex containing treatments to achieve 99% control as compared to the Liberty and Sharpen treatments, this excellent control was achieved at 28 days after treatment and maintained through at least 42 days after treatment. This data shows that Arylex is an acceptable preemergence burndown herbicide that would add another mode of action to the management of glyphosate resistant horseweed. This study also evaluated the use of Enlist Duo and other postemergence herbicides for weed control after V2-V3 soybean growth. Excellent weed control was maintained throughout the growing season when a postemergence herbicide other than glyphosate was used. When glyphosate alone was sprayed horseweed control ratings were evaluated to be from 45-75% control. For all other treatments in which a herbicide other than glyphosate was used control ratings were at 90% or above and the only treatment below 99% was the 2,4-D ester followed by Durango DMA + FirstRate treatment. This data shows that good to excellent glyphosate resistant horseweed control can be accomplished by a sequential system of Sharpen, Liberty, or Arylex followed by Enlist Duo or another postemergence herbicide other than glyphosate.
INFLUENCE OF DROPLET SIZE ON LACTOFEN AND ACIFLUORFEN EFFECTIVENESS FOR PALMER AMARANTH CONTROL. L.X. Franca*,1, D. Dodds1, C. Samples1, G. Kruger2, T. Butts2; 1Mississippi State University, Mississippi State, MS, 2University of Nebraska-Lincoln, North Platte, NE (175)

ABSTRACT

Widespread occurrence of glyphosate and ALS-resistant Palmer amaranth has led to increased use of protoporphyrinogen 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 and 2017 at Hood Farms in Dundee, MS, and the West Central Research and Extension Center in North Platte, NE to evaluate the influence of droplet size on lactofen and acifluorfen effectiveness for Palmer amaranth control. Lactofen (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 μm, 300 μm, 450 μm, 600 μm, 750 μm, and 900 μm. Prior to experiment initiation, droplet size spectra for each herbicide was characterized in a low speed wind tunnel at the Pesticide Application Technology Laboratory at University of Nebraska, North Platte, NE. Treatments were POST applied to 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 collected at 7, 14, 21, and 28 days after application. Fifteen plants per plot were tagged and used for dry biomass calculation at the end of the experiment. Data were subjected to analysis of variance using PROC GLM procedure in SAS® Software v. 9.4 (SAS Institute Inc., Cary, NC 27513-2414) and means were separated using Fisher’s Protected LSD at α=0.05.

Different droplet sizes of lactofen did not differ with respect to Palmer amaranth control, regardless of rating period. Acifluorfen applied using 300 μm droplets provided the greatest Palmer amaranth control, regardless of rating period. Furthermore, compared to 450 μm, acifluorfen applied with 300 μm provided a 25% increase in Palmer amaranth control. All droplet sizes of lactofen provided significant dry biomass reduction of Palmer amaranth. Acifluorfen applied using 300 μm, 150 μm, and 750 μm droplet sizes resulted in significant reductions of Palmer amaranth biomass. These data suggest that the use of small or large droplet sizes does not affect lactofen effectiveness on 15 cm Palmer amaranth. In addition, the use of 300 μm droplets is recommended to optimize Palmer amaranth control from acifluorfen.
RESIDUAL WEED CONTROL FROM THIENCARBAZONE-METHYL WITH AND WITHOUT COMMON SOYBEAN RESIDUAL HERBICIDES. Z.D. Lancaster*, J. Norsworthy, C. Meyer, M.H. Moore, J.T. Richburg; University of Arkansas, Fayetteville, AR (176)

ABSTRACT

Due to the continual spread of herbicide resistance, growers are increasingly relying on residual herbicides to achieve season long weed control. New residual herbicide options are needed to effectively rotate herbicide mode of action, and slow the development of additional herbicide resistance. Thiencarbazone-methyl (TCM), an ALS herbicide, could provide preemergence and postemergence activity on many troublesome midsouth weeds in soybean. A field experiment was conducted at the Agricultural Research and Extension Center in Fayetteville, Arkansas in the summer of 2016 and 2017 to determine the residual activity of TCM compared to several common residual herbicides. The experiment was set up as a two factor, randomized complete block design with factor-A being TCM rate applied and factor-B being tank-mix partner. TCM treatments evaluated were no TCM, 33.5 g ai ha\(^{-1}\) TCM, and 67 g ha\(^{-1}\) TCM. Tank-mix partners evaluated were labeled rates of Dual Magnum, Valor, Zidua, Tricor, and Balance Bean along with a no tank-mix partner treatment. Data were collected on entireleaf morningglory (\textit{Ipomoea hederacea}), broadleaf signalgrass (\textit{Urochloa platyphylla}), and yellow nutsedge (\textit{Cyperus esculentus}) control at 14, 28, 42, and 56 days after application (DAA) for both years with Palmer amaranth (\textit{Amaranthus palmeri}) control evaluated as well in 2015. Overall, TCM provided excellent control of broadleaf signalgrass with 92% and 98% respectively for 33.5 and 67 g ha\(^{-1}\) at 42 DAA. Control of the native ALS-resistant Palmer amaranth population was only 69% with 67 g ha\(^{-1}\) of TCM at 42 DAA in 2015. However, the addition of 67 g ha\(^{-1}\) of TCM to the labeled rate of Tricor resulted in a significant increase in Palmer amaranth control with 84% control from Tricor alone and 96% control from Tricor + 67 g ha\(^{-1}\) TCM. Likewise, the addition of 67 g ha\(^{-1}\) TCM to Dual Magnum increased entireleaf morningglory control from 82% alone to 100% with TCM. This research shows that TCM alone provides excellent residual weed control of broadleaf signalgrass and entireleaf morningglory, with some added Palmer amaranth control (48-69%). Furthermore, the addition of TCM increases the spectrum of activity and length of residual control for many common residual herbicides.
TIMING AND APPLICATION RATE FOR SEQUENTIAL APPLICATIONS OF GLUFOSINATE IS CRITICAL FOR MAXIMIZING EFFICACY ON A. AMARANTHUS PALMERIÅ AND ECHINOCHLOA CRUS-GALLI. C. Meyer*, J. Norsworthy, J. Green, M. Zaccaro; University of Arkansas, Fayetteville, AR (177)

ABSTRACT

Widespread prevalence of glyphosate-resistant weeds and availability of multiple crop technologies allowing POST applications of glufosinate will likely continue to intensify the use of glufosinate. However, LibertyLink® remains the only commercially available glufosinate-resistant technology in soybean and preserving the effectiveness of glufosinate is critical for managing herbicide-resistant weeds. An experiment was conducted at the Arkansas Agricultural Research and Extension Center in Fayetteville, AR, in 2015, 2016, and 2017 to identify POST-application strategies that maximize the utility of glufosinate. A RCBD with a factorial treatment structure was used for the experiment, in which factor 1 was glufosinate rate (451, 595, 738, 882 g ai ha⁻¹) and factor 2 was sequential application structure. The five levels for the sequential application structure were: no sequential application, initial application followed by (fb) a sequential application 7 days after the initial application (DAI), initial fb sequential 10 DAI, initial fb sequential 14 DAI, and initial fb sequential 21 DAI. The plot area was planted to LibertyLink® (glufosinate-resistant) soybean and the first herbicide application occurred when weeds reached 20-25 cm in height. For treatments that contained a sequential application, the same rate used in the initial application (e.g. 451 g ai ha⁻¹) was also used in the sequential. Three weeks after the final application occurred, Palmer amaranth control was 8% greater when the sequential application occurred 10 DAI compared to 21 DAI, averaged over glufosinate rates. For barnyardgrass control, sequential applications of 595 g ai ha⁻¹ 7 d apart provided 87% control compared to 82% control when applied 21 d apart. Soybean yields were greater when the glufosinate applications occurred 7 or 10 d apart compared to 21 d, averaged over glufosinate rates. Based on these results, when large weeds are present in the field glufosinate should be applied sequentially with a 7-14 day interval between applications. If sequential applications of glufosinate are used in combination with a comprehensive weed control management program (using residual herbicides PRE and POST, tillage, etc.) the likelihood of evolving glufosinate-resistant weeds should be greatly reduced, and the LibertyLink technology should remain a valuable weed management tool.
**IMPACT OF PALMER AMARANTH SIZE ON YIELD IN LIBERTYLINK® COTTON.**

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**ABSTRACT**

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

This experiment was conducted in 2016 and 2017 at Hood Farms in Dundee, MS to evaluate the efficacy of various glufosinate-based weed control programs on Palmer amaranth size. Deltapine 1646 B2XF was planted on May 7, 2016 and May 10, 2017 in 4-row plots 3.9 m wide x 12.2 m long. Applications of glufosinate (Liberty) at 0.65 kg ai ha⁻¹, S-metolachlor (Dual Magnum) at 2.13 kg ai ha⁻¹, and ammonium sulfate (AMS) at 10.2 g L⁻¹ were made to cotyledon cotton on May 19, 2016 and May 15, 2017 and were followed by applications of glufosinate at 0.65 kg ai ha⁻¹ and AMS at 10.2 g L⁻¹ as needed. Other treatments consisted of applications of glufosinate at 0.65 kg ai ha⁻¹, S-metolachlor (Dual Magnum) at 2.13 kg ai ha⁻¹, and AMS at 10.2 g L⁻¹ when the Palmer amaranth reached heights of 7.6, 15, and 23 cm followed by glufosinate at 0.65 kg ai ha⁻¹ and AMS at 10.2 g L⁻¹ 7 to 10 d after the initial application. Visual Palmer amaranth control ratings were collected at 7, 14, 21, 35, and 42 days after application. End of season data collected included lint yield. Data were subjected to analysis of variance using PROC Mixed procedure in SAS 9.2 and means were separated using Fisher’s protected LSD at p = 0.05.

The treatment with the highest visual Palmer amaranth control 42 DAT after all applications had been made was glufosinate + s-metolachlor + AMS applied to cotton at the cotyledon growth stage following a PRE herbicide application. Visual control at this timing was 20-29% greater than either the application made to 15 cm Palmer amaranth or 23 cm Palmer amaranth, respectively. The treatment with the highest seedcotton yield (kg/ha) was following applications made at the cotyledon growth stage in cotton following a PRE application. Seedcotton yield at this timing was 21% greater than applications made at the 15 cm Palmer amaranth timing, 36% greater than applications made at the 23 cm Palmer amaranth timing, and 100% greater than untreated plots. Overall, as weed size of Palmer amaranth increased above 7.6 cm, both visual control and seedcotton yield decreased. Based on these results the optimum timing for Palmer amaranth control in a glufosinate-based weed control system is when weeds are 7.6 cm in height or less.
GRAZON P+D EFFECTS ON PEANUT. O. Carter*, E.P. Prostko; University of Georgia, Tifton, GA (179)

ABSTRACT

Grazon P + D (picloram + 2,4-D) is used on approximately 20% of the pastures in Georgia. Picloram injury (leaf roll) is frequently observed in peanut fields due to short crop rotations, contaminated irrigation water, treated hay, and animal urine/feces. Limited data on peanut response to picloram is available. In 2015, 2016, and 2017, small-plot field trials were conducted to determine the effects of picloram + 2,4-D on peanut growth and yield. Picloram + 2,4-D was applied to GA-06G peanut at four different timings: preemergence (PRE); 30 days after planting (DAP); 60 DAP; and 90 DAP. At each timing, four rates of picloram + 2,4-D were applied including the following: 1/10thX (0.18 + 0.67 kg ai/ha); 1/100thX (0.018 + 0.067 kg ai/ha); and 1/300thX (0.006 + 0.023 kg ai/ha). A non-treated control (NTC) or 0 rate was also included for comparison. A 4 (rate) X 4 (timing) factorial treatment arrangement in a randomized complete block design with 3-4 replications was used. Data collected include peanut density, visual estimates of crop injury (leaf roll), plant height, and yield. Peanut density was not reduced by any rate or timing of picloram + 2,4-D. For peanut injury (leaf roll), a significant rate X timing interaction was observed. At 120 DAP, leaf roll was significant for the 1/10thX rate applied at 30, 60, and 90 DAP, the 1/100thX rate applied at 60 and 90 DAP, and for the 1/300thX rate applied at 90 DAP. When averaged over timing, peanut height at 120 DAP was significantly reduced by the 1/10thX and 1/100thX rates. When averaged over rate, peanut height reductions were greatest when picloram + 2,4-D was applied at 60 DAP. When averaged over timing, only the 1/10thX rate caused significant yield reductions (~11%). When averaged over rate, timing had no effect on yield (P=0.5403). Peanut plants exposed to picloram + 2,4-D rates ≥ 1/100thX can exhibit typical injury symptoms but should not experience yield losses.
THREE YEAR EVALUATION OF HERBICIDE PROGRAMS IN XTENDFLEX™ COTTON ON GROWTH, DEVELOPMENT, AND YIELD. C. Samples*, D. Dodds, S. Davis; Mississippi State University, Mississippi State, MS (180)

ABSTRACT

Due to the continued spread of glyphosate resistant Palmer amaranth (*Amaranthus palmeri*), technologies have been developed allowing growers to apply auxin-type herbicides post emergence. The XtendFlex® technology from Monsanto will allow growers to apply glyphosate, glufosinate, and dicamba over the top of cotton (*Gossypium hirsutum* L.). Dicamba applied at 1.1 kg ae ha⁻¹ provided up to 90 percent Palmer amaranth control. Dicamba tank mixed with glufosinate increased Palmer amaranth control over dicamba alone. Dicamba has also been observed to control other glyphosate resistant species 79 to 100 percent 14 days after application.

Experiments were conducted in 2015, 2016, and 2017 in Starkville, MS at the R. R. Foil Plant Science Research Center and in Brooksville, MS at the Black Belt Branch Experiment Station. Plots consisted of 4-1 m spaced rows that where 12.2 m in length. Each plot was replicated four times. DP 1522 B2XF was planted in Starkville and Brooksville. Applications were made on 2-4 leaf cotton with a CO₂-powered backpack sprayer calibrated to apply 140 L ha⁻¹ @ 317 kpa while walking 4.8 kph. Treatments applied to DP 1522 B2XF included glyphosate @ 1.1 kg ae ha⁻¹, glufosinate @ 0.6 kg ai ha⁻¹, S-metolachlor @ 1.07 kg ai ha⁻¹, dicamba (Engenia) @ 0.6 kg ae ha⁻¹, dicamba (Clarity) @ 0.6 kg ae ha⁻¹, and dicamba (MON 119096) @ 0.6 kg ae ha⁻¹ either alone or in combination. Visual injury ratings were made 3, 7, 14, 21, and 28 days after applications. Other data collected included height at 1st bloom, height at the end of the season and lint yield. Data were analyzed using the PROC MIXED procedure in SAS version 9.4 and means were separated using Fisher’s protected LSD at p=0.05.

All six of the highest injury levels 3 days after application on DP 1522 B2XF were from treatments containing glufosinate and S-metolachlor in which visual injury ranged from 36- 42 percent. The highest level of injury came from treatments containing dicamba (Engenia) + glyphosate + glufosinate + S-metolachlor. Similar to 3 days after application, five of the six treatments with the highest level of injury seven days after application contained glufosinate and S-metolachlor with injury levels ranging from 26-31 percent. At 14 days after application injury to DP 1522 B2XF had dissipated however, five of the six highest levels of injury contained glufosinate + S-metolachlor and there injury ranged from 12-14 percent. At 21 Days after application, cotton injury had further dissipated but significant differences persisted with the highest levels of injury still being attributed to treatments containing glufosinate+S-metolachlor. Significant differences persisted through bloom with height of cotton treated with the most injurious treatments being significantly shorter than the untreated check. Heights ranged from 63 cm -70 cm. Similarly, height at the end of the season was affected. Height of cotton that was treated with the most injurious treatments was reduced compared to the untreated control. However, there were no significant differences in lint yield at the end of the season with yields ranging from 1,589-1,777 kg lint ha⁻¹.
INITIAL ASSESSMENT OF 26 LATE SUMMER- AND FALL-PLANTED COVER CROPS IN SOUTHEAST TEXAS. S.L. Samuelson*1, B. Young1, M. Bagavathiannan2; 1Texas A&M University, College Station, TX, 2Texas A&M AgriLife Research, College Station, TX (181)

ABSTRACT

With the increased dependence on herbicides and the widespread evolution of herbicide-resistant weeds, alternative methods of weed control are of great interest and demand. Cover crop species planted during late summer to fall in Southeast Texas can take advantage of the long growing season and provide suppression of post-harvest emerging weeds (by live biomass) as well as spring emerging weeds (by cover crop residues). The objectives of this study were to determine which cover crop species offer i) the greatest impact on weed suppression and ii) the lowest impact on stored soil moisture in this region. Thirteen summer and 13 winter cover crop species were planted during early September 2017 and early November 2017, respectively and arranged in a randomized complete block design with four replications per species. Ground cover and cover crop density measurements were carried out along with weed infestation and weed density estimates at 21 days after planting and at cover crop termination. Soil moisture and temperature were recorded in each plot at three depths (0-6 cm, 15-21, and 30-36 cm) during key cover crop growth stages. Weed and cover crop biomass are separated and recorded at cover crop termination. Results will help in determining ideal cover crops species or mixtures for this region. Future research will investigate the impact of cover crop planting and termination timing on weed suppression and soil moisture dynamics.
PALMER AMARANTH INTERFERENCE AND SEED PRODUCTION IN GRAFTED AND NONGRAFTED WATERMELON. M. Bertucci*1, K. Jennings2, D. Monks2, D. Jordan2, J.R. Schultheis1, F.J. Louws1; 1NC State University, Raleigh, NC, 2North Carolina State University, Raleigh, NC (182)

ABSTRACT

Watermelon grafting was initially adopted for management of diseases caused by soilborne pathogens, and there is evidence that grafted plants confer additional benefits such as tolerance to drought, salinity, and suboptimal temperatures. However, there is little research available to compare weed-competitive ability of grafted and nongrafted watermelon. Field studies were conducted at the Horticultural Crops Research Station in Clinton, North Carolina in 2015 and 2017. ‘Exclamation’ triploid (seedless) watermelon was used as the scion for all grafted plants. Grafting treatments included two interspecific hybrid squash rootstocks (ISH) rootstocks ‘Carnivor’ and ‘Kazako’, as well as nongrafted Exclamation as the control. Weed treatments included Palmer amaranth at densities of 1, 2, 3, and 4 Palmer amaranth per triploid watermelon vine (0.76 m−1 row) as well as a weed-free control. Both grafting treatment and Palmer amaranth density had a significant effect (P < 0.05) on marketable yield and fruit number. Watermelon yield reduction was described as a rectangular hyperbola model, and 4 Palmer amaranth 0.76 m−1 row reduced marketable yield 41, 38 and 65% for Exclamation, Carnivor and Kazako, respectively. Neither grafting treatment nor Palmer amaranth density had a significant effect on SSC or on the incidence of hollow heart in watermelon fruit. Total Palmer amaranth seed number was similar across weed population densities, but seed number per female Palmer amaranth decreased according to an exponential decay curve. Thus, increasing weed population densities resulted in increased intraspecific competition among Palmer amaranth. While grafting may offer benefits regarding disease resistance and tolerance to abiotic stresses, there is no immediate benefit regarding weed-competitive ability and a consistent yield penalty was associated with grafting, even in weed-free treatments.
ERADICATING ENDOPHYTE-INFECTED TALL FESCUE (SCHEDONORUS ARUNDINACEUS): AN INTEGRATED APPROACH FOR INVASIVE PERENNIAL WEEDS. D. Russell*, J. Byrd; Mississippi State University, Mississippi State, MS (183)

ABSTRACT

Tall fescue [Schedonorus arundinaceus (Schreb.) Dumort = Lolium arundinaceum (Schreb.) Darbysh.], the dominant cool-season perennial forage species found throughout the mid-South, has a mutualistic association with the fungal endophyte, Neotyphodium coenophialum. This fungus is known to produce ergot alkaloids, which frequently cause bovine and equine toxicosis. The objective of this study was to take a systematic approach to determine the length of time necessary to eliminate the threat of fescue-associated toxicity through seed and underground rhizome eradication.

Mississippi State University’s Prairie Research Unit (PRU) (Prairie, MS) and Town Creek Farm (TC) (West Point, MS) were site locations used to measure management effects on tall fescue removal. Year-round management included spring or spring and autumn 1.68 kg ae ha\(^{-1}\) glyphosate applications each with or without autumn tillage. Winter wheat (Triticum aestivum L.) and Roundup Ready® Eagle© forage soybeans (Glycine max (L.) Merr.) were planted as winter and summer forage cover crops, respectively. At PRU, spring and autumn glyphosate applications used with autumn tillage significantly reduced the percentage of tall fescue through the following March (10 months after treatment (MAT)) to 27% coverage. However, by 19 MAT, tall fescue had recovered from all treatment combinations to < 1% coverage and had increased to 91% by 34 MAT when seedheads were allowed to mature. At TC, all treatment combinations reduced tall fescue coverage compared to the untreated check ($P < 0.0001$) to < 1% coverage 10 MAT. This remnant population increased to 7.7% by 34 MAT. Two consecutive years of sequential treatments reduced mean tall fescue to < 2% coverage 36 MAT across both locations. The most successful treatment at initially reducing tall fescue coverage was a spring and autumn glyphosate application with an autumn tillage when the spring herbicide was applied prior to seed maturity. However, management is required for more than one year to limit the amount of tall fescue recovery. Forage soybeans produced over 8,000 kg ha\(^{-1}\) at each location by the second year and are a viable feed option to make up for tall fescue forage losses during renovation.
USING PGR'S ON GOLF COURSES TO SAVE MONEY. P. Brown*, L.B. McCarty; Clemson University, Clemson, SC (184)

ABSTRACT

Golf course roughs and low maintenance areas of sports turf require regular upkeep, including mowing. Plant Grown Regulators (PGR’s) help reduce turf growth, and so reduce the amount of maintenance these areas require; this could potentially reduce mowing costs. The goals of this research were to compare sequential PGR applications for reducing mowing frequency and turf safety in low maintenance areas.

Research was conducted on the Walker Golf Course in Clemson, SC in Tifway and common bermudagrass (Cynodon dactylon x C. transvaalensis) roughs. Treatments were applied three times during the summer in early June, July, and August on the same plots following mowing to 2 in (5 cm), and the study was replicated over two years. Treatments included Primo (Trinexapac-ethyl 1 EC) at 22 fl oz/a, Plateau (Imazapic 2 L) at 4 fl oz/a, Primo + Plateau (Trinexapac-ethyl + Imazapic 1 EC + 2 L) at 22 fl oz/a + 4 fl oz/a, Aneuw (Prohexadione calcium 27.5 WP) at 44 fl oz/a, Cutless (Flurprimidol 1.3 L) at 37 fl oz/a, Legacy (Flurprimidol + Trinexapac-ethyl 1.5 SL) at 18 fl oz/a, Legacy (Flurprimidol + Trinexapac-ethyl 1.5 SL) at 30 fl oz/a, Musketeer (Flurprimidol + Trinexapac-ethyl + Paclobutrazol 1 SL) at 30 fl oz/a, Roundup (Glyphosate 4 L) at 3 fl oz/a, Finale (Glufosinate 1 SC) at 1 pt/a, & Journey (Imazapic + Glyphosate 2.25 SL) + NIS at 11 fl oz/a. Treatments were applied with a CO₂ backpack sprayer calibrated to deliver 40 GPA, using 8004 flat fan spray nozzles. Turfgrass phytotoxicity ratings were taken weekly, turfgrass height (cm), and percentage seedhead cover were recorded at the end of each application cycle. Experimental design was a randomized complete block with three replications. Data was analyzed using ANOVA with means separated by LSD (α=0.05).

Applications of Finale at 1 pt/a had >80% phytotoxicity one week after application. Treatments containing Imazapic had ~20% phytotoxicity two to three weeks after application. Minimum phytotoxicity was seen with other treatments. By 4 weeks after application all treatments recovered to within acceptable ranges. Untreated, Roundup, and Finale plots had highest (>3 in, >8 cm) turfgrass heights at the end of each application cycle. Primo, Legacy at the high rate, and treatments including Imazapic had the lowest (~1.5 in, 4 cm) turfgrass height. Untreated plots and glyphosate treatments had the greatest (>30%) seedhead cover. Primo and treatments containing Imazapic had the lowest (~10 %) seedhead cover. Further research will include the exploration higher rates and shorter treatment frequencies of glyphosate to increase activity, the use of lower rates of Finale and Imazapic for reduced turfgrass phytotoxicity, and to explore the addition of Primo to other treatments for reduced turf height and phytotoxicity.
CONTROLLING RUBUS SPECIES IN LOW-MAINTENANCE TURF. J. Brewer*, J. Craft, S. Askew; Virginia Tech, Blacksburg, VA (185)

ABSTRACT

Low-maintenance turf has been increasingly adopted in rough or out-of-play areas on golf courses due to budget restraints. Reduced mowing and pesticide treatments on low-input areas encourages weed infestation especially hard-to-control, perennial broadleaves. Most blackberry (Rubus spp.) are favored by reduced mowing and tolerate common herbicides used on golf courses for broadleaf weed control. Past research in pasture, native areas, and bahiagrass turf found that metsulfuron, fluroxypyr, and triclopyr can effectively control blackberry species. Less is known, however, about efficacy of herbicide products common to ornamental turfgrass. We hypothesized that treatment programs that contained triclopyr, fluroxypyr, or metsulfuron would effectively control blackberry in ornamental turfgrass. We initiated four randomized complete block studies between 2015 and 2017 in Blacksburg, VA at the Virginia Tech Golf Course and the Glade Road Research Facility. Our objectives were to assess efficacy of several market-leading turfgrass herbicides and mixtures that contained triclopyr, fluroxypyr, or metsulfuron for Pennsylvania or highbush blackberry (Rubus pensilvanicus Poir.) control and fine fescue response. All treatments were replicated three times and herbicides were applied with a CO2-powered boom sprayer calibrated to deliver 280 L ha⁻¹. Treatments included: triclopyr at 1.12 kg ha⁻¹, fluroxypyr at 525 g ha⁻¹, metsulfuron at 21 g ha⁻¹ and 42 g ha⁻¹, triclopyr at 1.12 kg ha⁻¹ + metsulfuron at 21 g ha⁻¹, fluroxypyr at 525 g ha⁻¹ + metsulfuron at 21 g ha⁻¹, penoxulam+sulfentrazone+2,4-D+dicamba at 675 g ha⁻¹, triclopyr+sulfentrazone+2,4-D+dicamba at 1.41 kg ha⁻¹, carfentrazone+2,4-D+dicamba+MCPP at 1.54 kg ha⁻¹, sulfentrazone+quinclorac 1.12 kg ha⁻¹, fluroxypyr+2,4-D+dicamba at 2.1 kg ha⁻¹, 2,4-D+picloram at 2.85 kg ha⁻¹, 2,4-D+picloram at 2.85 kg ha⁻¹ + metsulfuron at 21 g ha⁻¹, and a nontreated check for comparison. All metsulfuron-containing treatments received 0.25% v/v of nonionic surfactant. Blackberry cover and control were rated every 2 weeks until leaf drop. A final assessment of cover, control, and shoot counts was taken the following spring. Fine fescue was rated for cover and injury every 2 weeks until injury was no longer evident.

By 4 weeks after treatment (WAT), all triclopyr- and fluroxypyr-containing treatments except triclopyr+sulfentrazone+2,4-D+dicamba controlled blackberry greater than 90%, and those treatments maintained that degree of control for the entirety of the 2 studies. At 8 WAT, picloram+2,4-D+metsulfuron, low and high rates of metsulfuron, and triclopyr+sulfentrazone+2,4-D+dicamba controlled blackberry between 75 and 90%. All treatments containing triclopyr, fluroxypyr, and metsulfuron except triclopyr+sulfentrazone+2,4-D+dicamba, picloram+2,4-D+metsulfuron, and fluroxypyr+2,4-D+dicamba contained less than 15 shoots per 3.24 m² compared to 75 shoots per 3.24 m² in the nontreated check. Unacceptable injury was only observed at 2 WAT by triclopyr+metsulfuron, high rate of metsulfuron, and picloram+2,4-D+metsulfuron, in which the fine fescue injury ranged from 30 to 35%.
SCREENING COMPETITIVE WEEDY RICE GERMPLASM FOR TOLERANCE TO SUBMERGENCE. S. Stallworth*, T. Tseng; Mississippi State University, Mississippi State, MS (186)

ABSTRACT

Globally, approximately 480 million metric tons of rice are produced annually, accounting for almost 50% of the daily caloric intake for those living in poverty. In the US, rice is primarily produced in four regions: Arkansas Grand Prairie, Mississippi Delta, Gulf Coast, and Sacramento Valley of California. Arkansas currently accounts for more than 40% of the rice produced in the US. Approximately 250,000 acres of rice are planted in the Mississippi Delta area each year contributing more than $130 million to the state’s economy. Unexpected submergence due to climate change and unpredictable flash flooding can cause an approximate yield reduction of 40% and can affect 20 million ha of agriculture farmlands. The development of submergence tolerant rice will, therefore, help farmers increase yield production while also serving as a weed management strategy. WR is a noxious weed with increased competition to cultivated rice in the areas of plant height, shatter sensitivity, and panicle length. WR has demonstrated its ability to withstand extreme climates, but the extent of its tolerance to submergence has not been studied. Fifty-four WR accessions with two rice-breeding lines and three cultivated rice lines were planted and germinated for approximately 14 days after which plants were 100% submerged for 14 days. After 14 days, water was reduced to 5 – 10 cm to maintain a consistent flood environment. Plant heights were measured every 7 days for 28 days, and plant biomass was collected 28 days after treatment. Rice-breeding lines showed 64.5% stunting with 0.3 g biomass. On the other hand, among all WR lines, ten of them showed 20% or less stunting and produced at least 0.35 g biomass. When comparing the best three performing WR lines, the average stunting was 12% with 0.48 g biomass. These submergence-tolerant WR accessions can potentially serve as a valuable genetic resource for rice improvement that can be achieved through conventional or marker-assisted breeding.
DEVELOPING A TRADITIONAL FOURIER-TRANSFORM INFRARED SPECTROSCOPY METHOD FOR DETECTION AND HIGH-FIDELITY DIFFERENTIATION OF ULTRA-LOW CONCENTRATIONS OF VARIOUS AUXIN HERBICIDE FORMULATIONS IN DAMAGED SOYBEAN AND COTTON TISSUE. J. Buol*1, D.B. Reynolds1, A. Brown-Johnson2, C. Reid2; 1Mississippi State University, Mississippi State, MS, 2Mississippi State Chemical Laboratory, Mississippi State, MS (187)

ABSTRACT

Injury and yield loss in sensitive cotton and soybeans can occur from exposure to dilute concentrations of 2,4-D and dicamba. The availability of older formulations not labeled for use in new weed control systems complicates crop injury diagnosis. Crop response from an event involving a legally applied auxin herbicide does not differ visually from that of older, non-labeled herbicides. Fourier-Transform Infrared spectroscopy (FTIR) is an accurate and inexpensive way to analyze samples for the presence of different chemical functional groups. FTIR has great potential to differentiate plant tissue damaged by herbicides with identical active ingredients that differ only in the molecular structure of the additives they are formulated with. An experiment was conducted to develop a FTIR method to identify various auxin herbicides present in cotton and soybean tissue damaged by a dilute herbicide rate. Principal component analysis (PCA) and linear discriminant analysis (LDA) were used to model sample FTIR spectra. LDA models for soybean samples taken 0, 3, 7, 14, and 28 DAT identified auxin formulation with 89, 92, 84, 91, and 93% accuracy, respectively. Cotton samples taken at the same timings yielded herbicide identification with 90, 87, 90, 84, and 89% accuracy, respectively. IR spectrum peaks at 1687-1560 cm⁻¹ and 1633-1556/1395-1350 cm⁻¹ were critical for sample identification in soybeans and cotton, respectively. Future efforts will seek to develop models for more herbicide formulations and multiple rates and tissue types.
DISTRIBUTION OF PPX2 MUTATIONS CONFERRING PPO RESISTANCE IN TENNESSEE PALMER AMARANTH POPULATIONS. J. Copeland*, L. Steckel; University of Tennessee, Jackson, TN (188)

ABSTRACT

Protoporphyrinogen oxidase (PPO) inhibiting herbicides have been used in agronomic row crops for over 50 years. Broadleaf weeds, including glyphosate-resistant (GR) Palmer amaranth (Amaranthus palmeri), have been controlled by this mode of action both preemergence (PRE) and postemergence (POST). Consequently, A. palmeri evolved resistance to PPO-inhibitors in 2011 in Arkansas, 2015 in Tennessee, and 2016 in Illinois. Historically, the mechanism for this resistance involves the loss of a glycine at position 210 (ΔG210) in the mitochondrial isoform of the PPO enzyme, encoded by PPX2 gene. However, the ΔG210 deletion did not explain all PPO-resistant A. palmeri, resulting in false negatives in Tennessee populations. Recently, researchers at the University of Illinois have documented two new mutations within PPX2 (R128G, R128M) that confer resistance to PPO-inhibitors in A. palmeri. Therefore, research is needed to document the presence and distribution of the three known mutations that confer PPO-resistance in Tennessee.

In 2017, a survey was conducted in 18 fields with suspected PPO-resistant A. palmeri to determine whether resistance existed and how prevalent each known mutation was at each site. Fomesafen was applied at 270 g ai ha⁻¹ to infestations of A. palmeri (8-10 cm in height) within a row-crop field. Seven days after application, plant tissue from 10 surviving plants at each site was used to extract genomic DNA using a modified CTAB protocol. A TaqMan qPCR assay was used to score the plant as wild type or heterozygous/homozygous for the ΔG210 mutation. The two R128 mutations are found at two neighboring nucleotide positions within the PPX2 sequence. Thus, two dCAPS assays were used requiring a nested PCR approach followed by digestion with the appropriate restriction enzyme. Fully digested products were scored as wild type or heterozygous/ homozygous R128G or R128M mutants.

All three known mutations to confer PPO-resistance were detected in A. palmeri populations in Tennessee. Where resistance was explained, the ΔG210 mutation was detected in 50% of resistant plants. The R128G mutation accounted for 42% of resistance, similar to the frequency of the ΔG210 mutation. Additionally, the R128M mutation only described 8% of explained PPO-resistance and was significantly less frequent than the other two mutations. However, similar to previous research, 72% of PPO-resistance was explained with the three known mutations leaving 28% of resistance not explained in Tennessee populations. Survivors not showing any of the three known PPO mutations may permit other resistance mechanisms such as additional unknown target-site-based mutations or metabolic resistance.
TRANSLOCATION INHIBITION GRANTS NEW INSIGHTS ON THE TIME OF DAY EFFECT WITH 2,4-D CHOLINE. C. Johnston*1, W. Vencill1, T. Grey2; 1University of Georgia, Athens, GA, 2University of Georgia, Tifton, GA (189)

ABSTRACT

The efficacy of several herbicide mechanisms of action have been reported to vary across application time of day. Reduced herbicide efficacy at dawn and dusk has been reported with auxinic herbicides (WSSA Group 4), which may potentially limit the utility of these chemistries as postemergence weed control options in resistant crops. Previous research has provided substantial evidence that in Palmer amaranth, differential translocation may be a key association with the reduced efficacy of 2,4-D obtained during dawn applications. However, the physiological mechanism behind this differential translocation is unknown. A study was conducted with N-1-naphthylphthalamic acid (NPA), a broad inhibitor of PIN and ABCB auxin transport proteins, to evaluate the effect of deactivating these proteins on the difference in 14C-2,4-D translocation across simulated dawn and mid-day application timings and further determine any responsibility of these proteins on the time of day effect. Palmer amaranth plants were grown in the greenhouse and transplanted into individual hydroponic bottles prior to placing under an LED light program simulating an early-spring light spectrum and schedule. A factorial design combining two 2,4-D application timings (simulated dawn and mid-day) and four rates of NPA (0, 1, 10 and 25 µM) was used. Plants treated with NPA had the compound applied to hydroponic solution 8 h prior to 2,4-D treatment. At each 2,4-D application timing, non-radiolabeled 2,4-D choline was applied at 0.28 kg ae ha⁻¹ followed by a 1.83 kBq application of 14C-2,4-D choline to a single leaf in 5 2-µL drops. Nonlinear regression parameters describing the relationship between increasing NPA concentration and translocation of 14C-2,4-D out of the treated leaf into the stem indicated an insignificant difference in translocation at saturation with NPA (T_min) across application timings. This illustrates an inability to reject the null hypothesis that T_min is statistically similar across application timings, suggesting the translocation differential across application timings is potentially eliminated by the inhibitory mechanism of NPA. These results imply that PIN and/or ABCB transport proteins (likely among other processes) may be involved in the previously reported increased translocation at dawn. In consistency with these results, a statistically significant approximate F-test between regression equations leaves open the possibility of increased sensitivity of Palmer amaranth to NPA at mid-day, which suggests a potential decrease in total activity of these mechanisms at mid-day. Further research is necessary to narrow down the pool of translocation mechanisms potentially responsible for this phenomenon. Identification of the mechanism(s) responsible for the difference in translocation may lead to the identification of WSSA Group 4 chemistries that are effective across a wider range of application times.
DOES SALINITY ALTER THE RESPONSE OF TWO GRASS SPECIES TO HERBICIDE TREATMENTS? C. Prince*, G. MacDonald; University of Florida, Gainesville, FL (190)

ABSTRACT

Many freshwater environments in the United States are becoming increasingly saline due to various anthropogenic sources. To understand how this might impact invasive plant management, we grew *Panicum repens* (torpedograss) and *Phragmites australis* (common reed) in freshwater and brackish conditions in a greenhouse. Plants were treated with one of four rates of either glyphosate (0.5, 1, 2, or 4 lb a.e. per acre) or imazapyr (0.125, 0.25, 0.5, or 1 lb a.e. per acre). Thirty days after treatment (DAT), plants were evaluated for injury, height, stem number, and aboveground biomass. Plants were allowed to regrow, and at 60 DAT were evaluated for height, stem number, and above- and belowground biomass. Torpedograss was more impacted by salinity treatments than common reed, with plants grown in the brackish conditions showing less response to herbicide than those in freshwater.
KEY MORPHOLOGICAL EVENTS FOLLOWING FALL GOOSEGRASS (ELEUSINE INDICA (L) GAERTN) GERMINATION. B. Kerr*, L.B. McCarty; Clemson University, Clemson, SC (191)

ABSTRACT

Goosegrass (*Eleusine indica* (L.) Gaertn.) a weedy C₄ grass species found throughout the warmer regions of the world, is a major pest in turfgrass systems. Limited research has been reported investigating its life cycle. The objective of this study was to determine if goosegrass that germinates on August 15 will complete a life cycle before the first killing frost, typically November 15 in Clemson, SC. A biotype from Clemson, SC was collected and a growth chamber experiment conducted to simulate fall maximum and minimum temperatures. Culm, leaf, root and raceme biomass was determined on a weekly basis and growth curves modelled. Development through the life cycle was characterized based on the BBCH scale. Exponential growth or the inflection point for the following growth parameters occurred on; culm dry weight 26.5 days after emergence (DAE), leaf dry weight 26.6 DAE, number of raceme per plant 50.7 DAE, raceme dry weight including germinable seed 56.0 DAE and root dry weight 42.1 DAE. The completion of the life cycle occurred 68 DAE which was October 22, approximately 3 weeks before the typical first killing frost. In summary, turf managers need to address goosegrass that germinates through approximately the first week of September at this location to avoid it producing viable seed.
RESIDENTIAL HERBICIDE SOIL DISSIPATION IN GEORGIA PECAN GROVE. T. Grey*1, D. Netzband2, L. Vang3; 1University of Georgia, Tifton, GA, 2Bayer CropScience, Raleigh, NC, 3Bayer CropScience, Tifton, GA (192)

ABSTRACT

Pecan production in the southeastern United States has increased due to the worldwide demand for the nuts of this tree. Information about the effects of the residual herbicides indaziflam and rimsulfuron on newly planted pecan trees was evaluated over time and dissipation from sandy loam soil. After winter pecan tree planting, spring herbicide applications were applied to pecan trees. Visual injury and soil samples were taken up to 10 times during the growing season. Regression analysis of treatments over time indicated indaziflam half-life was 71 days while rimsulfuron was 1.5 days. This information will benefit growers seeking viable weed control options when establishing new groves to meet the increased worldwide demand for pecan nuts.
EVALUATION OF WEED COMPETITION WITH NOVEL SWEET POTATO LINES.
M. Cutulle*1, P. Wadl2; 1Clemson, Charleston, SC, 2USDA-ARS, Charleston, SC (193)

ABSTRACT

Tolerance to weed interference is a desirable trait to select for in a sweetpotato breeding program. Most commercial cultivars exhibit a creeping-type growth habit. Cultivars exhibiting a vine-type growth habit are typically susceptible to weed interference. Comparatively, sweetpotato plants that exhibit a bunch-type growth habit are more competitive against weeds. However, there is only one commercially available sweetpotato variety. At the United State Vegetable laboratory in Charleston sixteen sweet potato clones that exhibited a bunch-type growth habit were selected for placement in weed interference studies. In the 2017 trial four commercial cultivars and 16 experimental selections were kept weed free at intervals of 0, 2, 3 and 4 weeks. Weed counts, insect damage, and yield data were collected from the trial. The greatest weed interference was observed in the commercially available creeping-type cultivar Beauregard and Covington. USDA-16-154 had the least amount of insect damage while Covington had the most insect damage. Weed interference and sweetpotato cultivar/clone selection had a significant effect on marketable yield, though there was no variety by weed free interval interaction. The highest yielding sweetpotato treatment came from the USDA-16-154 clone, which produced 226.42 Bu/Acre while the lowest yielding treatment was 20.48 Bu/Acre, which was harvested from Beauregard. Across all varieties yield decreased from 166.56 Bu/Acre to 45 Bu/Acre when the weed free interval was decreased from 4 weeks to 0 weeks. Experimental cultivars USDA-16-154 and USDA-16-169 will be evaluated in 2018 field trials.
SCREENING OF SWEETPOTATO CULTIVARS FOR ALLELOPATHIC ACTIVITY AGAINST WEEDS. G.A. Caputo*1, M. Ferreira1, S. Shrestha2, S. Meyer1, T. Tseng1; 1Mississippi State University, Mississippi State, MS, 2Mississippi State University, Starkville, MS (194)

ABSTRACT

With a social and economic importance, the sweet potato (Ipomoea batatas L.) plays an important role in states such as Mississippi, Louisiana and North Carolina. However, with limited herbicide options, difficult to control weeds such as, palmer amaranth, yellow nutsedge and purple nutsedge can cause yield reductions up to 90%. There is therefore a distinct need to find alternative weed control strategies to overcome herbicide limitations and improve sweet potato quality and yield. One such promising weed control option is to use the weed suppressive ability already present in crop varieties, also known as allelopathy. The main objective of this study was to evaluate the allelopathic capacity of eighteen sweet potatoes cultivars in suppressing yellow nutsedge and palmer amaranth. Greenhouse screening was conducted to evaluate allelopathic potential of sweet potato accessions against each of the two weed species, while a field test was performed to assess the allelopathic potential of all 18 sweet potato accessions against native weed populations. Accessions 32, 39, 29, 33, and 43 inhibited palmer amaranth height the most, with accessions 32, and 39 reducing palmer amaranth biomass by 80% or more. Sweet potato accessions that inhibited yellow nutsedge height by 20% or more were 10, 22, 43, and 5. In the field study to assess the suppressive ability of sweet potato on native weed populations, accessions 31, 32, and 43 showed maximum weed suppression. Findings therefore suggest that accessions 32 and 43 can potentially be used in sweet potato breeding program to develop varieties with weed suppressive ability against problematic weeds such as yellow nutsedge and palmer amaranth.
TOLERANCE OF HALOSULFURON TREATED CALLUS DERIVED LINES OF LA 07-146 SWEET POTATO TO OVER-THE-TOP APPLICATION OF HALOSULFURON.
D. Miller*1, D.R. LaBonte2, N. Biasakh2; 1LSU AgCenter, St Joseph, LA, 2LSU AgCenter, Baton Rouge, LA (195)

ABSTRACT

A field study was conducted in 2017 at the Sweet Potato Research Station near Chase, La with the objective to evaluate halosulfuron treated callus derived lines of LA07-146 to differing rates of halosulfuron. A three replication factorial arrangement of treatments was used and included herbicide rates (Factor A: Halomax applied at 0, 1, 1.5, or 2 oz/A) and micro molar (mm) halosulfuron callus derived media concentration (0- regular Bayou Belle plants, 2mm, 6mm, 8mm, or 10 mm). Treatments were applied to each 3 x 7.62 m plot 21 d after transplanting on July 12. Parameter measurements included visual crop injury 7 and 14 d after application (DAT), NDVI measurements 16 DAT, and yield (U.S. #1, canner, jumbo, and total).

At 7 DAT, when averaged across mm concentration, greatest injury was observed following application of Halomax at the highest rate (33%). Injury was equivalent for the 1.5 (27%) and 1 (25%) oz rates. At 14 DAT, when averaged across mm concentration, a stepwise reduction in injury was observed from the 2 (24%) to the 1.5 (17%) and 1 (11%) oz application rates. At 14 DAT, when averaged across Halomax rate, the 10 mm concentration resulted in 17% visual injury, which was equal to that observed for the 8 (15%) and 2 (14%) mm concentrations and greater than that for the 0-regular Bayou Bell (11%) and the 6 mm (9%) concentration.

When averaged across Halomax rate, the 0-regular Bayou Belle resulted in an NDVI of 0.84, which was equal to that for the 6 (0.82) and 10 (0.81) mm concentrations and greater than that for the 2 (0.8) and 8 (0.77) mm concentrations. When averaged across mm concentration, the 0 Halomax rate resulted in an NDVI of 0.83, which was equal to that for the 1 oz rate (0.82) and greater than that for the 1.5 (0.8) and 2 (0.78) oz rates.

U.S. #1 yield, when averaged across mm concentration, was 373 bu/A for the 0 Halomax rate and greater than all other rates which resulted in equivalent yield ranging from 222 to 279 bu/A. Averaged across Halomax rate, U.S. #1 yield, with the exception of the 8 mm concentration (123 bu/A), was equivalent and ranged from 293 to 361 bu/A for all concentrations. Jumbo yield, when averaged across Halomax rate, was equal for the 0-regular Bayou Belle, 2, and 10 mm concentrations (135 to 181 bu/A) and greater than that for the 6 (75 bu/A) and 8 (37 bu/A) mm concentrations. Total yield, when averaged across Halomax rate, was 787 bu/A for the 10mm concentration, which was equal to that for the 0-regular Bayou Belle (703 bu/A) and the 2 mm concentration (752 bu/A). Lowest total yield was observed with the 8 mm concentration (448 bu/A).
ELUCIDATION OF HERBICIDE SAFENER CONCEPTS IN TOMATO. M. Cutulle¹, H.T. Campbell*², ¹Clemson, Charleston, SC, ²Clemson University, Charleston, SC (196)

ABSTRACT

Metribuzin, is a commonly used herbicide in tomato production throughout much of South Carolina. While Metribuzin is an effective broadleaf weed and annual grass weed herbicide in tomato settings, crop injury has been observed with its use. Particularly, tomato injury associated with Metribuzin takes place when applied after several days of warm, cloudy, humid, and rainy weather that stimulates fast growth, which is common in South Carolina. Greenhouse experiments were conducted in 2017 to assess various tolerance and susceptibility traits displayed by 6 tomato varieties commonly produced in South Carolina (Rocky Top, Red Bounty, Defiant PhR, Carolina Gold, Mountain Majesty, and Mountain Magic) to various application rates of Metribuzin. Further experiments were conducted with a more tolerant variety (Mountain Majesty) and a more susceptible variety (Carolina Gold) to evaluate the potential of an iron chelate product to act as a crop safener when mixed with Metribuzin. Five rates of Metribuzin were selected (224, 420, 840, 1680, and 3360 g ai/ha) and applied to both varieties alone, and in combination with an Fe chelate product (Sequestrene). Carolina Gold injury was observed to decrease with the addition of Fe chelate at all rates compared to treatments not containing Fe chelate, except for the highest rate (3360 g ai/ha), which saw the same amount of injury, while Mountain Majesty injury decreased by more than 50% with the addition of Fe chelate at the highest rate, compared to the highest rate treatment not containing Fe chelate. A field trial was conducted in Charleston, SC to determine if chelated Fe would safen metribuzin in the field when applied to Rocky Top tomato, selected for its disease tolerance and moderate sensitivity to metribuzin. Chelated Fe products significantly reduced injury from metribuzin 1 week after treatment. No antagonism regarding weed control was detected when chelated Fe was mixed with metribuzin.
TOMATO TOLERANCE AND PEST CONTROL FOLLOWING FUMIGATION WITH DIFFERENT RATIOS OF DIMETHYL DISULFIDE AND CHLOROPICRIN. J. Yu*1, N. Boyd2; 1University of Florida, Balm, FL, 2University of Florida, Wimauma, FL (197)

ABSTRACT

Dimethyl disulfide (DMDS) has demonstrated efficacy to control nematodes, soil-borne pathogens, and weeds. DMDS can be used alone but is more frequently used in mixtures with chloropicrin (Pic). Experiments were conducted from February to June 2017 (spring experiment) and July to December 2017 (fall experiment) at the Gulf Coast Research and Education Center in Balm, Florida to identify the optimal ratios of DMDS and Pic for weed and fusarium control in tomato (*Solanum lycopersicum* L.). The experiments were conducted as a randomized complete block design with four blocks and twelve treatments. Fumigant treatments included 374 L ha⁻¹ DMDS plus Pic (DMDS + Pic) mixed in different ratios, including 355 L ha⁻¹ DMDS + 19 L ha⁻¹ Pic, 377 L ha⁻¹ DMDS + 37 L ha⁻¹ Pic, 318 L ha⁻¹ DMDS + 56 L ha⁻¹ Pic, 296 L ha⁻¹ DMDS + 79 L ha⁻¹ Pic, 224 L ha⁻¹ DMDS + 150 L ha⁻¹ Pic, and 150 L ha⁻¹ DMDS + 224 L ha⁻¹ Pic. Treatments also included DMDS alone at 224, 299, 337, 355, and 374 L ha⁻¹. A non-fumigant control was included in each block. The fumigant applications were made with a standard fumigation rig equipped with three shanks set to evenly distribute fumigant at the base of the 20 cm tall bed. All fumigant treatments were safe to tomato. None of the fumigant treatments damaged and stunted the tomato crops. There were no differences in tomato fruit weight per categories among the non-fumigant control and plots treated with fumigants. In spring experiment, purple nutsedge (*Cyperus rotundus* L.) density was low and the non-fumigant control had an average of 3 purple nutsedge shoots m⁻². There were no significant differences among fumigant treatments for purple nutsedge control in spring experiment. However, the DMDS + Pic combinations containing more Pic tended to be more effective. In fall experiment, weed densities were high and the nontreated control had an average of 30, 61, 147, and 152 purple nutsedge shoots m⁻² at 1, 6, 9, and 13 weeks after transplanting (WATP). DMDS on its own did not generally control nutsedge as affectively as DMDS+Pic. All DMDS alone treatments did not significantly reduce purple nutsedge densities compared with the non-fumigant control at all rating dates. 296 L ha⁻¹ DMDS + 79 L ha⁻¹ Pic provided effective purple nutsedge control at 6 and 9 WATP but not at 13 WATP. In comparison, 150 L ha⁻¹ DMDS + 224 L ha⁻¹ Pic provided ≥99% control of purple nutsedge at 6, 9 and 13 WATP. In spring experiment, DMDS at 355 L ha⁻¹ and 374 L ha⁻¹ effectively controlled fusarium, whereas DMDS rates ranging from 224 to 337 L ha⁻¹ failed to provide effective fusarium control. In fall experiment, none of evaluated DMDS alone treatments effectively controlled fusarium. In contrast, all DMDS + Pic treatments effectively controlled fusarium. Overall, results suggest that the addition of Pic to DMDS improves purple nutsedge control. 150 L ha⁻¹ DMDS + 224 L ha⁻¹ Pic is more effective as compared to 296 L ha⁻¹ DMDS + 79 L ha⁻¹ Pic for purple nutsedge control. The addition of Pic to DMDS is helpful to control fusarium but as low as 5% in the mixtures would be adequate to control fusarium.
PRECISION APPLICATION OF PREEMERGENCE HERBICIDES IN PLASTICULTURE TOMATO PRODUCTION. N. Boyd*, A. Schumann2; 1University of Florida, Wimauma, FL, 2University of Florida, Lake Alfred, FL (198)

ABSTRACT

The use of preemergence (PRE) herbicides under the plastic mulch for broadleaf and grass control in Florida plasticulture production has increased following the loss of methyl bromide. Weeds, with the exception of nutsedge species, are unable to puncture the plastic mulches and as a result emergence is limited to transplant holes and between the beds. Growers typically broadcast apply PRE herbicides on the bed top following fumigation immediately prior to laying the plastic mulch. A precision hole punch sprayer was developed that facilitates application of PRE herbicides in the transplant hole during the hole punch operation. This limits the application of herbicides to the area where broadleaf and grass weed are able to emerge. Tomato and bell pepper growth and yield as well as weed control were unaffected by the use of precision herbicide applications compared to a broadcast application. Herbicide use was reduced by 90-92% in a bell pepper crop when using the precision applicator compared with a broadcast application to the bed top. Initial accuracy was low (55-86%) but equipment modifications resulted improvement to near 100% accuracy. Adoption of this technology has the potential to significantly reduce overall herbicide use with no reduction in weed control.
INCLUSION OF S-METOLACHLOR IN SUMMER COVER CROPS FOR WEED CONTROL IN FALL PLANTED LEAFY VEGETABLES. P. Dittmar*1, N. Boyd2; 1University of Florida, Gainesville, FL, 2University of Florida, Wimauma, FL (199)

ABSTRACT

The fallow period during the summer months allows Florida farmers the opportunity to use cover crops to suppress weed growth, control nematode populations, and improve soil. Preemergence herbicides provide nutsedge and grass control early in the fallow period before the cover crop has canopy closure. Field studies were conducted in 2016 to evaluate s-metolachlor PRE in iron clay pea, sunnhemp, and sorghum Sudangrass. The treatments included the three cover crops with or without s-metolachlor, two applications of glyphosate at 6 week interval, and a nontreated. Bok choy was direct seeded after the cover crops had been terminated. The weed control in the bok choy was lowest in the glyphosate treatments. Sorghum Sudangrass with s-metolachlor had lower nutsedge populations than sorghum Sudangrass with s-metolchlor. The clay pea and sunnhemp had similar nutsedge populations with or without s-metolachlor. The benefit of s-metolchlor PRE is dependent on the canopy structure of the cover crop. Cover crops with a more open canopy structure like sorghum Sudangrass benefitted from the herbicide application. The clay pea and sunnhemp have a more dense canopy structure and could shade the larger weeds that emerged earlier in the season.

ABSTRACT

Black medic infestations are problematic in Florida strawberry production, competing with the crop and hindering harvest. Current management techniques for postemergence broadleaf weed control using clopyralid are ineffective at controlling black medic, providing suppression only. Earlier clopyralid applications may solve this issue but neither the tolerance of strawberry such applications nor the field emergence patterns of black medic are understood. The objective of the studies were: 1) to test the tolerance of strawberry plants to clopyralid when applied shortly after transplant, and 2) model field emergence of black medic using empirical techniques to coordinate application timings. For strawberry tolerance, the main factors were application timing (2, 3, and 4 weeks after transplant (DATr)) and clopyralid rate (140 and 280 g ha⁻¹). For black medic emergence, four sites in Hillsborough County, Florida, were monitored using four replications per site. For strawberry tolerance, clopyralid induced ≥36% leaf cupping with a dose of 280 g ha⁻¹ at 21 and 28 DATr. By 8 weeks after treatment, there was no visible leaf cupping by any treatment. Treatments did not affect aboveground strawberry plant biomass, the number of crowns, or yield. There was a 3% reduction in plant height by the 280 g ha⁻¹ dose compared to 140 g ha⁻¹. For black medic field emergence, in year one, emergence began at 862 GDD and peaked at 1416 GDD. This corresponded to November 22, 2014 and December 25, 2014, respectively. In year two, black medic failed to emerge. Overall, earlier applications are safe on strawberry plants and the period for black medic emergence better defined. Further study is required to produce a feasible prediction model using reductionist techniques to be reliable over years.
EGGPLANT TOLERANCE TO REFLEX - SPECIAL LOCAL NEEDS LABEL POSSIBLE? K.J. Goodman*1, J. Smith1, A.S. Culpepper2, H. McLean3; 1University of Georgia, Tifton, GA, 2University of Georgia, Tifton, GA, 3Syngenta Crop Protection, Perry, GA (201)

ABSTRACT

Eggplant is an important vegetable crop for Georgia farmers with a farm gate value exceeding $25 million per year. Managing weeds in eggplant is difficult partly in response to limited registered herbicides. Thus, a bareground experiment was conducted twice to determine the tolerance of eggplant to potentially new herbicides including fomesafen (Reflex at 0.13, 0.19, 0.25, 0.375, and 0.5 lb ai/A), prometryn (Caparol at 0.5 and 1 lb ai/A), and oxyflourfen (Goal Tender at 0.25 and 0.5 lb ai/A). Land was prepared conventionally followed by the application of all herbicide treatments and 0.3 inch of irrigation. The following day, Santana eggplant were transplanted. Each location was maintained weed-free to evaluate crop response to herbicide treatments. Maximum visual injury was noted between 3 and 4 wk after planting. Injury from fomesafen was less than 5% at rates of 0.25 lb or lower and was only 10% with 0.5 lb. Greater injury was noted with both prometryn (40 to 86%) and oxyflourfen (46 to 56%). Prometryn was the only herbicide to reduce stand (20 to 50%). Fomesafen at rates up to 0.375 lb and oxyflourfen at 0.25 lb did not impact fresh weights while fomesafen at 0.5 lb, prometryn, and oxyflourfen at 0.5 lb reduced fresh weights 20 to 77% when compared to the control. Marketable eggplant was harvested 21 to 26 times and no rate of fomesafen influenced yield. Both rates of oxyflourfen (22-39%) and prometryn (22-70%) reduced eggplant fruit harvested.
SPECIES DIFFERENTIATION AND SPECTRAL VARIABILITY OF CROP AND WEED SPECIES USING HYPERSPECTRAL REMOTE SENSING. N. Basinger*1, K. Jennings2, E.L. Hestir3, D. Monks2, D. Jordan2, W. Everman2; 1North Carolina State Univ., Raleigh, NC, 2North Carolina State University, Raleigh, NC, 3University of California, Merced, Merced, CA (202)

ABSTRACT

Interest is increasing for the use of remote sensing in agriculture, with specific applications for weed detection and monitoring. One important use of this technology in agricultural settings is the ability to differentiate species from one another, allowing for discrimination between weed and crop species. Therefore, field studies were conducted in 2016 and 2017 at the North Carolina State University Horticulture Field Lab near Raleigh to determine if weed and crop species could be differentiated separately using hyperspectral reflectance. Weeds [common ragweed (Ambrosia artimisiifolia), Palmer amaranth (Amaranthus palmeri), yellow nutsedge (Cyperus esculentus), and large crabgrass (Digitaria sanguinalis)] and crops [soybean (Glycine max), sweetpotato (Ipomea batatas), peanut (Arachis hypogaea), and cucumber (Cucumis sativas)] and one bareground (no weed, no crop) control were established in large 95 L pots. Crop and weed phenology in both years greatly affected the spectra at which species could be differentiated. Early season differentiation, at three wk after planting (WAP), between species was represented by spectra in the visible (VIS) (chlorophyll, pigment absorption), and shortwave infrared (SWIR) (lignin and cellulose) in 2016. In 2017, plants were slower to emerge and early differentiation occurred in areas associated with VIS, (chlorophyll, pigment absorptions), and near infrared (NIR) (biomass and leaf area index). In both years 5 WAP wavelengths across the spectrum in the VIS, NIR and SWIR allowed for differentiation. At 9 and 10 WAP (2017), spectra associated with differentiation were concentrated in the VIS and SWIR portions of the spectrum. Additionally, canopy structure (planophile or erectophile) and leaf structure (simple or compound) also affected reflectance. Across collection dates and years, plants with simple leaves and planophile structures (sweetpotato, cucumber, Palmer amaranth), or dense prostrate growth (large crabgrass), tended to have higher reflectance values than plants with compound leaves or erectophile growth (peanut, ragweed, soybean, yellow nutsedge) in the NIR region.
COTTON VARIETY TOLERANCE AND YIELD RESPONSE TO SOIL HERBICIDES APPLIED PRE. F.B. Browne*, S. Li, K.J. Price; Auburn University, Auburn, AL (203)

ABSTRACT

Although newly commercialized cotton varieties with herbicide tolerant traits allow flexible postemergence applications, incorporation of soil-applied herbicides into weed management programs remains critical to decrease weed pressure for postemergent applications and allow quicker crop development in the absence of weed competition. Additionally, glyphosate-resistant weeds continue to be problematic and incorporation of different modes of action into weed management programs can reduce the risk for resistance development. However, crop injury from soil-applied herbicides has been reported under certain environmental conditions and may be affected by soil types. Therefore, field studies were conducted in 2017 in Escambia, Henry, and Macon counties in Alabama to evaluate injury resulted from applications of soil herbicides at planting on four common cotton varieties. Treatments included applications of fomesafen in combination with acetochlor, diuron, fluridone, and prometryn at 1x and 2x of label rates for sandy soils. Cotton emergence at 3 weeks after planting (WAP) was reduced by 16% after treatments of fomesafen + prometryn at 1x rates in Henry County and by 13% after treatments of fomesafen + diuron at 2x rate in Macon County. However, cotton stand recovered by 7 WAP as compared to NTC. Cotton height at 3 WAP was reduced by 24% after applications of fomesafen + prometryn at 2x rates in Macon County but recovered by 7 WAP. No stand or height reductions were observed in Escambia County where rainfall exceeded 2.5 inches more than Henry and Macon counties in the first 14 days after planting. No reductions in cotton seedling biomass were observed 3 WAP and cotton yield was not affected by treatments. These data indicate the fomesafen-based treatments tested in this study may be applied at planting without interfering with cotton development or yield.
CONTROL AND SEED SUPPRESSION OF GLYPHOSATE-RESISTANT ITALIAN RYEGRASS. T. Bararpour*, J. Bond2, H.M. Edwards3, J. Peeples Jr.4, R.R. Hale3, J.W. Seale1; 1Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 2Delta Research and Extension Center, Stoneville, MS, 3Mississippi State University, Stoneville, MS, 4Delta Research and Extension Center, Stoneville, MS (204)

ABSTRACT

Italian ryegrass (Lolium perenne L. ssp. multiflorum) is a major weed problem in wheat (Triticum aestivum L.) production worldwide. Glyphosate-resistant (GR) ryegrass represents a serious threat to agricultural systems in the Mid-South, especially if it continues to spread. Two separate studies were conducted at the Delta Research and Extension Center, in Stoneville, Mississippi, in 2017 to evaluate: 1) the efficacy of herbicides available to Mississippi producers for controlling GR Italian ryegrass (control study) and 2) fall burndown herbicide programs to suppress Italian ryegrass seed production (seed suppression study). The experiments were designed as a randomized complete block. In the control study, treatments were as follows: 1) Axiom (flufenacet + metribuzin) at 0.255 EPOST (one- to two-leaf ryegrass); 2) Axial XL (penoxaden) at 0.0534 EPOST; 3) Osprey (mesosulfuron) at 0.0134 EPOST; 4) Finesse (chlorsulfuron + metsulfuron) at 0.0234 PRE; 5) Finesse PRE followed by (fb) Axial XL at LPOST (three- to four-tiller ryegrass); 6) Axiom + Axial XL EPOST; 7) Axiom EPOST fb Osprey LPOST; 8) Osprey EPOST fb Osprey LPOST; 9) TriCor (metribuzin) at 0.094 EPOST fb Osprey LPOST; 10) TriCor EPOST fb TriCor LPOST; 11) Zidua (pyroxasulfone) at 0.08 EPOST; 12) Osprey LPOST; 13) Zidua EPOST fb TriCor LPOST; 14) Osprey EPOST fb TriCor LPOST; 15) Axiom EPOST fb Axial XL LPOST (Standard). Activator at 0.25% v/v + UAN (urea-ammonium nitrate) at 3.33% v/v were added to treatments 3, 7, 8, 9, 12, and 14. In the seed suppression study, treatments were as follows: 1) Dual Magnum (S-metolachlor) at 1.27 + Valor SX (flumioxazin) at 0.064 + Gramoxone SL (paraquat) at 1 in Oct-Nov followed by (fb) Roundup PowerMax (glyphosate) at 1.13 + Select Max (clethodim) at 0.125 in Jan-Feb fb Gramoxone as needed (weed-free check); 2) Dual Magnum + Valor SX + Gramoxone in Oct-Nov; 3) field cultivator (disk) in Oct-Nov; 4) Roundup PowerMax + Select Max in Jan-Feb; 5) field cultivator in Oct-Nov fb Roundup PowerMax + Select Max in Jan-Feb. Activator at 0.5% v/v was added to each herbicide application. A nontreated check was included. Herbicide rates were in lb ai/A, except for Roundup PowerMax, which was in lb ae/A.

In the control study, Axiom EPOST fb Axial XL LPOST treatment (standard) provided 93% control of GR Italian ryegrass. Treatments 1, 2, 6, 7, 9, 10, 11, and 13 provided comparable Italian ryegrass control (92 to 97%) as standard treatment. Glyphosate-resistant Italian ryegrass control was 80 to 85% for treatments 3, 5, and 8. Treatments 4, 12, and 14 failed to control Italian ryegrass (only 68 to 73%). In the seed suppression study, GR Italian ryegrass control was 100, 100, 67.5, 97, and 99.5% for treatment 1 through 5, respectively. In nontreated plot, Italian ryegrass population was 39 plants per meter square and produced 97,239 seeds. The remaining Italian ryegrass from the application of treatments 3, 4, and 5 produced 61,204; 4,047; and 9 seeds per meter square, respectively. Glyphosate-resistant Italian ryegrass seed suppression was 100, 100, 37, 96, and 99.99% from treatment 1 through 5, respectively.

REVISITING FLUOMETURON OVER THE TOP OF COTTON. A. Kendig*1, D.
Downing2, A. Tinsley3, S. Eskelsen4; 1ADAMA, Chesterfield, MO, 2ADAMA, Raleigh, NC, 3ADAMA, Palo Alto, CA, 4ADAMA, Wenachee, WA (205)

ABSTRACT

Until the mid 1990s there were no herbicides providing selective, over-the-top control of broadleaf weeds in cotton. Weed control depended upon a strong preemergence herbicide program followed by post-emergence directed sprays of non-foliarily-selective herbicides starting as early as 3” tall cotton. When preemergence herbicides failed, fluometuron or MSMA/DSMA were sometimes recommended as an over-the-top spray. MSMA usually caused low to moderate crop response and provided excellent control of cocklebur, but less control of other weeds. Fluometuron response varied from none to severe with weed control also varying from none to excellent. Discussions with cotton weed scientists from the time indicated that this was an appropriate, last-option before destroying and replanting, but was never a good option. Conversely, literature mentions 1 and 2 lb ai/A, over-the-top applications of fluometuron having no yield effects. After the commercialization of pyrithiobac and herbicide-tolerant triats like bromoxynil and glyphosate, the practice was largely forgotten. However, label language still supports this use and we have learned that some growers are still making over-the-top applications in limited areas.

Ten trials were conducted across the Cotton Belt comparing fluometuron PRE at 0.5, 0.75 and 1 lb ai/A, versus 0.5 lb ai/A POST at the cotyledon stage. Standard, small-plot weed science methodology was used. Nine trials were successful in recording crop response, eight trials were successful in recording weed control. Crop response was excellent (0-3%) in five trials, acceptable (10-18%) in three trials and high (38%) in one trial. Pigweed control (predominately Palmer amaranth) was inadequate (0 to 43% in five trials). Adequate control (77, 84 and >95%) was observed in three trials. In two of eight trials (25%), adequate weed control and acceptable crop injury were observed. The injury results seem consistent with past verbal information, and over-the-top fluometuron is prohibitively risky for today’s uses. However, the lack of adequate weed control may be a bigger limitation to the concept.
OPTIONS FOR SALVAGE TREATMENTS IN XTENDFLEX COTTON. W. Coffman*1, T. Barber2, J. Norsworthy1, Z. Hill3; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas, Lonoke, AR, 3University of Arkansas Cooperative Extension Service, Monticello, AR (206)

ABSTRACT

The productivity of a cotton crop can be threatened by the rapid growth and interference of weeds like Palmer amaranth (Amaranthus palmeri) and barnyardgrass (Echinochloa crus-galli), which allows them to compete for water, sunlight, and nutrients, if they are not controlled early season. Because herbicide-resistant weeds are becoming more widespread and timely applications are sometimes challenging due to weather, time, and label constraints, effective postemergence (POST) herbicide control options can be limited. To determine if glyphosate, glufosinate, and dicamba could be used to salvage an XtendFlex® cotton crop infested with weeds commonly found in Arkansas, a field trial was conducted at the Rohwer Research Station near Watson, Arkansas in 2017. Treatments were arranged in a two-factor factorial, with the first factor being herbicide combination and the second being POST timing. POST applications that included glyphosate as Roundup PowerMax (1.06 kg ae/ha), glufosinate as Liberty (0.59 kg ai/ha), or dicamba as Engenia (0.56 kg ae/ha) were made alone or in combination to non-crop plots infested with 60-cm tall barnyardgrass and 50-cm tall Palmer amaranth, followed by (fb) a second application of the same product(s) either 7 or 14 days later. Weed control ratings were taken three weeks after the final treatment was applied. When dicamba plus glyphosate was applied fb the same treatment 7 and 14 days later, 81% and 75% control were obtained, respectively. However, dicamba alone offered 96% control of Palmer amaranth at both second application timings due to intense competition from barnyardgrass. Acceptable levels of barnyardgrass control were unable to be achieved with any treatment. The highest numerical value for control of barnyardgrass (84%) was shown when dicamba plus glyphosate was applied and fb the same application 7 days later. Although this research demonstrates viable options to control large Palmer amaranth, it is important to continue to use preemergence herbicides and make timely POST applications.
NON-DICAMBA WEED CONTROL PROGRAMS IN XTENDFLEX COTTON. B. Wilson*1, D. Dodds2, S. Garris3, M. Plumblee2, L.X. Franca2; 1Mississippi State, Mississippi State, MS, 2Mississippi State University, Mississippi State, MS, 3Bayer CropScience, Bentonia, MS (207)

ABSTRACT

Glyphosate resistant Palmer amaranth (Amaranthus palmeri) has caused increased yield losses in cotton yield in recent years. XtendFlex™ cotton cultivars released in 2015 by Monsanto Company which confer tolerance to glyphosate, glufosinate, and dicamba. XtendFlex™ cotton varieties were planted on over 70% of Mississippi hectares in 2017. Due to the popularity of these cotton varieties this study was conducted to evaluate non-dicamba herbicide options in XtendFlex™ cotton production systems.

This study was conducted at Hood Farms in 2017 in Dundee, MS to evaluate non-dicamba herbicide options in XtendFlex™ cotton systems. Deltapine 1646 B2XF was planted on 10 May 2017 in 4 row plots 3.9 m wide x 9 m in length. A PRE application of flumeturon (Cotoran® 4L) at 1.12 kg ai ha⁻¹ was made prior to all POST treatments. The initial post application was made when Palmer amaranth was less than 7.6 cm. The second POST application was made when survival and remerged Palmer amaranth populations reached 7.6 cm. Another POST application was made when survival and remerged Palmer amaranth was 15 cm. Each POST application included glufosinate (Liberty 280 SL®) at three increased rates 0.66, 0.74, 0.88 kg ai ha⁻¹ alone, and in conjunction with acetochlor (Warrant®) at 1.3 kg ai ha⁻¹, glyphosate (Roundup PowerMAX®) at 1.1 kg ai ha⁻¹, and S-metolachlor (Dual MAGNUM®) at 1.4 kg ai ha⁻¹. A layby application was made with flumioxazin (Valor® SX) at 0.17 kg ai ha⁻¹ + MSMA (MSMA 6 Plus) at 4.4 kg ai ha⁻¹. Plots treated when Palmer amaranth was 15 cm received another POST application of glufosinate at the three increased rates. Visual Palmer amaranth control ratings were taken 10 days after PRE application, and 7 days after each POST application. End of season data consisted of lint yield. Data were subjected to analysis of variance using PROC Glimmix procedure in SAS 9.4 and means were separated using fisher’s protected LSD p = 0.05

No significant differences in Palmer amaranth control were observed 10 days after PRE application. All treatments excluding the untreated check resulted in greater than 90% visual Palmer amaranth control at this time. The greatest palmer amaranth control 7 days after the initial post application was from glufosinate (0.74 and 0.88 kg ai ha⁻¹) + acetochlor (98%) and glufosinate at (0.66 kg ai ha⁻¹) + S-metolachlor (99%). No significant differences in Palmer amaranth control were observed 7 days after the second POST application between glufosinate tank mix combinations (98% - 99%). Also, no significant differences in Palmer amaranth control were observed 7 days after the third post emergence application between glufosinate tank mix combinations (91% - 95%). The greatest visual Palmer amaranth control 7 days after the layby application was from glufosinate at 0.74 kg ai ha⁻¹ (99%). However, no significant differences were observed across all herbicide treatments in cotton lint yield.
XTENDIMAX HERBICIDE WITH VAPORGRIP TECHNOLOGY IN ROUNDP ROLD PU RDUP READY XTEND CROP SYSTEM. N. Rana¹, G. Montgomery*²; ¹Monsanto Company, St Louis, MO, ²Monsanto Company, Trenton, TN (208)

ABSTRACT

Monsanto Company has developed formulations containing dicamba for use in the Roundup Ready® Xtend Crop System. XtendiMax® herbicide with VaporGrip® Technology was registered for commercial over-the-top use by the EPA in 2016 and is a key component of the Roundup Ready® Xtend Crop System. Field trials were completed in 2017 to evaluate management of instances of lack of control with XtendiMax herbicide with VaporGrip Technology and its approved tank-mix combinations. XtendiMax® with VaporGrip® Technology + Roundup PowerMAX® herbicide and XtendiMax® with VaporGrip® Technology + Roundup PowerMAX + Warrant® Ultra herbicide provided ≥ 95% broadleaf and narrowleaf control for management of instances of lack of control. Field trials were also conducted to determine impact of time of day on weed efficacy when systemic and contact herbicides are combined for weed control. Time of day was a significant factor across herbicide applications. Improved weed efficacy was observed for herbicide applications at solar noon compared to sunrise or dark. The XtendiMax® herbicide with VaporGrip® Technology label requires application to be between sunrise and sunset.

XtendiMax® herbicide with VaporGrip® Technology is part of the Roundup Ready® Xtend Crop System and is a restricted use pesticide for retail sale to and use only by Certified Applicators or persons under their direct supervision.
ABSTRACT

Burndown or pre-plant herbicide applications are important for establishing a weed-free seed bed prior to planting. Due to the increase in evolution of herbicide resistant weeds, herbicides that provide residual control are recommended. Oxyfluorfen is a protoporphyrinogen oxidase (PPO)-inhibiting herbicide that provides residual control of grass and broadleaf weeds. Incorporating oxyfluorfen into a burndown or pre-plant application prior to planting cotton will offer another residual herbicide in combating the spread of herbicide-resistance in the field. A bareground study was conducted in 2017 at the Delta Research and Extension Center in Stoneville, MS, to evaluate oxyfluorfen-containing tank-mixtures with commonly used burndown herbicides for enhanced and residual weed control 30 days prior to planting cotton (*Gossypium hirsutum*) or soybean (*Glycine max*). Treatments were arranged in a randomized complete block design. Herbicide treatments included: 1) oxyfluorfen (Goal 2XL) at 280 g ai ha\(^{-1}\) + glufosinate (Liberty) at 656 g ai ha\(^{-1}\) + non-ionic surfactant (NIS) at 0.50% (v/v); 2) oxyfluorfen + dicamba (Clarity) at 244 g ai ha\(^{-1}\) + NIS; 3) oxyfluorfen + glyphosate (Roundup PowerMAX) at 1,156 g ai ha\(^{-1}\) + NIS; 4) glufosinate + NIS; 5) dicamba + NIS; 6) glyphosate + NIS; 7) oxyfluorfen + glufosinate. An untreated check was included. Visual ratings of weed control and crop injury were estimated between 0 (no control or no injury) to 100% (complete control or crop death) and recorded every 2 wk. At the time of application, cutleaf eveningprimrose (*Oenothera laciniata*), horseweed (*Conyza canadensis*) and broadleaf signalgrass (*Urochloa platyphylla*) were present with densities of 3, 2, and 15 m\(^{-2}\), respectively.

Cutleaf eveningprimrose control was 93, 84, and 88% for treatments 1, 4, and 7 at 14 d after treatment (DAT), respectively. At 28 DAT, treatments 1, 3, and 7 exhibited >91% control of cutleaf eveningprimrose. Horseweed control was ≤89% (Trts. 1 and 7) 14 DAT, however, 100, 95, and 97% horseweed control was observed in treatments 1, 4, and 7 at 28 DAT, respectively. Broadleaf signalgrass control at 14 DAT was >96% for treatments 1, 4, 6, and 7. By 28 DAT, 93, 99, 91, and 99% broadleaf signalgrass control was observed for treatments 1, 3, 4, and 7, respectively. Based on these results, treatments 1 and 7 provided greater residual control of the weed species evaluated. Treatments 2 and 5 did not exceed >63% control of any broadleaf weeds evaluated. For broadleaf signalgrass, significantly greater control (89%) was observed with treatment 2 compared to treatment 5 (0%). Based on these results, treatments 1 and 7 are viable burndown options with residual activity when both grasses and broadleaf weeds are present. Tank-mixing oxyfluorfen with dicamba may provide additional control if grass weeds are present. Oxyfluorfen offers another mode of action with residual benefits.
PERFORMANCE OF HPPD TOLERANT COTTON IN WESTERN TEXAS. P.A. Dotray*1, F.T. Moore2, C. Thompson2; 1Texas Tech University, Texas A&M AgriLife Research and Extension Service, Lubbock, TX, 2Bayer CropScience, Lubbock, TX (210)

ABSTRACT

Cotton tolerant to 4-hydroxyphenylpyruvate dioxygenase (HPPD) inhibitors, such as isoxaflutole (IFT), is under development by Bayer CropScience and was field tested in 2016 and 2017. This novel mode of action for cotton will provide growers a new solution to control both herbicide resistant (including glyphosate) broadleaf and grass weeds as well as other problematic weeds. The objective of this research was to evaluate HPPD-Inhibitor tolerant cotton to IFT applied either preemergence or early postemergence, alone or in combination with glyphosate (RUPM) or Liberty, and the impacts of crop response, as measured by yield. HPPD-Inhibitor tolerant cotton was planted at 60,000 seeds/A at four locations in western Texas. Field trials were conducted at Lubbock (Amarillo fine sandy loam with overhead irrigation), New Deal (Pullman clay loam with subsurface drip irrigation), Plainview (Pullman clay loam with overhead irrigation), and San Angelo (Tobosa clay with furrow irrigation). Isoxaflutole was applied preemergence (PRE) or early-postemergence (EPOST) at the 2- to 4-leaf stage. Additional mid-postemergence (MPOST) applications of RUPM or Liberty at squaring and late-postemergence (LPOST) applications of RUPM at full bloom were included in some treatments. All herbicide treatments were applied at 2X the maximum labeled rate in a carrier volume of 15 GPA. The IFT EPOST treatments included crop oil concentrate and ammonium sulfate (AMS) and all solo RUPM and Liberty applications included AMS. Plots were maintained weed-free. Cotton stand, phytotoxicity, plant height, and crop maturity were evaluated after treatment and yield and fiber quality were determined at the end of the growing season. No adverse effects were observed on cotton stand. Mean visual phytotoxicity (leaf chlorosis) did not exceed 3% following IFT applications. Isoxaflutole followed by (fb) sequential applications of RUPM made EPOST, MPOST, and LPOST or Liberty made EPOST and MPOST did not result in mean phytotoxicity that exceeded 6%. Isoxaflutole applied alone or in tank mix combination with RUPM or Liberty did not impart mean phytotoxicity that exceeded 10%. All phytotoxicity dissipated throughout the growing seasons and injury did not exceed 1% at the final rating. Mean plot yield ranged from 1480 to 1656 lb/A. No yield differences were observed when comparing any IFT treatment to the nontreated weed free check. Exceptional cotton tolerance was observed following IFT applied PRE across all soil types and irrigation regimes. Isoxaflutole applied PRE fb sequential postemergence applications of RUPM induced chlorosis (≤4%) and dissipated rapidly, while Liberty caused spotty necrosis and cuticle thickening that did not exceed 6%. Visual symptomology observed following IFT applied EPOST alone or in tank mix with RUPM or Liberty (≤10%) did not adversely affect plant growth or development. No difference in plant height, maturity, lint yield, or HVI fiber quality was observed following any IFT treatment when compared to the nontreated weed free check. Future research will include testing elite germplasm containing HPPD tolerance in diverse growing conditions throughout the cotton growing regions of the USA.
SUNNHEMP VARIETY RESPONSES TO COMMON COTTON AND PEANUT HERBICIDES. K.J. Price*, S. Li; Auburn University, Auburn, AL (212)

ABSTRACT

Sunnhemp is a leguminous tropical cover crop that quickly produces large amounts of biomass and can add over 112 kg of nitrogen per hectare. While it is an extremely productive cover crop, it may become problematic the following growing season with volunteer sunnhemp interfering with row crops. The objective of this study was to evaluate the responses of two sunnhemp varieties (AU Golden and South African) to 7 preemergence (PRE) and 17 postemergence (POST) frequently utilized peanut and cotton herbicides in a greenhouse and field setting. PRE herbicides were applied the day of planting and POST herbicides were applied when the majority of the plants reached the height of 30.5 cm. Herbicides were sprayed at 1X labeled rate in the field and ¾ labeled rate in the greenhouse. In the greenhouse study, plant heights, stand counts, injury ratings and biomass data were collected. At three field locations (Henry and Baldwin County in Alabama and Santa Rosa County in Florida), stand counts, plant heights and biomass data were collected. In the greenhouse study, the South African variety showed significant sensitivity to all PRE herbicides applied with a biomass reduction of 97-100%. Flumioxazin and diuron had complete control of AU Golden closely followed by acetochlor and diclosulam with 93-99% biomass reduction. The top 5 most injurious POST herbicides both varieties were glufosinate, lactofen, glyphosate, paraquat and imazapic. AU Golden was more sensitive than the South African variety with a biomass decrease of 87-96% and 59-85% respectively to the top five injurious herbicides. For the South African variety 2,4-DB, MSMA, bentazon, imazaethapyr, chlorimuron ethyl and carfentrazone-ethyl were least effective treatments at injuring sunnhemp seedlings in the greenhouse with a biomass reduction of less than 25%. For the AU Golden variety 2,4-DB, MSMA, and imazaethapyr, were least effective treatments with a biomass reduction of less than 52%. Overall in the field, glufosinate was the most injurious POST herbicide with a biomass reduction of 95-100%. Paraquat closely followed glufosinate with 85-97% biomass reduction. Dicamba and glyphosate were also effective with controlling sunnhemp with biomass reductions of 82-84% and 81-95% respectively. The most effective PRE treatment in field trials was flumioxazin with a biomass reduction of 54% and 92% for South African and AU Golden respectively. Diuron was the most ineffective treatment at controlling sunnhemp with only 24-28% biomass reduction. For the South African variety, pendimethalin and diclosulam were less effective at controlling sunnhemp with less than 40% biomass reduction. For AU Golden variety 2,4-D, pyroxasulfone, 2,4-DB and S-metolachlor had less than 40% biomass reduction. Therefore, in crop fields where volunteer sunnhemp is problematic, a PRE-application of flumioxazin may help prevent seed germination. POST applications of glufosinate, paraquat, dicamba and glyphosate may also control volunteer sunnhemp more effectively.
ENLIST DUO HERBICIDE LAUNCH IN ENLIST COTTON 2017. D. Simpson*1, J. Richburg2, M. Lovelace3, J. Ellis4, B. Braxton5, J. Siebert6; 1Dow AgroSciences, Indianapolis, IN, 2Dow AgroSciences, Headland, AL, 3Dow AgroSciences, Lubbock, TX, 4Dow AgroSciences, Sterlington, LA, 5Dow AgroSciences, Travelers Rest, SC, 6Dow AgroSciences, Greenville, MS (214)

ABSTRACT

In 2017 approximately 500,000 acres of WideStrike® 3 Roundup Ready® Flex Enlist™ cotton was treated with at least one POST application of Enlist Duo® herbicide. An integrated technical and sales support team worked to educate growers on proper application requirements, provide in season recommendations and investigate product performance issues. Investigations conducted in 2017 were classified as crop response, weed control, physical drift of Enlist Duo, sprayer cleanout or physical drift of an herbicide other than Enlist Duo. Investigation of crop response revealed the addition of adjuvants increased transient crop response expressed as necrosis. Weed control investigations involved either lack of control of glyphosate-resistant kochia, which is not labeled as controlled by Enlist Duo, or applications to weeds greater than 24 inches tall. Physical drift investigations involved injury to cotton without Enlist trait in fields adjacent to Enlist Duo application. Physical drift was primarily associated with a lack of understanding of label restriction of do not to not apply if wind is blowing toward an adjacent field of cotton with the Enlist trait. Cotton injury from physical drift displayed the typical pattern of greater injury closest to the application with injury dissipating with distance and distance varying with changes in wind speed during application. No formal complaints were filed with any state regulatory department in 2017 concerning off-target movement of Enlist Duo. When label recommendations were followed for applications, no drift, weed control or crop response complaints were received. In 2018, Dow DuPont Agriculture Division of Dow DuPont will continue education of growers and applicators about proper application of Enlist Duo herbicide, with specific emphasis on nozzle selection, pressure, boom height, wind directional buffers to susceptible crops, and measurements of wind direction and speed.

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SURVEY OF PALMER PIGWEED (AMARANTHUS PALMERM) FOR RESISTANCE TO FOMESAFEN, DICAMBA AND GLUFOSINATE IN MISSISSIPPI AND ARKANSAS. P. Feng*, A. Perez-Jones, C. Wu; 1Monsanto Corporation, St. Louis, MO, 2Monsanto, Chesterfield, MO, 3Monsanto Co, St Louis, MO (215)

ABSTRACT

Glyphosate resistance (GR) has become prevalent in Palmer amaranth. Increased use of PPO herbicides to control GR-Palmer amaranth has led to selection of PPO resistance. Glufosinate is increasingly used in soy and cotton to control GR-Palmer amaranth and under selection pressure for resistance. Dicamba is a new tool for Palmer amaranth control. Dicamba tolerant soy and cotton were planted in >25 million acres in 2017 increasing selection pressure for dicamba resistance. The purpose of this survey is to establish a base-line for efficacies of fomesafen, dicamba and glufosinate in Palmer amaranth. About 150 seed samples were randomly collected along the Mississippi river in the states of Mississippi and Arkansas in 2016-17. This presentation will summarize our greenhouse studies on the performance of dicamba, glufosinate and fomesafen in populations of Palmer amaranth.
OFF-TARGET DRIFT ON LATE-SEASON RICE (Oryza sativa) IN ARKANSAS. R.C. Doherty*, T. Barber*, Z. Hill*, A. Ross*; 1University of Arkansas at Monticello, Monticello, AR, 2University of Arkansas, Lonoke, AR, 3University of Arkansas Cooperative Extension Service, Monticello, AR (216)

ABSTRACT

Field research was conducted at one location in Arkansas, in 2016 and 2017, to evaluate the effects of rice growth habit and yields following simulated drift rates of glyphosate, glufosinate-ammonium, paraquat, and sodium chlorate at varying crop growth stages. The trial was conducted at Rohwer, Arkansas on the Southeast Research and Extension Center in a Sharkey clay soil. In 2016, CL111 rice cultivar was planted on April 18th. In 2017, CL 172 was planted on June 10th. Trials were arranged in a randomized complete block design with four replications utilizing 6.33 ft. by 20 ft. plots. Treatments were applied using a compressed air Mudmaster™ sprayer at 12 GPA. Rates of glyphosate at 0.113 lb ai/A and glufosinate at 0.053 lb ai/A were applied to rice at boot, 50% heading, soft dough, hard dough, and draining crop stages. Paraquat at 0.0625 lb ai/A and sodium chlorate at 0.6 lb ai/A were applied at soft dough, hard dough, and draining crop stages. Evaluations were taken observing necrosis, stunting, and reduced heading. Yields were collected with a Massey 10 combine outfitted with a HarvestMaster System utilizing Mirus software.

In 2016, drift simulations of glyphosate caused 21% stunting of rice at the boot stage and 13% at the 50% heading stage, with necrosis being 3 and 4%, respectively. Heading was reduced by greater than 98% at the boot stage and by 66% at the 50% heading stage. These stages also suffered yield losses of 100 and 56%, respectively. Less than 10% necrosis was observed at the boot and 50% heading stages and 12% at soft dough following glufosinate applications. Heading was reduced by 61 and 50% at the boot and 50% heading stages. Yield was reduced by 21% at boot and 19% at 50% heading stage. Paraquat caused less than 5% stunting across timings, 28% necrosis at soft dough, and 4% at hard dough stages. A 45% yield reduction was recorded at the soft dough stage, while less than 20% was recorded at the hard dough and draining stages. Sodium chlorate caused less than 20% stunting or necrosis and a 10-24% yield reduction was noted. In 2017, drift simulations of glyphosate caused 5% stunting of the rice at the boot stage and 3% at the 50% heading stage, while causing no necrosis. Heading was reduced by greater than 98% at the boot stage and by 34% at the 50% heading stage. These stages also suffered yield losses of 100 and 26%, respectively. Glufosinate caused necrosis levels of 51% at boot, 66% at 50% heading and 72 and 67% at soft and hard dough, while causing 34% at draining. Heading was reduced by 27 and 21% at the boot and 50% heading stages, while causing less than 5% reduction at remaining stages. Yield was reduced by 47% at boot and 27% at 50% heading stage. Paraquat caused no stunting at any stage. Necrosis levels ranged from 65-73%. An 18% yield reduction was recorded at the soft dough stage, while less than 4% was recorded at the hard dough and draining stages. Sodium chlorate caused no stunting and 36-56% necrosis, while an 8-23% yield reduction was noted.
IMPACT OF REDUCED RATES OF HALOSULFURON ON QUIZALOFOP ACTIVITY IN PROVISIA RICE. L.C. Webster*1, B. McKnight1, E.P. Webster2, G.M. Telo1, M.J. Osterholt1, S.Y. Rustom1; 1Louisiana State University AgCenter, Baton Rouge, LA, 2Louisiana State University, Baton Rouge, LA (217)

ABSTRACT

Imidazolinone resistant (IR) weedy rice (Oryza sativa L.) and barnyardgrass [Echinochloa crus-galli (L.) P. Beauv.] resistance prompted BASF to develop an acetyl coenzyme A carboxylase (ACCase) resistant (ACCase-R) rice (O. sativa L.) to be sold under the tradename of Provisia®. The targeted herbicide for use is quizalofop, a member of the aryloxyphenoxypropionate herbicide family. The targeted single application rate of quizalofop is 92 to 155 g ai ha⁻¹, not to exceed 240 g ha⁻¹ per year. ACCase-R rice will allow quizalofop to be applied postemergence (POST) in ACCase-R rice for control of annual and perennial grasses including weedy rice and barnyardgrass.

Herbicides are often applied in a mixture to broaden the weed control spectrum, save time, and save application costs. Herbicide interactions may result in one of three responses: synergistic, antagonistic, or additive/neutral. ACCase herbicide antagonism for grass weed control is commonly observed when applied in a mixture with a broadleaf or sedge herbicide. Halosulfuron mixed with quizalofop has been shown to be slightly antagonistic for weedy rice and barnyardgrass control. Increasing the ratio of graminicide to broadleaf or sedge herbicide in a mixture can potentially reduce the antagonism of the graminicide. The objective of this study was to evaluate reduced rates of halosulfuron on quizalofop activity. A Gowan supplied halosulfuron (halosulfuron-P) (Permit label, Gowan Company, Yuma, AZ) and an Aceto supplied halosulfuron (halosulfuron-H) (Halomax label, Aceto Agricultural Chemicals Corporation, Lake Success, NY) were evaluated at reduced rates in a mixture with quizalofop.

A study was conducted in 2017 at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana. Plot size was 1.5 by 5.1 m with eight, 19.5 cm drill-seeded rows of ACCase-R ‘PVL01-B’ long grain rice. In addition to PVL01-B, eight, 19.5 cm drill-seeded rows of IR ‘CLXL-745’, and ‘CL-111’ were planted perpendicular to the PVL01-B at 84 kg ha⁻¹. Awnless red rice was broadcasted at 50 kg ha⁻¹ across the research area, and the area was naturally infested with barnyardgrass.

Each halosulfuron formulation was a separate study. The study was a randomized complete block with a two-factor factorial arrangement of treatments with four replications. Factor A consisted of POST applications of quizalofop at 0 and 120 g ha⁻¹. Factor B consisted of POST applications of either halosulfuron formulation 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 21 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 7 and 21 DAIT. Rice yields were obtained and adjusted to 12% moisture.
For halosulfuron-H, CLXL-745 treated with quizalofop applied alone was controlled 97% at 7 DAIT and 99% at 21 DAIT. At 7 DAIT, CLXL-745 treated with quizalofop plus halosulfuron-H at 17, 35, and 53 g ha\(^{-1}\) was controlled 91, 93, and 91%, respectively; however, at 21 DAIT, the same mixtures resulted in 99% control for all three rates of halosulfuron-H. At 7 DAIT, CLXL-745 treated with halosulfuron-H plus thifensulfuron at 34 and 53 g ha\(^{-1}\) in a mixture with quizalofop was controlled 91 and 93%, respectively, and at 21 DAIT, the same mixtures resulted in 99% control for both rates of halosulfuron-H plus thifensulfuron evaluated. No reduction in control was observed for red rice, CL-111, or barnyardgrass when halosulfuron-H or halosulfuron-H plus thifensulfuron were mixed with quizalofop. ACCase-R rice treated with halosulfuron-H at 53 g ha\(^{-1}\) mixed with quizalofop yielded 4410 kg ha\(^{-1}\), which did not differ from any of the halosulfuron-H or halosulfuron-H plus thifensulfuron containing applications.

In the second study, evaluating halosulfuron-P, no reduction in control was observed for red rice, CLXL-745, CL-111, or barnyardgrass when halosulfuron-P or halosulfuron-P plus thifensulfuron were mixed with quizalofop. ACCase-R rice treated with halosulfuron-P at 53 g ha\(^{-1}\) mixed with quizalofop yielded 5140 kg ha\(^{-1}\), which did not differ from any of the halosulfuron-P or halosulfuron-P plus thifensulfuron containing treatments.

In conclusion, the slight reduction in quizalofop activity on CLXL-745 when mixed with halosulfuron-H at 7 DAIT did not differ with reduced rates of halosulfuron-H. This research indicates no antagonism occurred from any rate or brand of halosulfuron evaluated; however, research in Louisiana has shown slight antagonism with halosulfuron-P mixed with quizalofop.
EVALUATION OF PROVISIA MIXED WITH RICEONE, COMMAND, OR PROWL.
M.J. Osterholt*, B. McKnight¹, E.P. Webster², G.M. Telo¹, S.Y. Rustom¹, L.C. Webster¹; ¹Louisiana State University AgCenter, Baton Rouge, LA, ²Louisiana State University, Baton Rouge, LA (218)

ABSTRACT

With the confirmation of imidazolinone-resistant weedy rice (Oryza sativa) and documented cases of barnyardgrass [Echinochloa crus-galli (L.) P. Beauv] resistance to various sites of action, BASF has recently launched a quizalofop resistant rice system sold under the tradename Provisia. Quizalofop provides postemergence (POST) control of weedy rice along with broad spectrum control of annual and perennial grass weeds common in rice production. However, quizalofop offers very little residual activity, and with over 65% of rice acres under a dry-seeded planting system, rice growers are depending on preemergence (PRE) and/or POST applications of herbicides to help control weeds. RiceOne is a pre-packaged mixture of pendimethalin and clomazone at 307 and 128 g ai per liter, respectively, that offers residual activity on early season grasses. Louisiana rice growers could potentially benefit from an EPOST application of quizalofop mixed with RiceOne. However, research in Louisiana has documented cases of antagonism of quizalofop when mixed with other labeled rice herbicides. The objective of this research was to evaluate a potential mixture between EPOST applications of quizalofop mixed with RiceOne, clomazone, or pendimethalin.

A field study was conducted in 2017 at the LSU Agricultural Center H. Rouse Caffey Rice Research Station (RRS) near Crowley, LA. Treatments were arranged as a two-factor factorial in a randomized complete block design with four replications. Factor A consisted of EPOST applications, at the two-to three-leaf stage, of quizalofop at 0 or 120 g ai ha⁻¹. Factor B consisted of EPOST applications of clomazone at 336 g ai ha⁻¹, pendimethalin at 806 g ai ha⁻¹, a mixture of clomazone at 336 g ai ha⁻¹ and pendimethalin at 806 g ai ha⁻¹, or RiceOne at 1142 g ai ha⁻¹, and no mixture herbicide. Clomazone and pendimethalin rates applied alone are equal to the rates found in the pre-packaged mixture of RiceOne.

Herbicide applications were applied using a CO₂-pressurized backpack sprayer calibrated to deliver 140 L ha⁻¹ at 190 kPa. Plot sizes were 5.2 by 2.1 m and included eight, 19.5 cm drilled-seeded rows planted with Provisia rice variety ‘PVL01-B’. Eight rows of IR ‘CL 111’ was planted perpendicular to the Provisia rice in the front of each plot. Hybrid IR rice variety ‘CLXL 745’ was planted perpendicular to the Provisia rice in the back of the plot. CLXL 745, CL-111, and red rice all represented weedy rice species. Awnless red rice was also broadcasted in the plot area prior to drill seeding at 50 Kg ha⁻¹. A late post application of quizalofop was applied over the entire area at 120 g ai ha⁻¹ in order to follow the Provisia rice stewardship program. Visual injury and weed control assessments were recorded at 10 and 17 days after treatment (DAT) throughout the study where 0 = no injury and 100 = plant death.

At 10 DAT, control of red rice when treated with a single application of clomazone, pendimethalin, clomazone plus pendimethalin, or RiceOne was controlled 0%; however, quizalofop mixed with any of the residual herbicides controlled red rice 97 to 98%. Barnyardgrass treated with clomazone, clomazone and pendimethalin, or RiceOne controlled
barnyardgrass 85 to 88%; however, when quizalofop was added to any of the residual herbicides controlled barnyardgrass 98%. Amazon Sprangletop [*Leptochloa panicoides* (J. Presl) Hitchc.] treated with clomazone, clomazone and pendimethalin, or RiceOne was controlled 89 to 91%. With the addition of quizalofop to any of the residual herbicides, Amazon sprangletop was controlled 98 to 99% at 10 DAT. Though no herbicide interaction test was run on the data, it appears that no antagonism occurred between quizalofop when mixed with clomazone, pendimethalin, clomazone and pendimethalin, or RiceOne.
PROGRAMS FOR RICE WEED CONTROL IN PROVISIA™ RICE. Z. Hill*,1, T. Barber2, R.C. Doherty3, A. Ross2; 1University of Arkansas Cooperative Extension Service, Monticello, AR, 2University of Arkansas, Lonoke, AR, 3University of Arkansas at Monticello, Monticello, AR (219)

ABSTRACT

With the continued spread of propanil- and quinclorac-resistant barnyardgrass throughout Arkansas’s rice acres; as well as the difficulty in controlling other grass species such as Amazon sprangletop and weedy rice, new management practices are needed. Provisia™ rice is a new cultivar that expresses tolerance to ACCase-herbicide quizalifop-p-ethyl (Provisia). Provisia provides selective postemergence (POST) control of annual and perennial grasses, red rice, and weedy rice biotypes. Two experiments were conducted in 2017, the first on a Sharkey clay soil at Rohwer, Arkansas to evaluate the use of Provisia in a programs approach in flooded rice system, and the second on a Calloway silt loam soil at Marianna, Arkansas to evaluate the use of Provisia in a furrow-irrigated rice system. These experiments were conducted as a randomized complete block design with four replications, where herbicide efficacy was evaluated for control of barnyardgrass, Amazon sprangletop, hemp sesbania, and Palmer amaranth. The first experiment consisted of programs containing Command applied preemergence (PRE) followed by (fb) Provisia either alone or tank-mixed with POST herbicides applied at 3-4 leaf rice and 1 week after flood. The second experiment consisted of programs containing Command alone or tank-mixed with Sharpen PRE fb Provisia alone or tank-mixed with POST herbicides applied at 4-5 leaf rice and 2-3 inch weeds. In the flooded experiment, >95% control of hemp sesbania was only achieved when residual herbicides were applied with Provisia at the 3-4 leaf rice application. Control of hemp sesbania continued to diminish in treatments that did not have a residual or POST herbicide applied with Provisia at 3-4 leaf rice. In the furrow-irrigated experiment, >90% control of Palmer amaranth was achieved from most treatments 16 days after the delayed PRE application. Tank-mixing Command and Sharpen PRE provided the most effective control of Palmer amaranth early in the season. Similar to the flooded rice experiment, Palmer amaranth was only controlled when residual and selective POST herbicides were tank-mixed with Provisia. Regardless of the experiment, annual and perennial grasses were effectively controlled throughout the season from all Provisia programs. These data suggest that utilizing the Provisia rice system will be beneficial in controlling herbicide-resistant grasses, red rice, and weedy rice biotypes commonly found in Arkansas rice fields. However, when applied alone Provisia will have no effect on broadleaf weeds, such as hemp sesbania and Palmer amaranth. In order to combat these troublesome broadleaf weeds, a Provisia herbicide program will need to include multiple residual and selective broadleaf POST herbicides.
RICE RESPONSE TO GLYPHOSATE OR PARAQUAT EXPOSURE DURING REPRODUCTIVE GROWTH STAGES. J. McCoy*1, B. Golden1, J. Bond1, T. Bararpour2, D. Dodds3, J. Gore4, B. Lawrence4; 1Delta Research and Extension Center, Stoneville, MS, 2Mississippi State University - Delta Research and Extension Center, Stoneville, MS, 3Mississippi State University, Mississippi State, MS, 4Mississippi State University, Stoneville, MS (220)

ABSTRACT

In 2017 4.2 million acres of principal crops were planted in the state of Mississippi. Of this acreage, 120,000 acres were devoted to rice production in 2017. The close proximity to other crops such as cotton (Gossypium hirsutum L.), corn (Zea mays), and soybean [Glycine max (L.) Merr.], creates a great potential for off-target herbicide movement onto rice fields. The growing adoption of harvest-aid use in soybeans throughout Mississippi only furthers the risk of late season exposure to off-target herbicide movement. Therefore research was conducted evaluating rice response across multiple cultivars to late-season exposure to glyphosate or paraquat.

Research was established in 2016 & 2017 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate rice grain yield and yield component response to late season off-target herbicide movement. Secondary objectives of this research were to identify differences in visual injury response across multiple rice cultivars and identify differences in visual injury response across multiple herbicide chemistries. Treatments were arranged in a randomized complete block with a five (rice cultivars) × three (herbicide chemistry) factorial. The rice cultivars evaluated were CLXL745, XL753, CL163, Rex and Jupiter. Herbicide chemistries evaluated were none (0 lb ai/A), glyphosate (0.1125 lb ae/A) and paraquat (0.025 lb ai/A). Rates were based on 0.10 of the labeled harvest-aid rate in Mississippi. Herbicides were applied at a constant carrier volume of 140 L/ha with a CO₂ pressurized backpack sprayer. Herbicide applications were initiated at the 50% heading growth stage of each respective cultivar. Visual estimates of rice injury were recorded 3, 7, 14, 21, and 28 day after treatment. At maturity a small plot combine was utilized to harvest each plot and collect rough rice yields. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with α = 0.05.

Visual estimates of injury from glyphosate were not observed across all cultivars. Paraquat application produced visual injury estimates ranging from 5 to 25%. Hybrid cultivars (CLXL 745 and XL 753) were observed to incur less injury than inbred cultivars. Rex and Jupiter sustained the greatest visual injury estimates in response to paraquat application.

Rice grain yield was influenced by late-season exposure to glyphosate and paraquat. Yield reduction from the untreated control ranged from 3 to 32% across cultivar and herbicide chemistries. Hybrid cultivar yield reduction for glyphosate and paraquat and was observed to not differ from the untreated control. Grain yield reduction for inbred cultivars ranged from 14 to 32% to 18 to 28% for glyphosate and paraquat respectively. Across application timings rice yield reduction for glyphosate and paraquat was observed to range from 2 to 14% and 3 to 16%, respectively. Paraquat application was observed to significantly reduce yield up to the date of
draining; while glyphosate reduced yield up to one week before harvest. Yield reductions from herbicide applications were observed to decrease as rice neared maturity.

Preliminary research suggests that rice may be influenced by late-season off target herbicide movement. Observations suggest differences in response to exposure to glyphosate and paraquat exists across cultivar and application timing. Further research will be required to validate and quantify the differential response of cultivars and application timings to late-season off target herbicide movement onto rice.
FLORPYRAUXIFEN-BENZYL-CONTAINING WEED CONTROL PROGRAMS IN FURROW-IRRIGATED RICE. H.E. Wright*1, J. Norsworthy1, Z.D. Lancaster1, G.L. Priess1, R.C. Scott2, J. Ellis3; 1University of Arkansas, Fayetteville, AR, 2University of Arkansas - Extension Service, Lonoke, AR, 3Dow AgroSciences, Sterlington, LA (221)

ABSTRACT

Florpyrauxifen-benzyl is a new broad-spectrum, postemergence synthetic auxin (WSSA group 4) herbicide from DowDuPont recently labeled for use in rice. It has strong activity on both Palmer amaranth (Amaranthus palmeri) and barnyardgrass (Echinochloa crus-galli), two troublesome weeds in Arkansas rice production. The weed control spectrum of florpyrauxifen-benzyl indicates it will be a good fit in a herbicide program for furrow-irrigated rice. Field experiments were conducted in 2017 at the Pine Tree Research Station (PTRS) near Colt, AR and the Lon Mann Cotton Research Station (LMCRS) near Marianna, AR to evaluate florpyrauxifen-benzyl-containing weed control programs in furrow-irrigated rice. This experiment was arranged as a randomized complete block design with a three-factor factorial. The first factor consisted of clomazone plus quinclorac or clomazone plus imazosulfuron applied preemergence (PRE) followed by fenoxaprop as an early-postemergence (EPOST) application. The second factor was florpyrauxifen-benzyl applied as a mid-postemergence application (MPOST) alone and as a mixture with pendimethalin and with cyhalofop plus pendimethalin and compared to the standard treatment of pendimethalin plus propanil. The third factor consisted of an as-needed application of penoxsulam plus triclopyr late-postemergence (LPOST) vs no as-needed. In both locations, florpyrauxifen-benzyl-containing MPOST treatments provided better Palmer amaranth control 4 weeks after treatment (WAT) when compared to the standard treatment. Contrasts were conducted for LMCRS to compare florpyrauxifen-benzyl- and penoxsulam plus triclopyr-containing treatments to those that did not contain either herbicide. At this location, treatments that contained both florpyrauxifen-benzyl MPOST and penoxsulam plus triclopyr LPOST controlled Palmer amaranth 4 WAT better than the treatments that did not contain either herbicide. Additionally, yields of florpyrauxifen-benzyl-containing treatments at LMCRS were higher than treatments that did not contain florpyrauxifen-benzyl. The results from these experiments in addition to knowledge from previous research indicates florpyrauxifen-benzyl will be a good fit in furrow-irrigated rice as part of a herbicide program and will provide a much-needed option for Palmer amaranth control.
EFFECT OF A SUB-LETHAL RATE OF PARAQUAT APPLIED TO RICE AT DIFFERENT GROWTH STAGES. B. Lawrence*1, J. Bond2, B. Golden2, H.M. Edwards1, J. Peeples Jr.3, J. McCoy2; 1Mississippi State University, Stoneville, MS, 2Delta Research and Extension Center, Stoneville, MS, 3Delta Research and Extension Center, Stoneville, MS (222)

ABSTRACT

Paraquat is widely utilized for preplant herbicide applications in corn (Zea mays L.), cotton (Gossypium hirsutum L.), and soybean [Glycine max (L.) Merr] to control glyphosate-resistant weeds. Paraquat is often applied in mixtures with other herbicides representing different MOA for improved postemergence and residual weed control. Due to Mississippi’s diverse cropping systems and extended planting windows for corn, cotton, and soybean, incidents of off-target paraquat movement to rice have increased in recent years. Rice is most sensitive to off-target movement of systemic herbicides during early reproductive growth stages; however, little is known of how rice responds to paraquat off-target movement. Off-target herbicide movement to rice from applications containing paraquat often creates a complex situation because multiple MOA are represented. Therefore, research was conducted to determine at which growth stages rice is most susceptible to exposure to a sub-lethal rate of paraquat and if mixing a sub-lethal rate metribuzin or fomesafen with paraquat compounds the negative effects.

Two studies were conducted from 2015 to 2017 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 paraquat at different growth stages and to evaluate rice response to a sub-lethal rate of paraquat alone or in mixtures with sub-lethal rates of metribuzin or fomesafen. Experimental design for both studies was a randomized complete block with four replications. In the timing study, paraquat was applied at 0.075 lb ai A-1 to spiking to one-leaf rice (VEPOST), two- to three-leaf rice (EPOST), three- to four-leaf rice (MPOST), 7 days postflood (7 d PTFLD), and to rice at panicle differentiation (PD). In the herbicide mixture study, treatments were arranged as a two-factor factorial with Factor A consisting of paraquat applied at 0 and 0.075 lb A-1 and Factor B being herbicide mixture and including no herbicide mixture, metribuzin at 0.037 lb ai A-1, and fomesafen at 0.035 lb ai A-1. In both studies, visual estimates of rice injury were recorded 3, 7, 14, 21, and 28 d after treatment (DAT), and rice height was determined 14 DAT. The number of days to 50% heading was recorded as an indication of rice maturity. Rough rice yields were collected at maturity. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with $\alpha = 0.05$.

Injury to rice with paraquat was $\geq 41\%$ 14 and 28 DAT regardless of growth stage at time of exposure. Injury 14 DAT was greatest following paraquat applied VEPOST; however, by 28 DAT, injury was greatest following MPOST, 7 d PTFLD, and PD treatments. Rice heights 14 DAT were reduced 42% with paraquat applied MPOST. Delays in rice maturity were >6 d regardless of growth stage at time of exposure with delays in maturity up to 2 wk following PD treatments. Rough rice yields were reduced to 8% of the nontreated following rice exposure to paraquat at PD; however, rice exposed at VEPOST produced yields 94% of the nontreated control.
In the herbicide mixture study, rice injury 14 and 28 DAT was <10% following applications of metribuzin or fomesafen alone. Rice injury was 54 to 58% following rice exposure to paraquat alone or mixed with fomesafen; however, the addition of metribuzin to paraquat increased rice injury to >68% 14 and 28 DAT. Pooled across herbicide mixtures, paraquat delayed rice maturity 9 d. Rough rice yield was reduced at least 28% following exposure to paraquat compared with where no paraquat was applied.

These data indicate that as rice matured, delays in rice maturity following exposure to paraquat increased. Rice yield was negatively affected following exposure to paraquat applied anytime after VEPOST; however, 7 d PTFLD and PD applications reduced rice yield ≤20% of the nontreated control. Early-season injury to rice following exposure to paraquat had less effect on rice yield compared with injury occurring at later developmental stages. However, delays in rice maturity were ≥6 d with all treatments, so harvest efficiency could be affected regardless of growth stage at which exposure occurred. Although rice yield was affected by exposure to paraquat anytime after VEPOST, the addition of metribuzin to paraquat increased early-season injury. Rice exposure to paraquat negatively affected rice growth and development regardless of timing of exposure or mixture; therefore, caution should be exercised when applying paraquat in proximity to emerged rice.
ASSESSING ZERO PALMER AMARANTH (AMARANTHUS PALMERI) SEED RETURN IN A GRAIN SORGHUM-SOYBEAN ROTATION VERSUS CONTINUOUS SOYBEAN. M. Flessner*, S. Beam, S. Haring, K. Bamber; Virginia Tech, Blacksburg, VA (223)

ABSTRACT

A zero-tolerance policy is currently recommended for Palmer amaranth (*Amaranthus palmeri*) management, but eliminating returns to the weed seed bank via hand weeding are costly. Alternatively, crop rotation to grain sorghum may be more economical, due to available herbicide options. Research was conducted to evaluate Palmer amaranth control and economics thereof in a grain sorghum-soybean rotation versus continuous soybean.

The experiment had two main factors: crop rotation and Palmer amaranth management program. Crop rotation was grain sorghum-soybean versus continuous soybean. Management programs varied by crop. The program for grain sorghum was atrazine at 1.5 kg ha\(^{-1}\) + S-metolachlor at 1.5 kg ha\(^{-1}\) + mesotrione at 0.09 kg ha\(^{-1}\) PRE. Four management programs were assessed in soybeans: no weed control (nontreated), a “low input” program of flumioxazin at 0.14 kg ha\(^{-1}\) PRE followed by (fb) glyphosate at 1.1 kg ha\(^{-1}\) POST, a “high input” program of sulfentrazone at 0.15 kg ha\(^{-1}\) + S-metolachlor at 1.4 kg ha\(^{-1}\) + metribuzin at 0.42 kg ha\(^{-1}\) PRE fb fomesafen at 0.27 kg ha\(^{-1}\) + glyphosate at 1.1 kg ha\(^{-1}\) + S-metolachlor at 1.4 kg ha\(^{-1}\) POST and a “zero-tolerance” program that was the “high input” program + hand-weeding after POST, prior to seed shed. The experiment was a split-plot randomized complete block with four replications. Plot locations were identical across years. Weed control, yield, and an economic analysis were assessed.

Due to a poor cropping year, no treatments were profitable in year one. However, results indicated that grain sorghum lost the least money, followed by the “low input,” followed by the “high input” and nontreated, and “zero tolerance.” Grain sorghum was the cheapest way to ensure zero Palmer amaranth seed return, due to the high cost of hand weeding.

Data analyses from year two indicate the grain sorghum-soybean rotation resulted in better Palmer amaranth control (77 versus 60%, respectively four weeks after POST; \(p<0.001\)), 15% greater yield (\(p=0.030\)), and was 26% more profitable (\(p=0.030\)) compared to continuous soybeans. Palmer amaranth counts were collected from nontreated plots in year two, and indicated that grain sorghum-soybean rotation reduced Palmer amaranth density by 3.1 fold (\(p<0.001\)) compared to continuous soybeans.

Combining the loss from year one and profit in year two, the grain sorghum-soybean rotation was 88% more profitable than continuous soybean (\(p=0.007\)) when assessed across all programs or 60% more profitable (\(p=0.014\)) when assessed across programs excluding the nontreated.
IMPACT OF POST-APPLIED PPO AND ALS-INHIBITING HERBICIDES ON SOYBEAN CANOPY FORMATION AND YIELD. M.C. Castner*, G.L. Priess¹, Z.D. Lancaster¹, R.C. Scott², J. Norsworthy¹; ¹University of Arkansas, Fayetteville, AR, ²University of Arkansas - Extension Service, Lonoke, AR (224)

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.
WEED CONTROL WITH WARRANT ULTRA HERBICIDE TANK MIXES IN TRIPLE STACK HERBICIDE TOLERANT SOYBEANS. S.A. Nolte*1, M. Matocha2; 1Texas A&M AgriLife Extension, College Station, TX, 2Texas AgriLife Extension Service, College Station, TX (225)

ABSTRACT

The management of herbicide resistant and difficult to control weeds such as palmer amaranth and common waterhemp continue to be a growing issue in Texas. The development of triple stack herbicide tolerant soybean allows for the use of herbicides with multiple effective sites of action (SOA) to better manage against herbicide resistance and difficult to control weeds. In 2017, a field experiment was conducted in College Station, TX to assess weed control with Warrant Ultra Herbicide with various tank mixes utilizing preemergence (PRE) and postemergent (POST) herbicide systems. The experiment was a randomized complete block design with four replications and plots were 4 m wide x 9 m long. Weed species evaluated included Palmer amaranth (Amaranthus palmeri), common waterhemp (Amaranthus rudis) and Junglerice (Echinochloa colona). PRE herbicide treatments were made on May 18, early-postemergence (EPOST) treatments were made on June 9, and mid-postemergence (MPOST) treatments were made on June 16. Herbicides and rates included the following: Rowel at 2oz/ac, Roundup PowerMax at 32oz/ac, MON76981 at 64oz/ac, Liberty at 29oz/ac, MSO at 1% v/v, Warrant Ultra at 50oz/ac, and Warrant at 48oz/ac. All PRE followed by MPOST treatments provided 94% or greater control of palmer amaranth at all evaluation times. The treatment containing Warrant Ultra applied PRE followed by Warrant and MON76981 applied MPOST, controlled 100% of palmer amaranth and common waterhemp and over 95% of junglerice at all evaluation timings throughout the season.
EFFECT OF SIMULATED MESOTRIONE DRIFT ON NON-HPPD-TOLERANT SOYBEAN. D.O. Stephenson1, B. Woolam1, T. Buck2; 1LSU Ag Center, Alexandria, LA, 2LSU Ag Center, Gates, NC (226)

ABSTRACT

Research was conducted at the LSU AgCenter Dean Lee Research and Extension Center near Alexandria, LA in 2017 to evaluate the effect of simulated mesotrione drift on non-HPPD-tolerant soybean. Experimental design was a factorial arrangement of application timings and mesotrione rates in a randomized complete block design with four replications. Application timings were unifoliate, 2-trifoliate, or 4-trifoliate soybean. Mesotrione rates were 1/16x, 1/8x, or 1x of 175 g ai ha\(^{-1}\), which is the field use rate. Visual estimations of percent overall injury, with injury divided into chlorosis, necrosis, and height reduction,\(^{-1}\) were recorded 3, 7, 14, 28, and 42 d after treatment (DAT). Soybean height was recorded 14, 28, and 42 DAT and just prior to harvest. Soybean node number was also recorded just prior to harvest. Yields were collected at harvest and adjusted to 15% moisture prior to analysis. Soybean heights, node number, and yield were converted to percent of the nontreated prior to analysis.

Averaged across evaluation date, injury increased with increasing mesotrione rate at all application timings with the 30 to 40% injury following the 1/16x rate, 45 to 55% injury following the 1/8x rate, and 65 to 85% injury following the 1x rate of mesotrione. Injury was observed predominately as height reduction and chlorosis with 10% or less necrosis. Regardless of mesotrione rate, injury 3 DAT following the unifoliate, 2-, and 4-trifoliate applications was 60, 39, and 8%, respectively, with all injury observed as chlorosis and necrosis. However, injury 7 through 42 DAT was similar at 40 to 70%. Averaged across application timing, injury following the 1/16 and 1/8x rates were similar 3 DAT, but greater injury occurred 7 through 42 DAT following the 1/8x rate. For both application timing and mesotrione rate, injury manifest as chlorosis and necrosis 3 and 7 DAT, but became more a reduction in plant height 28 and 42 DAT. Soybean height, regardless of evaluation date, decreased more following the 2- or 4-trifoliate application timings compared to the unifoliate timing. However, following only the unifoliate timing, a difference in height was observed between the 1/16 and 1/8x mesotrione rates which were 97 and 82% of the nontreated, respectively. The 1x mesotrione rate reduced height 50 to 58% of the nontreated. Averaged across mesotrione rate, soybean height was 62 to 83% of the nontreated 14, 28, and 42 DAT; however, soybean height just prior to harvest was 96, 81, and 67% of the nontreated following the unifoliate, 2-trifoliate, and 4-trifoliate applications, respectively. At all evaluation dates, soybean height following the 4-trifoliate application was less than the unifoliate and 2-trifoliate timings when averaged across mesotrione rate. Soybean node number was 91 and 87% of the nontreated following the 2- and 4-trifoliate applications, respectively, and only the 1x mesotrione rate reduced node number greater than 3% of the nontreated. At all evaluation timings, the 1x rate of mesotrione reduced yield 50 to 85% of the nontreated with greater yield loss as mesotrione application was delayed from unifoliate to 4-trifoliate. When the 1x mesotrione rate was excluded from yield analysis, yields following the unifoliate, 2-, and 4-trifoliate applications were 97, 98, and 92% of the nontreated, respectively, and no yield differences were observed between the 1/16x and 1/8x rates. Study will be repeated in 2018.
SOYBEAN WEED MANAGEMENT TOOLS FROM SYNGENTA. B. Lindenmayer*1, D. Bowers2, A. Franssen3, M. Schraer4; 1Syngenta Crop Protection, Perkins, OK, 2Syngenta, Greensboro, NC, 3Syngenta Crop Protection, Pleasant Dale, NE, 4Syngenta Crop Protection, Nampa, ID (227)

ABSTRACT

Syngenta remains committed to growth through innovation evidenced by the continued development of several upcoming herbicide products and genetic traits for improved weed control and herbicide resistance management in soybean production. Tavium™ plus VaporGrip® Technology, a premix herbicide combination of S-metolachlor and dicamba currently under development, will offer postemergence broadleaf weed control plus grass and broadleaf residual activity in both dicamba-tolerant soybeans and cotton. Also, Sequence® CS herbicide will be an improved formulation of the glyphosate and S-metolachlor combination that will offer improved storage and tank-mix compatibility with equivalent efficacy and crop safety to the previous formulation. Additionally, Syngenta continues to develop MGI soybeans that will offer genetic preemergence tolerance to mesotrione and isoxaflutole as well as postemergence tolerance to glufosinate, giving growers new options to combat ALS-, EPSPS-, and PPO-resistant weed populations. Finally, the EPA Human Health Mitigation decision for paraquat and its implications for registrants and applicators will also be discussed.
JUST WHAT DOES BICYCLOPYRONE BRING TO THE PARTY? P. Eure*1, G. Vail2, R. Lins3, L. Smith4; 1Syngenta, Richmond, TX, 2Syngenta, Greensboro, NC, 3Syngenta, Rochester, MN, 4Syngenta, King Ferry, NY (228)

ABSTRACT

The HPPD-inhibiting herbicide bicyclopyrone has been developed for the corn weed control market as a component in active ingredient mixture products (Acuron, Acuron Flexi) and commercially launched in 2015. Mixtures with bicyclopyrone have shown improved weed control compared to products with similar active ingredients (Lumax, Lexar, Zemax). However, as a mixture component, little information is widely available regarding the activity of bicyclopyrone applied alone. This paper highlights the weed control benefits that bicyclopyrone provides when applied alone and in mixtures.
POST EMERGENCE CONTROL OF SOUTHERN WATERGRASS (LUZIOLA FLUITANS) AND TORPEDOGRASS - PART 2. J.R. Weaver*1, L.B. McCarty2, N. Gambrell2, B. Cross2; 1Clemson University, Pendleton, SC, 2Clemson University, Clemson, SC (229)

ABSTRACT

Southern watergrass (Luziola fluitans, formerly Hydrochloa caroliniensis) is a warm-season perennial aquatic grass that has become problematic in SEUSA turf. Generally floating in shallow water, Southern watergrass can escape to wet turf areas and form dense colonies, spreading via a network of stolons and stem fragmentation. Foliage is bright green, resembling young crabgrass, and seedheads are rare making identification difficult. Initial attempts by turf managers for control of this weed with MSMA were unsuccessful prompting an investigation for additional potential postemergence control options. A study was conducted during summer 2016 in Lexington, SC on a mixed common/hybrid bermudagrass golf course rough. Southern watergrass cover had reached >90% in a low, wet area adjacent a pond. All herbicide treatments were applied twice at either 7- or 21-day intervals. MSMA at 1.5 lb ai/a with and without Sencor 75DF (metribuzin) at 0.33 lb/a and Dismiss 4L (sulfentrazone) at 8 oz/a + Sencor at 0.33 lb/a were applied on 7-day intervals. Drive 1.5L (quinclorac) 85 oz/a, Tribute Total 61WDG (thiencarbazone + foramsulfuron + halosulfuron) at 3.2 oz/a, Celsius 68WDG (thiencarbazone + iodosulfuron + dicamba) at 3.7 oz/a, Monument 75WG (trifloxysulfuron) at 0.56 oz/a, Xonerate 70WDG (amicarbazone) at 5 oz/a, Tenacity 4L (mesotrione) at 8 oz/a + Princep 4L (simazine) at 25 oz/a, and Pylex 2.8SC (trameprazine) at 0.5 oz/a + Xonerate at 5 oz/a were applied on 21-day intervals. The initial application was made on June 5, 2017, and all treatments included NIS at 0.25% v/v. At 6 weeks after initial treatment (WAIT), ~90% control followed Tribute Total, Monument, and Xonerate. Control was <50% with all other treatments. At 15 WAIT, control was 40% for Monument while all other treatments provided <5% control. Over two years, best (>90%) short-term control (~6 weeks) followed repeat Tribute Total and Monument treatments. However, by 12 WAIT, all treatments provided <40% control.

Torpedograss (Panicum repens) is perhaps the most difficult to control of all weeds in turf as >80% of this plant is underground as thick, torpedo-shaped rhizomes. Few herbicide options exist for control, with traditional control in bermudagrass attempted with Drive and Monument. A study was conducted in Savannah, GA in summer 2016 on a hybrid bermudagrass fairway to evaluate potential alternative herbicide options. All treatments were applied twice on 21-day intervals and included NIS at 0.25% v/v. Treatments included: Drive at 2 lb ai/a followed by (fb) 1 lb ai/a; Monument at 0.56 oz/a; Drive at 1 lb ai/a + Monument at 0.56 oz/a; Pylex at 1 oz/a + Xonerate at 5 oz/a; Pylex at 2 oz/a + Xonerate at 5 oz/a; Pylex at 2 oz/a + Xonerate at 10 oz/a; Pylex at 2 oz/a + Sprint 330 (chelate Fe) at 4 oz/1,000 ft.²; Dismiss South 4SC (imazethapyr + sulfentrazone) at 14.4 oz/a; Dismiss South at 14.4 oz/a + Drive at 1 lb ai/a + Monument at 0.56 oz/a; Roundup 4L (glyphosate) at 4 oz/a; Drive at 1 lb ai/a + Monument at 0.56 oz/a + Roundup at 4 oz/a; and Roundup at 4 oz/a fb Drive at 1 lb ai/a + Monument at 0.56 oz/a. At 6 WAIT (3 WAST), treatments providing >90% torpedograss control included: Drive; Drive + Monument; Dismiss South + Drive + Monument; and Roundup fb Drive + Monument. Monument, Pylex plus chelated iron, Dismiss South and Drive + Monument followed by Roundup provided ~85% control while Roundup followed by Drive + Monument provided 70% control. All other
treatments provided <60% control. At 10 WAIT, highest control followed Dismiss South + Drive + Monument (~65%); Pylex (2 oz/ac) + Xonerate (10 oz/ac) (~55% control) and Dismiss South (~50% control). All other treatment provided <40% control at this time. Over two years, short–term control >90% followed Drive + Monument combinations at 6 WAIT. By 10 WAIT, all treatments provided <60% control. Therefore, long-term (>10 WAIT) single-season torpedograss control in bermudagrass remains elusive.

Overall, long-term Southern watergrass and torpedograss control was not achieved in these studies. Over 90% control of both weeds was achieved short-term (6 WAIT), but significant energy reserves in perennial parts of these weeds allowed for regrowth beyond this time point. Future research will continue to investigate potential control options of these troublesome perennial weeds.
POSTEMERGENCE CONTROL OF VIRGINIA BUTTONWEED (DIOEDIA VIRGINIANA) WITH SPECTICLE APPLICATIONS. S. Wells*, B. Spesard; 1Bayer Crop Sciences, Milledgeville, GA, 2Bayer Environmental Science, Res Tria Park, NC (230)

ABSTRACT

Virginia buttonweed is a herbaceous perennial with a prolific growth habit. It can be a problematic, difficult-to-control weed in golf turf and residential/commercial landscapes. Specticle Flo is positioned as a preemergence herbicide, although postemergence activity has been observed against some weed species. In 2016, postemergence activity was noted on Virginia buttonweed with Specticle Flo at 16 g ai/ha applied in June and July. These findings warranted additional work in 2017 with the objective of confirming post herbicidal activity on Virginia buttonweed. Five field trials were initiated with Specticle Flo applied at 16 g ai/ha. Single and split applications and timings were evaluated. A single application of 24 g ai/ha was also evaluated. One greenhouse trial was initiated to evaluate activity with 16 g ai/ha across three soil types and two moisture levels. Field trial results demonstrated postemergence suppression and were inconsistent depending on geography. The greenhouse results showed best post activity in sandy soils with low soil moisture. Based on trial results in 2017, Specticle Flo is not recommended as a stand-alone post control option for Virginia buttonweed.
HERBICIDE PROGRAMS FOR FALSE-GREEN KYLLINGA CONTROL IN COOL-SEASON TURFGRASS. A.J. Patton*1, M. Elmore2; 1Purdue University, W Lafayette, IN, 2Rutgers University, New Brunswick, NJ (231)

ABSTRACT

False-green kyllinga (*Kyllinga gracillima*) is an increasingly problematic weed of cool season turfgrass. A field experiments was conducted in 2017 at four locations to test the efficacy of various postemergence herbicides against false-green kyllinga.

The four locations for this trial were: Bloomington Country Club (BCC, Bloomington, IN) on a creeping bentgrass (*Agrostis stolonifera*) tee box, Victoria National Golf Club (VNGC, Newburgh, IN) on creeping bentgrass fairway, and either a creeping bentgrass fairway or driving range at Stone Harbor Golf Club in Cape May, New Jersey. All sites contained natural populations of false-green kyllinga. Initial and sequential applications were made on 13 June and 13 July, respectively in NJ and May 30th and June 30th, respectively in Indiana.

Field treatments included both single and sequential applications of: imazosulfuron (420 g/ha), imazosulfuron (735 g/ha), halosulfuron-methyl (70 g/ha), and sulfentrazone (110 g/ha). Treatments were arranged in a randomized block design at each site. ‘Control’ was determined by assessing the percent cover of false-green kyllinga in each plot compared to the non-treated control at 4, 8, and 12 weeks after initial treatment (WAIT). A control rating was also determined from grid intersect counts conducted at 12 WAIT. For each experiment, data were analyzed in SAS (v9.4) using a single factor RCBD and Fisher’s Protected LSD (α=0.05).

Imazosulfuron provided >73% false-green kyllinga control. Two applications of imazosulfuron at 420 or 735 g ha\(^{-1}\) provided complete control, but single applications also provided acceptable control. With the exception of visual control at BCC were a single application of imazosulfuron at 420 g ha\(^{-1}\) provided less control than two applications, all imazosulfuron rates and application programs (single or sequential) resulted in optimum control.

Two sequential applications of halosulfuron-methyl provided >92% control in New Jersey but control of false-green kyllinga populations with halosulfuron was <37% at VNGC and ranged from 56-74% at BCC. This discrepancy in halosulfuron control indicates potential population sensitivity differences between sites. Sulfentrazone provided <38% control across all sites.

Overall, the data indicates that imazosulfuron is the most effective herbicide tested for false-green kyllinga control. A single application of imazosulfuron at 735 g ha\(^{-1}\) provided acceptable control (>88%) and two applications of imazosulfuron at 420 g ha\(^{-1}\) provided complete control (100%) at each site. Further, our data alluded to potential halosulfuron sensitivity differences between populations and these differences should be explored further in future research.
POSTEMERGENCE TROPICAL SIGNALGRASS CONTROL IN FLORIDA. N. Gambrell*, L.B. McCarty, R.B. Cross; Clemson University, Clemson, SC (232)

ABSTRACT

Tropical signalgrass (*Urochloa subquadripara*) has become a serious weed problem in Florida in recent years in association with the ban of organic arsenical herbicide use in turf. The purpose of this research was to identify alternative POST herbicides which control tropical signalgrass. Four field experiments were conducted on common bermudagrass fairways in Florida in summer 2017. Several non-organic arsenical herbicide treatments controlled tropical signalgrass.

Initial treatments were applied on June 13, 2017 and August 10, 2017 with sequential applications made two weeks after initial (WAIT). In the first experiment, treatments containing Tenacity in combination with other herbicides provided >95\% tropical signalgrass control 10 WAIT. These included Tenacity 4SC at 8 oz/acre + Princep 4L at 25 oz/acre, with and without Roundup 4L at 5 oz/acre, and Tenacity 4SC at 8 oz/acre + Sencor 75DF at 0.33lb/acre, with and without Roundup 4L at 5 oz/acre. In the second experiment, initial treatments were applied on June 13, 2007 with sequential applications made 2 WAIT on June 29, 2017. Treatments containing Xonerate 4SC at 7.25 oz/acre in combination with other herbicides provided > 90\% tropical signalgrass control 10 WAIT. These included Xonerate 4SC at 7.25 oz/acre + Solitaire 2 F at 16 oz/acre, Xonerate 4SC at 7.25 oz/acre + Dismiss South at 7.25 oz/acre, Xonerate 4SC at 7.25 oz/ac + Tribute Total at 3.2 oz/acre, and Xonerate 4SC + Celsius 68WDG at 3.7 oz/acre. In the third study, treatments were applied on August 10, 2017 with sequential applications made 2 WAIT on August 23, 2017. Xonerate 2SC at 14.5 oz/acre + Dismiss South at 7.2 oz/acre provided > 90\% tropical signalgrass control 3 WAIT. In the fourth study, pinoxaden, was applied at different timings. Pinoxaden, trade named Manuscript, was applied in June and July with sequential applications made 2 WAIT. Sequential applications of pinoxaden at 38 fl oz/acre applied with either Ronstar at 150 lbs/acre or Barricade at 1.15 lbs/acre provided >90\% control tropical signalgrass control when applied in June and July.

Control was most effective when two herbicides were tank-mixed which is also a sound practice for managing herbicide resistance. Research will continue investigating tropical signalgrass control and other grassy weeds to determine potential alternatives for organic arsenical herbicides, including expanding research into St. Augustinegrass.
CAN PGRS CONTROL GOOSEGRASS IN GOLF COURSE PUTTING GREENS? J.S. McElroy*, A. Boyd, J. Peppers, A. Brown; Auburn University, Auburn, AL (233)

ABSTRACT

Goosegrass [Eleusine indica (L.) Gaertn] is a problematic grassy weed in maintained turfgrass. Management can be difficult due to the adaptability and hardiness of goosegrass plants coupled with few herbicides that offer acceptable control levels. Herbicide resistance to dinitroanilines, triazines, oxadiazoles, and glyphosate further complicate control efforts. New methods of control must be found for goosegrass. Research has shown that plant growth regulators (PGRs) affect weed species as well as turfgrasses. It is theorized that different PGRs can have herbicidal effects on goosegrass. Past research has shown that trinexapac-ethyl (Primo Maxx) suppressed goosegrass growth, while paclobutrazol (Trimmit) and flurprimidol (Cutless) enhanced growth. Our objective was to revisit past research and evaluate three goosegrass biotypes for response to PGRs used in turfgrass.

In 2017, a greenhouse evaluation was conducted at the Plant Research Center in Auburn, Alabama. Three goosegrass biotypes, designated Augusta (Augusta, GA), Woodward (Bessemer, AL), and Auburn (Auburn, AL) were used. The plants were in the 2-3 leaf stage at the time of the first application. Four different PGRs were evaluated, paclobutrazol at 0.28 and 0.56 kg ai ha$^{-1}$, flurprimidol at 0.84 and 1.68 kg ai ha$^{-1}$, trinexapac-ethyl at 0.087 and 0.175 kg ai ha$^{-1}$, and ethephon (Proxy) at 3.81 kg ai ha$^{-1}$. One application was made of each product at the beginning of the trial. Plant heights and new shoot lengths were measured biweekly. The treatments were arranged in a randomized complete block design with four replications and the trial was repeated in time. All data were analyzed using PROC GLM and Fisher’s Protected LSD (P<0.05) was utilized for means separation.

At 16 days after treatment (DAT), the non-treated Auburn biotype 4.95 cm height. Auburn biotype treated with paclobutrazol (0.28 and 0.56) were 1.7 and 2.5 cm, respectively. Auburn treated with flurprimidol (0.84 and 1.68) were 2.05 and 1.45 cm, respectively. Auburn treated with trinexapac-ethyl (0.087 and 0.175) were 3.83 and 3.4 cm, respectively. Non-treated Auburn biotype had a new shoot length of 3.23 cm 16 DAT. Auburn biotype treated with flurprimidol (1.68) had new shoot lengths of 0.73 cm at 16 DAT. At 16 DAT, non-treated Woodward biotype had a plant height of 4.5 cm. Woodward treated with paclobutrazol (0.28 and 0.56) were 2.68 and 2.15 cm height, respectively. Woodward treated with flurprimidol (0.84 and 1.68) were 1.83 and 1.45 cm, respectively. Woodward treated with trinexapac-ethyl (0.087 and 0.175) were 4.15 and 3.13 cm, respectively. New shoot length of the non-treated Woodward was 4.25 cm 16 DAT and flurprimidol treatment (0.84) had a new shoot length of 1.7 cm. At 16 DAT, the non-treated Augusta biotype had an average shoot length of 5.33 cm. Plants treated with paclobutrazol (0.28 and 0.56) were 2.83 and 2.5 cm, respectively. Plants treated with flurprimidol (0.84 and 1.68) were 1.0 and 0.83 cm, respectively. Plants treated with trinexapac-ethyl (0.087 and 0.175) were 8.33 and 6.2 cm, respectively. Augusta treated with ethephon was 6.07 cm height. These data indicate that paclobutrazol and flurprimidol reduce goosegrass growth and can possibly be used as control measures.
ENHANCING THE SELECTIVITY OF HERBICIDES IN BERMUDAGRASS USING GROWING DEGREE DAY APPLICATION TIMINGS. P. McCullough*, S. Williams; University of Georgia, Griffin, GA (234)

ABSTRACT

Field experiments were conducted in Griffin, GA from 2015 to 2017 to evaluate the influence of growing degree-day (GDD) application timings on the selectivity of four herbicides in a ‘Tifway’ bermudagrass fairway. Herbicides evaluated included glyphosate at 0.42 kg ae ha⁻¹, flumioxazin at 0.42 kg ai ha⁻¹, oxadiazon at 3.3 kg ai⁻¹, and atrazine at 1.12 kg ai ha⁻¹. The applications were made at 50, 100, 200, and 300 GDD with a base mode of 50°F beginning on January 1 each year. Bermudagrass was completely dormant at the beginning of each experiment. Turf injury was acceptable (<20%) during spring transition from all herbicides applied at the 50 and 100 GDD timings. Annual bluegrass control was acceptable (>70%) from glyphosate and atrazine applied at these timings by late April 2016 and 2017, while flumioxazin provided acceptable control in one of two years. Glyphosate, flumioxazin, and oxadiazon caused unacceptable injury when applied at 200 and 300 GDD. Bermudagrass injury from atrazine applied at 200 GDD was acceptable in all three years but injury was inconsistent at 300 GDD. Results suggest that end-users can optimize the selectivity of glyphosate and flumioxazin for annual bluegrass control by making applications at 50 and 100 GDD using the aforementioned model when bermudagrass begins the year in dormancy. Sprayable oxadiazon treatments can be safely applied at 50 and 100 GDD under these conditions. Atrazine can be used up to 200 GDD for selective control of annual bluegrass in bermudagrass, but there is a greater risk of unacceptable injury when applications are made at 300 GDD.
IMPACT OF VARIOUS IRON FORMULATIONS ON TOPRAMEZONE INJURY TO BERMUDAGRASS. A. Boyd*, J.S. McElroy; Department of Crop, Soil and Environmental Sciences, Auburn University, Auburn, AL (235)

ABSTRACT

Due to recent restrictions on MSMA and the loss of diclofop-methyl (Illoxan, Bayer CropScience, Research Triangle Park, NC) for use in turfgrass, postemergence options for goosegrass control are limited. A possible goosegrass control option is the HPPD inhibitor, topramezone (Pylex, BASF, Research Triangle Park, NC). Significant bleaching injury of bermudagrass limits its potential use. Previous research has shown that topramezone applied in combination with chelated iron offers excellent goosegrass control as well as safening potential on bermudagrass. However, only one source of iron was evaluated in these studies, and further research is needed to assess whether different sources of iron may have the same effect. Field trials were conducted in the summer of 2016 and 2017 (Auburn University) to determine whether different iron sources may help safen topramezone use on bermudagrass by reducing bleaching symptoms. Mixtures of topramezone (12.3 g ai ha⁻¹) and MSO (0.5% v/v) were applied in combination with 6 different iron sources including Sprint 138 (610 g ai ha⁻¹, BASF, Research Triangle Park, NC), Sprint 330 (610 g ai ha⁻¹, BASF, Research Triangle Park, NC), Ferromec (765 g ai ha⁻¹, PBI Gordon, Kansas City, MO), Ferromec AC (1150 g ai ha⁻¹, PBI Gordon, Kansas City, MO), Ironite (4.9 kg ai ha⁻¹, Pennington, Madison, GA), and Ferrous Sulfate Heptahydrate (FSH)(14 kg ai ha⁻¹, Crown Technology Inc., Indianapolis, IN). Bermudagrass necrosis and bleaching symptoms were visually rated on a 0 to 100% scale. The treatments were arranged as a randomized complete block design with 4 replications. All data was analyzed using PROC GLM and Fisher’s Protected LSD (P<0.05) was utilized for means separation.

No significant differences were observed between runs covering both years, so data was pooled across all runs. Results showed that at 5 days after treatment (DAT), all treatments except for FSH (13%) yielded bleaching percentages ranging from 35-63%. No signs of necrosis were observed 5 DAT. At 12 DAT, the Sprint 330 and FSH treatments ranged from 15-19%, while other treatments ranged from 38-46% respectively. Necrosis percentages at 12 DAT for all treatments excluding Sprint 330 (6%) and FSH (13%) ranged from 24-38%. At 16 DAT, Sprint 330 and FSH treatments bleached bermudagrass 2%, while the other treatments ranged from 4-15% respectively. Necrosis percentages at 16 DAT ranged from 11-30% excluding the Sprint 330 (1%) and FSH (3%). All plots had fully recovered and showed no signs of residual bleaching or necrosis by 24 DAT, which indicated that the symptoms of topramezone application are transient. Overall, Sprint 330 and FSH reduced topramezone injury more than other iron sources. This data suggests that the source of iron does have an impact on the overall safening effects of topramezone on bermudagrass.
REDUCING BERMUDAGRASS TURF PHYTOTOXICITY FROM POST GOOSEGRASS HERBICIDES. L.B. McCarty*, B. Kerr, N. Gambrell; Clemson University, Clemson, SC (236)

ABSTRACT

Goosegrass (*Eleusine indica*) is the most troublesome summer annual grass weed on most SEUSA turfgrass facilities. It tolerates highly compacted, wet soils which are increasing as turf facilities reduce agronomic practices such as aerifying to remain economically viable. The loss of effective POST herbicides such as Illoxan (diclofop-methyl), severe restrictions on MSMA (spot treatment only), and reduced efficacy of other products such as Revolver (foramsulfuron), further intensifies the search for viable options. One possible solution is tank mixing various herbicides in an attempt to reduce unacceptable turf damage as well as immediately watering these in. Research, therefore, was conducted with this objective. A series of field experiments were conducted during summer 2017 with this objective in mind. All trials were in RCBD designs with 4 replications on established Tifway bermudagrass (*Cynodon dactylon x C. transvaalensis*) with treatments having two irrigation regimes following application, ±0.25 inch (0.64 cm). Treatments were applied using a backpack sprayer calibrated at 20GPA. Turf phytotoxicity was visually rated on a percent scale with 30% injury considered maximum acceptable. In the first study, Pylex 2.8SC (topramezone) applied at 0.5 oz/ac produced 20% turf phytotoxicity 10DAT (days after treatment) but <5% if immediately irrigated. Tank mixing with Xonerate 70WDG (amicarbazone) at 4 oz/ac had minimum effect on reducing turf phytotoxicity. Adding a chelated iron source (Spring 330) at 131 oz/ac to Pylex reduced turf phytotoxicity to ~5%. Turf phytotoxicity was not seen either 3DAT or 24DAT in this study. In another study, irrigating in Pylex at 0.5 oz/ac reduced phytotoxicity below the 30% maximum threshold while not irrigating had unacceptable results. When Sencor 75DF (metribuzin) was applied at 0.5 lb/ac, phytotoxicity was eliminated following irrigation. When tank-mixed with Pylex, turf phytotoxicity from Sencor was excessive (~70%) if not irrigated in but was acceptable if irrigated in. At 14DAT, turf phytotoxicity was excessive (~40%) following Pylex at 0.5 oz/ac if not watered-in but <5% when done so. In a 3rd study, at 4DAT, Speedzone 2.2L (2,4-D + dicamba + MCPP + carfentrazone) alone at 4 pt/ac or tank-mixed with Pylex at 0.5 oz/ac not irrigated had unacceptable turf phytotoxicity but was <10% if irrigated in. Irrigating in Sencor also reduced turf phytotoxicity to <30%. At 7DAT, irrigating in Pylex, Speedzone and Sencor reduced turf phytotoxicity <30% while these treatments not irrigated in were unacceptable. Turf phytotoxicity from Tenacity 4L (mesotrione) at 8 oz/ac alone or tank-mixed with simazine 4L at 25 oz/ac was reduced when irrigated in. At 14DAT, Pylex alone treatments had unacceptable turf phytotoxicity whether irrigated in or not. Speedzone alone or with Pylex and Tenacity + simazine had unacceptable turf phytotoxicity if not irrigated in vs identical treatments that were. By 28DAT only Pylex not irrigated in had unacceptable turf phytotoxicity.

Overall, irrigation immediately following POST herbicides application reduced turf phytotoxicity, though, this was inconsistent with Pylex alone treatments. This is important for triazine herbicides such as Sencor as this provides a viable POST goosegrass control option. It is also important for simazine as this allows its safe use in summer for other hard-to-control weeds such as smutgrass (*Sporobolus indicus*). Pylex tank-mixed with a chelated iron source also reduced turf phytotoxicity while adding Xonerate was inconsistent in achieving this. Future
research should investigate additional irrigation timings and amount relative to POST herbicide applications. Furthermore, research should explore tank mixing chelated iron and Xonerate on reducing turf phytotoxicity as should other additives such as nitrogen and biostimulants. Lastly, the efficacy of treatments that reduce turf phytotoxicity should be confirmed for weeds such as goosegrass.
WILD GARLIC AND BERMUDAGRASS RESPONSE TO HERBICIDES APPLIED PRIOR TO SPRING GREEN-UP. J. Craft*, S. Askew; Virginia Tech, Blacksburg, VA (237)

ABSTRACT

Wild garlic (*Allium vineale*) is a troublesome winter perennial weed that emerges from underground bulbs and is found in various turfgrass settings throughout the southeast. Wild garlic is problematic due to its rapid growth, persistence of bulbs for many years, waxy cuticle, and clumpy appearance during the dormant period of warm-season grasses. It is recommended to make initial herbicide applications in the fall followed by a spring application for most effective control. However, control can take 2 to 3 years of post-emergence herbicide use to fully control wild garlic. The waxy cuticle is one characteristics that makes control challenging because it reduces herbicide adsorption. However, no research has examined brushing wild garlic to scarify stem material prior to herbicide application to increase adsorption. Therefore, research was conducted to determine the impact of herbicide programs alone or in combination with brushing for wild garlic control and bermudagrass response. A field trial was initiated on March 9, 2017 in Blacksburg, VA on lawn height ‘Premier’ bermudagrass that was fully dormant at treatment application. Treatments were arranged as a split plot design with three replications with herbicide being the main plot and brushing and no brushing being the subplots. Herbicide treatments included glyphosate at 1400 g ai/ha, 2, 4-D at 2150 g ai/ha (Cold water), 2, 4-D at 2150 g ai/ha (Hot Water), SpeedZone at 1230 g ai/ha, Avenue South at 506 g ai/ha, Q4 Plus at 1760 g ai/ha, Dismiss Turf at 280 g ai/ha, Monument at 28 g ai/ha, Surge at 990 g ai/ha, Cool Power at 1770 g ai/ha, Escalade 2 at 2100 g ai/ha, Certainty at 105 g ai/ha, MSM Turf at 26 g ai/ha, Blindside at 460 g ai/ha, and an untreated check was included for comparison. Data was subjected to ANOVA and means were separated using fishers protected LSD at the 0.05 level of significance. Brushing did not influence wild garlic response to herbicides. Therefore, data presented will only represent wild garlic and bermudagrass response to herbicides.

At 2 weeks after treatment (WAT), SpeedZone and Cool Power were the fastest acting treatments compared to other treatments controlling wild garlic 75% and 55%, respectively. Even though SpeedZone and Cool Power were the quickest acting treatments at the conclusion of the trial control had dropped below 70%. At 6 WAT, glyphosate, MSM Turf, Monument, Blindside, and Certainty controlled wild garlic ≥ 85%. At the same rating data Escalade 2, Blindside, and Cool Power injured bermudagrass ≥ 50 with Escalade 2 having the greatest, at 88%. Monument, Certainty, and MSM Turf also caused unacceptable bermudagrass injury but injury was not present 8 WAT. By 10 WAT, Escalade 2 was the only herbicide causing unacceptable injury and delaying bermudagrass green-up. Avenue South, Surge, Dismiss Turf, 2, 4-D, and Q4 Plus throughout the duration of the study never controlled wild garlic ≥ 50%. At the conclusion of the study Blindside, MSM Turf, and Monument were the most effective treatments controlling wild garlic ≥ 96% with glyphosate and Certainty controlling wild garlic 80 and 79%, respectively. These data suggest glyphosate, Monument, Blindside, and MSM Turf applied in the spring can effective wild garlic control options when applied to fully dormant bermudagrass in the spring.
ABSTRACT

Dinitroaniline herbicides are commonly applied in spring for preemergence (PRE) control of summer annual turfgrass weeds, particularly smooth crabgrass (Digitaria ischaemum). Several researchers have evaluated the PRE efficacy of dinitroanilines applied in autumn for control of summer annual weeds the following season. However, the majority of this research has been conducted in cool-season turfgrass stands on soil types found in the northeast and upper midwest regions of the United States. We hypothesized that autumn applications of dinitroaniline herbicides in warm-season turfgrass stands of the southeastern United States could control smooth crabgrass similar to traditional spring applications.

Separate studies were conducted from 2015 through 2017 on mature stands of bermudagrass (C. dactylon spp.) naturally infested with smooth crabgrass. Plots (1.5 by 3 m) in all studies were arranged in randomized complete block designs with three replications. Study locations were the East Tennessee AgResearch and Education Center (Knoxville, TN) and the Lake Wheeler Turfgrass Field Laboratory (Raleigh, NC). Sites were irrigated to supplement rainfall and nutrients were applied using complete fertilizer. Herbicide treatments in all trials were applied with CO2-pressurized boom sprayers calibrated to deliver 374 L ha⁻¹ utilizing four, flat-fan, 8002 nozzles at 276 kPa, configured to provide a 1.5-m spray swath. Smooth crabgrass cover reductions due to herbicide treatment were quantified May through September using a 1 m² grid with 100 intersection points. The presence or absence of smooth crabgrass at each point was recorded with cover reduction calculated using the following equation: Cover reduction (%) = 1 – [(Cover treated – Cover non-treated) / Cover non-treated] * 100. Smooth crabgrass cover reduction data were subjected to analysis of variance in R (version 3.4.0).

Study 1 evaluated the efficacy of different PRE herbicides applied in autumn 2015 compared to standard spring application timing in 2016. Treatments included prodiamine (1680 g ha⁻¹), dithiopyr (560 g ha⁻¹), pendimethalin (3350 g ha⁻¹), and indaziflam (49 g ha⁻¹) and were irrigated into the soil within 24 hours of application. Rates represent the maximum single application dose allowable for use in bermudagrass according to each product label. These treatments were applied at three autumn timings during 2015 in TN (October 5th, November 3rd, December 3rd), as well as a standard spring timing (March 14th, 2016). Application timings in NC were similar with treatments applied on October 9th, November 9th, December 8th, in the autumn of 2015, as well as March 17th, 2016. Study 2 evaluated PRE control efficacy and soil dissipation of autumn prodiamine (1680 g ha⁻¹) and pendimethalin (3350 g ha⁻¹) compared to applying the same treatments in spring. In TN, treatments were applied October 17th and December 11th, 2016 and March 8th, 2017. In NC, treatments were applied October 17th and December 12th, 2016 and March 3th, 2017. Unique soil cores were collected from prodiamine- and pendimethalin-treated and nontreated plots 1 day after treatment (DAT) as well as during March, June and August 2017 to quantify dissipation. Samples were homogenized and milled with pendimethalin and
prodiamine residues quantified using a high performance liquid chromatography-diode array detector and peak area measurements. Residue concentrations were then calculated as percent of the initial application.

Study 1 in NC, applications of prodiamine in October, November, or December 2015 reduced smooth crabgrass cover (≥ 94%) similar to applying the same treatment in March 2016. Applications of pendimethalin, dithiopyr and indaziflam applied in October, November or December 2015 only reduced smooth crabgrass cover ≤ 78% in August 2016 compared to ≥ 91% following application in March. In TN, prodiamine applied in November or December 2015 reduced smooth crabgrass cover in May 2016 ≥ 92%, similar to spring treatment (99%). Smooth crabgrass cover with these autumn applications of prodiamine decreased to ≤ 72% by July and ≤ 49% by August, whereas all other autumn applied herbicides reduced smooth crabgrass cover ≤ 34% in July and August. Results of Study 1 indicated that prodiamine (1680 g ha⁻¹) applied in November or December can provide effective control of smooth crabgrass the following season, similar to applying prodiamine in spring. However differences in responses between NC and TN suggested that additional research was needed to elucidate more information about the dissipation of autumn-applied prodiamine.

In Study 2 prodiamine (1680 g ha⁻¹) applied in October or December 2016 reduced smooth crabgrass cover ≥ 89% during summer of 2017, similar to spring application timing (≥ 98%). Comparatively, pendimethalin applied in October or December 2016 reduced smooth crabgrass cover ≥ 59 or 77%, respectively, during summer of 2017. Applied in October, no differences were observed among prodiamine or pendimethalin residue at any sample timing; however, applied in December, pendimethalin was less persistent than prodiamine in March and June. Specifically, 37.0% of applied prodiamine persisted through the March sample timing compared to 20.3% of the applied pendimethalin. Similar trends were observed in June from December and March applications. Regardless of application timing, neither prodiamine nor pendimethalin were detected in August.
FACTORS AFFECTING GREEN TRUENESS MEASUREMENT. S. Askew*1, J. Brewer1, J. Craft1, S.S. Rana2; 1Virginia Tech, Blacksburg, VA, 2Monsanto Company, Galena, MD (240)

ABSTRACT

Recent research elucidated several sources of error that can undermine determination of putt consistency or “green trueness.” By measuring golf ball center of gravity, using a mechanical putter to avoid ball wobble associated with rolling devices, measuring ball directional dispersion prior to near-terminal motion, and brushing green canopies between ball rolls to avoid legacy effects, lateral imprecision of balls rolling on visibly consistent creeping bentgrass or synthetic canopies was constrained to approximately 4 mm m⁻¹. When rolling over an infestation of annual bluegrass, for example, lateral imprecision increased to 9 mm m⁻¹. New methods of measuring ball directional consistency could help determine benchmarks that allow superintendents to monitor canopy consistency or steer agronomic inputs for its improvement. Devices that use accelerometers, like cell phones, can measure multidirectional forces imparted on the rolling ball as it traverses a greens canopy. Two such devices include the Sphero, a virtual-reality gaming and user-interface device in the shape of a large ball and the Parrymeter, a rolling device designed to transfer forces directly from a rolling golf ball into a platform that holds an IPhone or IPod device. We used these two devices to compare correlations between gravitational forces measured by accelerometers within the rolling devices to actual golf ball directional consistency. We also used the Parrymeter to show significant decreases in cumulative gravitational force when rolled over adjacent areas of three bermudagrass putting greens that differed in establishment method. Areas where prior creeping bentgrass sod had been removed before bermudagrass establishment were firmer and had greater cumulative, absolute g-force then areas where bermudagrass was sprigged directly into dead creeping bentgrass.
CONTROLLING HARDWOODS WITH INJECTION USING AMINOCYCLOPYRACHLOR ALONE AND IN MIXTURES. A. Ezell*¹, A. Self², J. Belcher³; ¹Mississippi State University, Miss State, MS, ²Mississippi State University, Grenada, MS, ³Bayer CropScience, Auburn, AL (241)

ABSTRACT

A total of six treatments and one untreated check were evaluated to determine the efficacy of injecting aminocyclopyrachlor alone or in mixtures with other herbicides. Other herbicides utilized in the study included imazapyr, metsulfuron, glyphosate, and aminopyralid. Treatments were applied with hatchets and spray bottles (hack-n-squirt) in October, 2015 to stems which were 1"-6" diameter breast height. Treatments were evaluated in October, 2016 and again in October, 2017. Results indicate that five of the six treatments provided more than 90% control of the injected stems.
LONGLEAF PINE GROWTH RESPONSE FOLLOWING SITE PREPARATION INCLUDING ESPLANADE, OUST EXTRA, ESCORT, AND METHOD. A. Ezell*1, A. Self2, J. Belcher3; 1Mississippi State University, Miss State, MS, 2Mississippi State University, Grenada, MS, 3Bayer CropScience, Auburn, AL (242)

ABSTRACT

Longleaf pine growth was monitored for two years following site preparation treatments which included differing additions of herbicides for residual herbaceous weed control (HWC). It has been established that controlling competition is a key element in getting longleaf seedlings out of the grass stage by the end of the second growing season, and that herbaceous competition is a serious detriment to attaining this desired growth. Imazapyr and glyphosate were very effective in controlling the existing vegetation at the time of application, and control of herbaceous species was then monitored during the first growing season to evaluate the efficacy of the different treatments added for HWC. Pine growth was measured at the end of the second growing season, and the percent of longleaf seedlings which had broken out of the grass stage was recorded. Results indicate that herbaceous weed control was important in getting longleaf out of the grass stage, and that response varied among treatments.
SCREENING ESPLANADE MIXTURES FOR SLASH PINE SEEDLING HERBACEOUS WEED CONTROL. J.L. Yeiser*; consultant, Nacogodches, TX (243)

ABSTRACT

Esplanade (indaziflam) was applied in combination with standard forest herbaceous weed control (HWC) treatments to see if weed control and pine growth improved. The test site was located near Jasper, TX (Newton County-Scrappin Valley). Harvested in November 2016, the yaupon dominated site was not prepared before container-grown slash pine seedlings were planted in the sandy loam soil on February 2016. Herbicides were applied on April 16, 2017 with a CO₂ backpack sprayer and single flood nozzle to plot bands 6-ft wide and over 80-ft long. Each row plot contained 14 seedlings-two buffer seedlings on each end and 10 measurement seedlings in the middle. The total application volume was 10 GPA. Treatments (rate in product/treated acre) were: (1) untreated check, (2) Esplanade 5oz, (3) Oust XP+Velpar L (2+32oz) (industrial standard), (4) Oust XP+Arsenal (2+8oz) (industrial standard), (5) Oust XP+Velpar L+Esplanade (2+32+5oz), (6) Oust XP+Arsenal+Esplanade (2+8+5oz), (7) Velpar L+Esplanade 32+5oz). Treatments were established in a randomized complete block design with four blocks. Each block contained seven treatment plots. Study parameter were bare ground (%), pine phytotoxicity, total height (in), ground line diameter (in), and volume index (cub in). Plots were visually evaluated for percent bare ground in 10% intervals at 90- and 150-days after treatment (DAT). Initial (April 16, 2017) and late season (September 16, 2017) measurements documented seedling performance. On application day, all plots had similar % bare ground, averaging about 87%. Woody, grass, and forb cover averaged about 8%, 4%, and 2%, respectively. At 90-dat, Oust XP containing treatment plots exceeded >80% bareground, <15% woody cover, <4% grass, and forbs. At 120-dat, treatments Oust XP+Velpar L, Oust XP+Velpar L+Esplanade, and Arsenal+Oust XP+Esplanade all exhibited >70% bareground. Weeds successfully recolonizing plots were (woody) yaupon, noncrop pine, sweetgum, oak, baccharis; (forbs) dogfennel, broomsedge; (semi-woody) American beautyberry; and (grasses) Vasey grass, panicgrass. Oust+Velpar L+Esplanade treated plots exhibited 6% more bareground at 90-dat and 7% more at 150-dat than Oust+Velpar L. Similarly, for Oust XP+Arsenal+Esplanade, the addition of Esplanade provided 12% or 14% more bareground at 90- and 150-dat, respectively. Seedling survival and measurements were recorded just before application and again on September 16, 2017. At study initiation, four seedlings in Oust XP+Arsenal and four seedlings in the Oust XP+Velpar L plots were noted as poorly planted with tops of plugs above the ground and exposed to spray. At 90-dat, Arsenal seedlings were yellowish and stunted (had not flushed) and the Velpar L seedings were dead. The literature documents mortality and/or stunting for poorly planted seedlings with roots exposed to spray. Seedling survival exceeded 80% for all plots. Greatest mean height, gld, and VI were recorded on treatment plots treated with Oust XP+Velpar L. Smallest seedings were treated with Arsenal+Oust XP. These seedlings were numerically smaller than untreated check seedlings. Greatest growth enhancement occurred on Velpar L+Esplanade treated plots. In conclusion, Esplanade mixed well with the industry standards tested. Addition of Esplanade to the Oust+Velpar L or Arsenal tanks did increase bare ground 90- and 150-dat. Additional weed control did not result in additional growth for Oust XP+Arsenal+Esplanade released seedlings. That is, Arsenal treated seedling did not perform as expected. Slash pine seedlings are more vulnerable to Arsenal than loblolly pine seedlings and managers tend to treat them alike. Container-grown seedlings have
different needle wax development than nursery-bed seedlings. Perhaps there is an interaction here that needs further examination. All treatments provided acceptable stocking going into the rotation.
RESPONSE OF GREEN ANTELOPEHORN MILKWEED (ASCLEPIAS VIRIDIS) TO COMMON RIGHTS-OF WAY AND FORAGE HERBICIDES. N. Thorne*1, J. Byrd2, D. Russell2; 1Mississippi State University, Mississippi State University, MS, 2Mississippi State University, Mississippi State, MS (244)

ABSTRACT

The monarch butterfly, (Danaus plexippus), utilizes milkweed species (Asclepias spp.) as a sole host for larvae development. Some reports suggest recent declines in both milkweed and monarch populations are an indirect cause of herbicide usage. To objectively test these claims, several herbicides commonly used for vegetation management on rights-of-way and forages were evaluated on green antelopehorn (Asclepias viridis) populations at three Mississippi locations. Treatments were separated into groups to accommodate area available for field evaluations. All treatments were replicated four times in a randomized complete block design. Response variables measured were visual estimates of herbicide injury, plant growth stage, and stand counts. Data were analyzed by analysis of variance and tested for significance of treatments, growth stage and interactions of treatment by growth stage. Means were separated by least square means. The following treatments one year after application were no different than the untreated comparing plant count; hexazinone applied at 0.38 and 0.75 lb ai/A, foramsulfuron+iodosulfuron-methyl+thiencarbazone-methyl at 1.1 and 2.2 oz ai/A, aminocyclopyrachlor+chlorsulfuron at 1.4 and 2.8 oz ai/A, metsulfuron-methyl at 0.15 and 0.3 oz ai/A, and sulfosulfuron at 0.03 and 0.06 lb ai/A., aminopyralid at 0.05 and 0.1 lb ae/A, nicosulfuron+metsulfuron at 0.53 and 1.1 oz ai/A, picloram+2,4-D choline at 0.62 lb ae/A, sulfometuron at 0.38 and 0.75 lb ae/A, triclopyr choline at 1 lb ae/A, 2,4-D+dicamba at 0.65 and 1.3 lb ae/A, aminocyclopyrachlor at 0.03,0.06, 0.13, and 0.19 lb ae/A, aminopyralid+2,4-D at 0.46 and 0.93 lb ae/A, and fluroxypyr at 0.24 lb ae/A controlled weeds and maintained milkweed populations as well as the untreated. Treatments of triclopyr ester at 1.25 and 2.5 lb ae/A, triclopyr choline at 2 lb ae/A, glyphosate at 1.12, 2.25, and 4.5 lb ae/A, imazapyr at 0.25 and 0.5 lb ae/A, and picloram+2,4-D at 1.3 lb ae/A significantly reduced green antelopehorn populations compared to the untreated 1YAT and may be used by forage producers to diminish weedy populations. These data indicated the majority of herbicides commonly utilized for integrated vegetation management on rights-of-way do not cause long term plant loss or population decline.
YEAR TWO LOBLOLLY PINE SEEDLING GROWTH RESPONSE TO CLEANTRAXX TREATMENTS. J.L. Yeiser*; consultant, Nacogodches, TX (245)

ABSTRACT

Cleantraxx with NIS or MSO was compared to Oustar, Goaltender, Milestone+Cleantraxx, and industrial treatments (Arsenal AC+Oust XP 4+2oz, and Oustar 10oz) for herbaceous weed control, as well as pine seedling performance. The test site was located near Fountain Hill (Ashley County) in the hilly-upper coastal plain of southeastern Arkansas. The soil was a Pheba loam with 0-2% slope. A wildfire swept the area in September 2013 destroying the early mid-rotational pine stand. The site was aerially sprayed with Arsenal 4SL+Accord XRT II (24oz+3qts; 15GPA) in May 2015 and root raked and combination plowed in September 2015. Advanced generation loblolly pine seedlings were planted in January 2016 on a 6-ft X 12-ft spacing. Research herbicides were applied on April 8, 2016 with a CO2 backpack sprayer and single flood nozzle in a 5-ft band over the top of newly planted seedlings. The total application volume was 10 GPA. Herbicides (rate in product/treated acre) were: (1) Cleantraxx-3pt+.25% NIS, (2) Cleantraxx-4.5+.25%NIS, (3) Ceantraxx-3pt+1%MSO, (4) Cleantraxx-4.5pt+1%MSO, (5) Goaltender-3pt+1%MSO, (6) Milestone+Cleantraxx+MSO-7oz+3pt+3pt+1%, (7) Arsenal Ac+Oust XP-4+2 (operational), (8) Oustar-10oz, and (9) untreated check. 0.33-in rainfall occurred on April 11, 2016. Spring growing conditions were uncommonly wet. Plots were visually evaluated for percent bare ground in 10% intervals at 30-, 60-, 90-, and 120-days after treatment (DAT). Initial and late season measurements documented seedling performance. Initial seedling total height and ground line diameter were recorded on March 22, 2016. Total height was recorded on July 11, 2016, when the first flush was fully mature and the 2nd flush was appearing. Total height and ground line diameter were recorded again on August 30, 2016 and November 24, 2017 after first- and second-growing seasons. Treatments were established in a randomized complete block design with three blocks. Each block contained nine treatment plots each containing 14 row-plot seedlings with an internal 10 measurement seedlings leaving two buffer seedlings on each end. On application day, panic grass, dogfennel, wild geranium, dandelion, venus lookinglass, cudweed, and common plantain were disproportionately more abundant on test plots with many developed beyond the 2-3 leaf stage. Cleantraxx controls early post-emergence weeds only. These weeds were too well developed for Cleantraxx and Goaltender control and influenced the bare ground values. Also, cudweed was uncommonly heavy and was not controlled by Cleantraxx, Goal, and Arsenal AC+Oust XP 4+2oz treatments. At 60-DAT, the winter forbs were largely dead. Bare ground was observed to increase on Cleantraxx, Goal and Arsenal AC plots from 30-DAT to 60-DAT, not because of herbicides, but due to the natural mortality of winter forbs. Weed recolonization of plots was dominated by horseweed and wooly and tropic crotons. Survival was similar for all treatment with a study average of 91%. Seedling tolerance of Milestone+Cleantraxx+MSO was inadequate with initial seedling heights 1.3-in taller than July seedlings. MSO seedling flushes were shorter than HIS and other herbicide treated seedlings. Largest seedlings were on plots treated with Oustar or Cleantraxx (4.5pt+.25%, 3pt+1%MSO). Only Milestone+Cleantraxx+MSO and Oustar treatments controlled yellow thistle. Oustar treatments exhibited >80% bareground 90-day and best first- and second-year seedling growth. The addition of penoxsulam to the oxyfluorfen tank did provide additional weed control and seedling growth over treatments of fluroxyfen only. Survival declined after 90-day in only one treatment, signifying the importance
of early weed control for establishment success. All treatments provided acceptable seedling survival and stocking going into the rotation.
FIELD TESTING OF SICKLEPOD EXTRACT AS EFFECTIVE DEER REPELLENT TO PROTECT SOYBEAN. Z. Yue*1, M. Lashley1, S. Shrestha1, G. Caputo1, T. Tseng2; 1Mississippi State University, Starkville, MS, 2Mississippi State University, Mississippi State, MS (248)

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 most of the time 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 our Captive Deer Facility at Mississippi State University (MSU) 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.

This project progressed to field test this year. The field tests were conducted in two locations separated by around 12 miles: 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 NF experimental design was to compare the repelling effect of sicklepod extract and three commercial deer repellents (Hinder (H), Liquid Fence (LF) and Flight control plus (FCP)) plus water as a control. Deer repellent application rates were following the commercial label instructions for dilution at 20 gallons/acre. Sicklepod extract was prepared at 500 mL/100 g fruit or seed. North Farm had fairly high deer pressure. However, there were more soybean rows beyond our experimental area. Deer almost completely avoided the experimental area (only browsed up to 2% in the unfenced part) and went to browse other area. No significant different browsing between treatments was observed. The soybean yield results proved not influenced by repellent applications; the insect damage was also evaluated that sicklepod extract and LF were equally low. The Longview experiments were designed to make up the goal to compare the repelling of sicklepod extract with the three deer repellents. Soybean were grown in trays (11 x 21 x 2.5 in) in greenhouse for one month then transported to the site for browsing tests. First trial used the field application rate as applied in North Farm, almost all the soybean plants (>95%) were browsed without difference between treatments within two days. This suggested the deer pressure was extremely high at LV at that time. Then application rates were adjusted to three times of the NF rate. Under such application rate, the repelling tests lasted one week until frost killed the soybean plants on Nov. 20 and the repelling effectiveness was tested to follow the order: LF > Sicklepod > Hinder > FCP.

So far, Hinder is the only deer repellent authorized by EPA to apply on food crops. Sicklepod extract had better repelling effect than Hinder, and also Hinder had obvious leaf damage when applied at high rate. Sicklepod and its extract are traditionally used as herbal medicine and health
tea and could be taken into human mouth. Hence sicklepod extract is potentially the best deer repellent for food crops and vegetables.
PHENOTYPIC EVALUATION OF DIFFERENT ECHINOCHLOA ECOTYPES COLLECTED IN TEXAS RICE BELT. R. Liu*1, V. Singh1, X. Zhou2, M. Bagavathiannan3; 1Texas A&M University, College Station, TX, 2Texas A&M AgriLife Research, Beaumont, TX, 3Texas A&M AgriLife Research, College Station, TX (249)

ABSTRACT

_Echinochloa_ spp. is one of the most prominent weeds found in rice production worldwide. It can cause yield loss up to 50%. The taxonomy of the genus _Echinochloa_ is complex due to its morphological variations. In Texas, _Echinochola crus-galli_ and _Echinochloa colona_ are most problematic in rice. Field surveys across Texas rice producing areas showed that there are _Echinochloa_ spp. which don’t strictly follow the taxonomic classes for this genus. We collected 54 _Echinochloa_ spp. seed samples during late-season field surveys in 2015 and 2016. Seedlings were generated in the greenhouse and transplanted to the field for a common garden study in 2017. This experiment was carried out using a split-plot design with four replications. Seven seedlings from each population were transplanted in a row within the same plot. Three plants that represent the population were characterized for morpho-physiological traits, including stem angle, stem color, leaf color and texture, flag leaf length, width and angle, days to flower, panicle length, seed shattering and grain yield per plant. The preliminary results showed that there are possibly three types of _Echinochloa_ species in Texas. The dominant type in rice producing regions in Texas is _Echinochloa colona_. The findings in this study will help direct the management of _Echinochloa_ species.
EVALUATION OF WEED SUPPRESSIVE RICE VARIETIES AS A NON-CHEMICAL TOOL FOR WEED MANAGEMENT IN RICE. S. Abugho*1, A.M. McClung2, J. Samford3, X. Zhou4, M. Bagavathiannan5; 1Texas A&M University, College Station, TX, 2USDA, Stuttgart, AR, 3Texas A&M AgriLife Research, Sealy, TX, 4Texas A&M AgriLife Research, Beaumont, TX, 5Texas A&M AgriLife Research, College Station, TX (250)

ABSTRACT

Weed management in organic rice production is a challenge due to limited tools in controlling weeds. The use of allelopathic rice varieties as a potential tool provides sustainability in controlling weeds in organic rice system. A field study was conducted in the summer of 2017 at the David Winterrman Rice Research Station, Eagle Lake, TX to determine the weed suppression and yield effect of four weed suppressive rice varieties (Rondo, Jasmine 85, PI 312777 and PI 338046). The experiment was conducted in a randomized complete block design with four replications. Weed suppression, weed biomass and yield were gathered. Weed suppression (0%=no weeds; 100%=weedy) was evaluated at 35, 45, 60, 75 and 90 days after planting (DAP). Yield was recorded at harvest. Major weeds observed were barnyardgrass (*Echinochloa* spp.) and broad leaf signal grass (*Urochloa platyphylla*). PI312777 had the least weed cover (38%) at 45 days after planting and the least relative weed biomass (<40%). PI 312777 had the highest relative yield (248%) followed by Rondo (150%). The results of this study suggest that weed suppressive rice varieties used may potentially be used as alternative methods for weed control in organic rice production systems in Texas.
DEVELOPMENT OF XTENDIMAX WITH VAPORGRIP TECHNOLOGY FROM THE LAB TO THE FIELD. G. Montgomery*1, N. Rana2, R. Rector3, R. Montgomery4, G. Elmore3; 1Monsanto Company, Trenton, TN, 2Monsanto Company, St Louis, MO, 3Monsanto Company, St. Louis, MO, 4Monsanto Company, Union City, TN (261)

ABSTRACT

Monsanto Company has developed formulations containing low-volatility dicamba for use in the Roundup Ready® Xtend Crop System. XtendiMax® herbicide with VaporGrip® Technology is registered for commercial over-the-top use, by the EPA in 2016, and is a key component of the Roundup Ready® Xtend Crop System. Monsanto has conducted 1200+ controlled environment and field volatility studies since 2009. This research was performed in laboratories and across many of the 34 states provisioned on the Xtendimax product label. These studies provided information and data which supported the initial product registration. Examine and quantification of volatility and the impact of any vapor that may occur were conducted in concurrence with the EPA in controlled environments and in numerous field locations across the United States. Upon approval from EPA, additional studies were conducted to further elucidate impacts of tank-mix partners and further application requirements. The compiled results of these studies indicate that volatility from applications, even at a commercially large scale, is not sufficient to cause significant off-target movement of due to volatility. Although XtendiMax® herbicide with VaporGrip® is a low volatility formulation, some volatility does occur. However, extensive research has proven that volatility from applications, in accordance with the product label, not result in sufficient levels to cause off-target symptomology.

XtendiMax® herbicide with VaporGrip® Technology is part of the Roundup Ready® Xtend Crop System and is a Restricted Use Pesticide for retail sale to and use only by Certified Applicators or persons under their direct supervision.
ABSTRACT

In the fall 2014, the University of Georgia (UGA) and the Georgia Department of Agriculture (GDA) began an educational training initiative to improve on-target pesticide applications and to prepare growers for stewarding the use of 2,4-D and dicamba in auxin-tolerant technologies as they neared commercialization. The program, Using Pesticides Wisely, consisted of over 35 in-person classroom training locations conducted throughout the state during 2015, 2016, and 2017. Meeting attendance of nearly 3000 people was recorded. Additionally during 2017 prior to the growing season, nearly 500 applicators/growers were trained locally by their UGA Cooperative Extension Agent.

Georgia’s Using Pesticide Wisely classroom and agent trainings have improved pesticide stewardship in Georgia. During 2017 when many state departments of agriculture were faced with overwhelming dicamba drift complaints, Georgia did not receive a single complaint for the use of dicamba applied in-season to tolerant cotton or soybean. In regards to in-season applications of 2,4-D to tolerant soybean or cotton, the GDA received only one complaint which was under investigation at the time of publication. Of greatest importance was the reduction of overall pesticide drift complaints made to the UGA Cooperative Extension service. Pesticide drift complaints to UGA Extension were 69% less in 2017 as compared to 2014, the year prior to training implementation. Cooperative efforts between UGA, GDA, the U.S. EPA, local industry partners and growers have been essential in the success of this educational outreach program to steward the use of all pesticides.
In the year 2017 following the introduction of Xtend or dicamba-tolerant crops the Arkansas State Plant Board received a total of 985 alleged complaints of off-target movement of dicamba to susceptible soybean and other areas. This was after an extensive training process and some of the highest restrictions placed on dicamba by any state, including limiting in-season use to only Engenia brand dicamba. Problems ranged from blatant disregard of label directions and restrictions to unexplainable movement in the up-wind direction at the time of application. Research was conducted at three locations in Arkansas to explore the possibility of volatilization of newer formulations of dicamba including Engenia and Xtendimax. Evaluation of these products resulted in the conclusion that when soybean was used an indicator species, these newer formulations were similar to DGA formulations but less volatile than DMA. This work also confirmed the danger of adding AMS to spray mixtures of Xtendimax by increasing volatility.
SECONDARY MOVEMENT OF XTENDIMAX AND ENGENIA IN DRIFT TRIALS: IS THIS VOLATILITY? J. Norsworthy*1, G. Kruger2, D.B. Reynolds3, L. Steckel4, T. Barber5, B. Young6; 1University of Arkansas, Fayetteville, AR, 2University of Nebraska-Lincoln, North Platte, NE, 3Mississippi State University, Mississippi State, MS, 4University of Tennessee, Jackson, TN, 5University of Arkansas, Lonoke, AR, 6Purdue University, West Lafayette, IN (265)

ABSTRACT

The extent of injury from dicamba to soybean and other off-target vegetation in 2017 led to many complaints by producers about the herbicide. Injury to non-target plants was speculated to be caused by primary movement of dicamba because of applicators not properly following label application guidelines, spray tank and/or product contamination, and misidentification of symptoms caused by other herbicides. Others noted that secondary movement of the herbicide via rainfall, irrigation, dust, and volatility was involved in injury. A large-plot field trial using non-Xtend soybean (dicamba-resistant) was conducted in Arkansas, Tennessee, Indiana, Missouri, and Nebraska in 2017 to evaluate primary + secondary and secondary movement of the dicamba formulations Engenia and XtendiMax following labeled guidelines. Engenia and XtendiMax were simultaneously applied to separate fields of 0.8 to 1.4 ha using two similarly equipped sprayers. To determine the extent of secondary dicamba movement, 19-L buckets were placed over three to four soybean plants every 3.3 m from 3.3 to 30.3 m and every 6.6 m from 30.3 to 60.7 m along four transects in the downwind direction of spraying. Buckets were removed 30 minutes after application. Soybean plants beneath the buckets and plants not covered were rated for injury 2 to 4 weeks after treatment, with covered plots evaluated for injury from potential secondary dicamba movement and plots not covered evaluated for primary + secondary movement. Soybean was injured from secondary movement of dicamba at all field sites, albeit the extent of movement differed slightly among locations. Off-target movement of Engenia and XtendiMax appeared similar across the field sites evaluated. At the Arkansas and Tennessee field sites, soybean injury occurred at locations in the field other than those that were downwind at the time of application, indicative of additional secondary movement. Changes in wind direction a few hours after application explained the off-target movement at both locations. Furthermore, at the Arkansas site, 20 greenhouse-grown soybean plants in pots and plastic trays were placed at 10 locations in the Engenia and XtendiMax treated areas beginning 0.5 and 24 hours after application. All potted soybean plants were removed 36 hours after application. Dicamba symptoms resulted on the greenhouse-grown soybean plants that were removed from the Engenia and XtendiMax treated areas for both periods, with no difference between formulations within a period. The occurrence of injury to plants covered by buckets at all sites, injury to soybean in multiple directions at two sites, and injury to potted soybean placed in the field following application would indicate that secondary movement of dicamba at least partially contributes to the injury to soybean observed in these field trials. For these reasons, it should be recognized that secondary movement is occurring for both of the newer formulations at appreciable levels that may injure soybean and other sensitive vegetation when applied under field conditions typical of summer month applications. Relying solely on a downwind buffer during application may not protect soybean or other sensitive vegetation from secondary movement following application. Future research should focus on factors contributing to secondary movement in hopes of understanding ways to minimize its occurrence and ways to
best utilize the new dicamba formulations for resistance management without incurring off-target movement.

ABSTRACT

The prevalence of herbicide resistant weeds throughout the US continues to become a bigger management issue for growers each year. Engenia(R) herbicide, the BAPMA salt of dicamba, was introduced for use in dicamba tolerant crops in the 2017 season to help growers manage these tough weed problems. With the launch of this innovative technology, Engenia herbicide was promoted in a two-pass herbicide system that included multiple, effective herbicide sites of action. Engenia herbicide can be applied preplant or preemergence, but was most commonly used postemergence in combination with glyphosate following a strong residual preemergence herbicide. Overall, weed control performance of Engenia herbicide was excellent across soybean and cotton growing areas.

Because of the high sensitivity of dicot plants to dicamba, it is critical that product label requirements be followed to mitigate off-target movement onto sensitive areas. BASF representatives investigated inquiries regarding potential off-target movement of dicamba during the 2017 growing season. Based on information provided during the investigations, improper application of Engenia herbicide was the most common cause of off-target movement. Attention to label requirements including spray buffer setback, wind speed, temperature inversion, boom height, nozzle selection, and mix system/sprayer hygiene are critical for an on-target application.

BASF worked with the federal EPA and local state regulatory agencies to help clarify the Engenia herbicide label for 2018. Nozzle and other off-target equipment mitigation incentive programs have been expanded. And, BASF is continuing applicator training and education efforts to ensure understanding and adherence to dicamba label requirements.
DICAMBA VOLATILITY UNDER FIELD AND LABORATORY CONDITIONS. T. Mueller*1, L. Steckel2; 1University of Tennessee, Knoxville, TN, 2University of Tennessee, Jackson, TN (267)

ABSTRACT

Much interest has been generated by the potential for off-site movement of dicamba, which has resulted in discussions related to the causes of this phenomenon. This report details two field studies, including optimizing field and laboratory conditions to enhance sensitivity and accuracy of dicamba sampling and analysis. The first study showed that diglycolamine salt of dicamba was more likely to move from green plant surfaces compared to either tilled bare ground or dead plant material. The second study showed that newer formulations of dicamba had slightly lower emissions under field conditions compared to the diglycolamine salt formulation. All samples showed dicamba above detectable levels, and the typical pattern of dicamba arising from treated plots was correlated to temperature. Humidomes have been proposed by other researchers as a test system to compare various attributes of herbicide behavior under more controlled conditions. This report will detail our efforts to conduct “modified” humidome studies. Fixed experimental parameters include herbicide formulation (DGA, DGA + vapor grip, or BAPMA) and surface condition (dry soil, wet soil or soybean foliage). Random variables focused on differences in temperature on herbicide behavior under greenhouse conditions, with studies conducted over a sufficient time interval to encompass temperatures expected to be encountered under field conditions. A diurnal cycle of temperature was also evident in the experiments, which ranged in duration from 1.5 to ~ 4 days in length. Dicamba formulation showed significant differences in detected amounts. Temperature appeared to be a major factor driving the amounts of herbicide detected. A surprising finding was the apparent detection of DGA dicamba, as well as the acid moiety of dicamba in the samples. All treatments based on the DGA salt (Clarity and Xtendimax) showed consistent detection of a chromatographic peak co-eluting with the DGA salt of dicamba, while none of the BAPMA treatments ever had the corresponding peak. Possible explanations for this are direct volatilization of DGA salt of dicamba, or possibly the dicamba is moving co-incident with soil or plant particles.
GIANT SMUTGRASS AND BAHIAGRASS RESPONSE TO BURNING, GRAZING INTENSITY, AND HEXAZINONE RATE. J. Dias*1, B. Sellers2, J. Ferrell3, S. Enloe3, J. Vendramini2, P. Moriel2; 1University of Florida, ONA, FL, 2University of Florida, Ona, FL, 3University of Florida, Gainesville, FL (268)

ABSTRACT

Giant smutgrass (Sporobulus indicus var. pyramidalis) is a perennial warm-season grass weed considered to be one of the most problematic weeds in improved perennial grass pastures in the southeastern U.S. The only chemical control option currently available is hexazinone, labeled for bahiagrass (Paspalum notatum) and bermudagrass (Cynodon dactylon) pastures. However, applications of hexazinone are expensive and subject to environmental conditions that often result in lack of control. Thus, single management programs have often failed to provide effective giant smutgrass control. Therefore, the objectives of this study were to determine the impacts of burning and grazing intensity (GI) in a rotational stocking method on bahiagrass and giant smutgrass herbage responses from March to July, and to determine the effects of hexazinone applied after the last grazing event (mid-July) on giant smutgrass plants. Bahiagrass cumulative herbage accumulation (HA), bahiagrass average herbage accumulation rate (HAR), giant smutgrass cumulative HA, giant smutgrass average HAR, giant smutgrass average height after grazing events and giant smutgrass % ground cover after the final grazing event were investigated in giant smutgrass-infested bahiagrass pastures located in Okeechobee, FL in 2014, and near Zolfo Springs, FL in 2016. Burning and grazing intensity treatments were distributed in a split-plot design with four replications. Main plot treatments were burning during early spring and no-burning, and subplot treatments were low GI (6 AU ha⁻¹) and high GI (12 AU ha⁻¹). Hexazinone treatments (0, 0.56, and 1.12 kg ai ha⁻¹) were included after the last grazing event as sub-subplot treatments. Treatments effects were analyzed for each year separately because the grazing period differed between years (90 days in 2014 and 120 days in 2016). In 2014, burning did not affect bahiagrass cumulative HA and HAR. However, the high GI treatment provided 19 and 21% less bahiagrass cumulative HA and HAR, respectively, compared with the low GI treatment. In 2016, the effects of both burning and GI were significant for bahiagrass cumulative HA and HAR. Burning resulted in a reduction of 11.5 and 10% of bahiagrass cumulative HA and HAR, respectively, compared to the unburned treatment; and the high GI treatment resulted in an 18% reduction of bahiagrass annual HA and HAR, respectively, compared to the low GI treatment. In 2016, the effects of both burning and GI were significant for bahiagrass cumulative HA and HAR. Burning resulted in a reduction of 11.5 and 10% of bahiagrass cumulative HA and HAR, respectively, compared to the unburned treatment; and the high GI treatment resulted in an 18% reduction of bahiagrass annual HA and HAR, respectively, compared to the low GI treatment at the end of the grazing events. The effects of burning were significant for all giant smutgrass variables in both years, except for % ground cover in 2016. The burning treatment resulted in a decrease of approximately 45, 49 and 55% smutgrass cumulative HA, HAR and height in both years, regardless of the GI. In 2014, the burning treatment provided a 1.1-fold greater reduction in giant smutgrass % ground cover than the unburned treatment. Conversely, in 2016, no reduction in giant smutgrass ground cover was observed. There were no GI effects for giant smutgrass annual HA, HAR, average height at the end of the grazing periods in 2016, and % ground cover in both years. However, the average height recorded after all grazing events in the high GI was 48% lower than the height in the low GI treatment in 2014. Despite the significant effects on giant smutgrass response variables at the end of the grazing events, pre-treatment burning, and grazing had no effect on smutgrass control with hexazinone, but this could have been confounded by excessive rainfall in within a week after application as smutgrass control was extremely poor in both years. While hexazinone activity did not increase as a result
of this particular integrated weed management study, burning in conjunction with low levels of grazing intensity in a rotational stocking method might work as tool in a IWM plan slowing the rate of giant smutgrass herbage production and spread in bahiagrass pastures in FL.
INDAZIFLAM, WHERE IT FITS IN TEXAS IMPROVED PASTURES. J. Jackson*1, C. Medlin2; 1Texas A&M AgriLife Extension, Stephenville, TX, 2Bayer CropScience, Paradise, TX (269)

ABSTRACT

Indaziflam, a cellulose biosynthesis-inhibiting herbicide, is currently labeled for preemergence control of many annual broadleaf and grass weeds in turf grass and various tree nut, fruit, and vine crops, as well as industrial vegetation management markets. Management of key annual grass weeds in improved pasture lands in Texas is necessary to maintain high quality forage production. Two common grass weeds that appear in improved pastures are sandbur (*Cenchrus sp.*) and annual ryegrass (*Lolium multiflorum*). Sandbur is a troublesome warm-season grass weed that affects forage quantity and quality. Sandburs, in advanced stages of seed production, produce a seed capsule that can penetrate tissues of animals and negatively affect forage and hay values. Annual ryegrass germinates in the fall and offers some value as a cool-season forage for livestock; however, if left unmanaged it can limit yields and reduce stands of perennial grass production the following spring. Research was initiated to evaluate potential uses for indaziflam in Texas’ improved pasture market. Trials were established throughout central Texas in the fall and winter of 2016 to determine the effect of indaziflam on both annual ryegrass and sandbur. Evaluations throughout 2017 indicate that indaziflam provides a high level of control of both sandbur and annual ryegrass when applied at rates of 45 to 75 g/ha in the fall; however, lower rates of indaziflam did not provide season-long control of sandbur. Annual ryegrass was controlled with 45 g/ha of indaziflam and higher when applied in the fall prior to annual rye grass germination.
Efficacy and Forage Tolerance with Indaziflam in Texas Pastures. M. Matocha*1, S.A. Nolte2, C. Medlin3; 1Texas AgriLife Extension Service, College Station, TX, 2Texas A&M AgriLife Extension, College Station, TX, 3Bayer CropScience, Paradise, TX (270)

ABSTRACT

Long term management of herbaceous weeds in improved pastures can be challenging. To meet these challenges, Bayer Environmental has begun to look at indaziflam and its possible fit into the pasture chemistry market. Field studies were established in 2016 and 2017 at the Texas A&M AgriLife Research facility in Brazos and Burleson Counties in Texas to evaluate indaziflam for forage tolerance and weed control in pastures. All studies were an RCB in design, utilized three or four replications, with either 10x20’ or 10x30’ plots, and were applied at 20-26 GPA. In 2016, a study was established on Tifton 85 bermudagrass in Burleson County with Alion at 3, 4, and 5 oz/A, Outrider at 1.33 oz/A, and Plateau at 6 oz/A. The site was over-seeded with prickly sida to evaluate efficacy, in addition to bermudagrass tolerance. An additional study in 2016 was conducted to evaluate winter weed control with Esplanade. In 2017, one forage tolerance study was conducted with Esplanade at 2.5 to 15 oz/A on Tifton 85 bermudagrass, and a second on field sandbur control in pastures with Esplanade at 2.5 to 7 oz/A, Prowl H2O at 2.1 qt/A, and Esplanade at 5 oz/A + Prowl H2O at 2.1 qt/A.

Results in 2016 show that Alion at 4 and 5 oz/A provided 87 and 89% control, respectively, of prickly sida at 30 DAT, with only a slight decline by 122 DAT (82 and 87%, respectively). At 10 MAT (months after treatment), Alion at 3-5 oz/A provided 75-90% control of annual ryegrass which was statistically greater than Outrider and Plateau (37 and 3%, respectively). Esplanade provided effective early season residual annual ryegrass control, 99-100%, with 3.5 to 7 oz/A, respectively, at 33 DAT. Ryegrass control was still good at these rates by 89 DAT (88-96%).

In 2017, Esplanade at the highest rate (7 oz/A) provided 70% control of field sandbur at 41 DAT. Lower rates of Esplanade (2.5 to 5 oz/A) provided only 40 to 62% control at this same date. Prowl H2O at 2.1 qt/A alone and with Esplanade 5 oz/A + Prowl H2O at 2.1 qt/A still only achieved 57 and 67% control of field sandbur, respectively.
EVALUATION OF PREEMERGENCE AND POSTEMERGENCE HERBICIDES FOR KNOTROOT FOXTAIL IN TALL FESCUE. J.A. Tredaway*, B. Greer¹, G. Stapleton²; ¹Auburn University, Auburn University, AL, ²BASF Corporation, Dyersburg, TN (271)

ABSTRACT

Field studies were conducted at the Sand Mountain Research and Extension Center in Crossville, Alabama in 2017 to determine the effect of herbicide treatments on Knotroot foxtail (Setaria parviflora) control and tall fescue (Festuca arundinacea) yields. Herbicide treatments consisted of Prowl H₂O at 2.1, 3.2, and 4.2 quarts per acre applied at dormancy; Prowl H₂O at 2.1 qt/acre applied at dormancy followed by (fb) Prowl H₂O at 2.1 qt/acre after 1st haycutting; Prowl H₂O at 2.1 qt/acre at dormancy fb Facet L at 22 fl. oz/acre after 1st hay cutting; Prowl H₂O at 2.1 qt/acre at dormancy fb Facet L at 32 fl. oz/acre after 1st hay cutting; Pastora at 1.5 oz/acre after the 1st hay cutting; and Esplanade at 5 oz/acre after the 1st hay cutting. The study was a randomized complete block design with four replications. Dormant treatments were applied on March 8, 2017 and 1st cutting treatments were applied on September 7, 2017. Treatments were applied so far apart due to wet weather conditions which persisted throughout the spring and summer. All treatments with the exception of Pastora (which was not applied) basically provided the same weed control 169 days after application (daa) except Prowl H₂O at 4.2 qt/acre. However, by 209 daa, only two applications of the 2.1 qt/acre rate of Prowl H₂O provided better foxtail control. Esplanade, Prowl H₂O at 2.1, 3.2, and 4.2 qt/acre all controlled foxtail the same; after the B applications were made, only the Prowl H₂O at 2.1 + Facet L at 1 qt/acre provided better control. The best overall treatment for Knotroot foxtail control and yield was Prowl H₂O at 2.1 qt/A fb Facet L at 1 qt/acre. Serious bermudagrass growers are willing to pay the cost of this treatment however, the average hay grower is not (personal communication in 2017 meetings). All treatments with the exception of Pastora (which was not applied) basically provided the same weed control 169 daa except Prowl H₂O at 4.2 qt/A.
MANAGEMENT SYSTEMS FOR KNOTROOT FOXTAIL IN BERMUDAGRASS HAY.
G. Stapleton*1, J.A. Tredaway2, B. Greer2, J. Via3, M. Dennison4; 1BASF Corporation, Dyersburg, TN, 2Auburn University, Auburn University, AL, 3University of Tennessee, Somerville, TN, 4BASF, Halls, TN (272)

ABSTRACT

Knotroot foxtail, *Setaria parviflora* also known as perennial foxtail has become one of the most invasive weeds in pastures and hay fields in the southern United States in the last several years. It is a warm season perennial grass that is particularly difficult to control bermudagrass hay fields and can also interfere with grazing. Seedheads of foxtail can cause blisters and mouth ulcers in horses and can sometimes be fatal.

A trial was initiated in 2017 on the Michael Anderson farm in Fayette County, TN on a Tifton-44 bermudagrass hay field. Plots were 10 ft by 35 ft long with three replications. Eighteen treatments were established with single and sequential application systems FacetL, Pastora and Prowl H2O. Treatment timings included: A - 22 days prior to first cutting; B - 16 days after first cutting; C - 12 days after the second cutting. Biomass samples were collected after the second and third cutting, dried, weighed and converted to tons/acre. Weed control ratings were recorded for foxtail and southern crabgrass *Digitaria ciliaris*.

The untreated check at the time of the third cutting yielded 0.75 tons/A with 62% knotroot foxtail as the most significant component. Single application treatments applied at A timing with FacetL at 32 oz/A provided excellent control of foxtail but needed Prowl H2O as a tankmix partner to provide good control of crabgrass by 105 Days after treatment. Poor control of crabgrass was recorded with FacetL alone. Sequential applications of Pastora 1.5 oz fb Pastora 1.0 oz AB or BC provided 85% foxtail control and fair control of crabgrass with 1.93 tons/A yield. However, these applications limited forage production in second cutting by 40% over the FacetL treatments. Sequential applications (AB or BC) of FacetL fb FacetL at 16 oz/A or 32 oz/A tankmixed with or without Prowl H2O 64 oz/A provided excellent control of foxtail with an average tonnage/A of 2.27. When the FacetL sequential programs at the BC timings included Prowl H2O, crabgrass control was 88% to 96%. Without Prowl H2O, FacetL fb FacetL at AB or BC timings only poor to fair control of crabgrass was observed. These results suggest that FacetL may offer a new option for knotroot foxtail management in bermudagrass hay.
LANCELEAF RAGWEED (AMBROSIA BIDENTATA) RESPONSE TO HERBICIDES.
J. Byrd*1, D. Russell1, N. Thorne2; 1Mississippi State University, Mississippi State, MS, 2Mississippi State University, Mississippi State University, MS (273)

ABSTRACT

Eight herbicides were applied to lanceleaf ragweed (Abrosia bidentata) mid-August 2017 to evaluate efficacy. Treatments were applied at 15 gpa with a CO2 pressurized sprayer to four replicates of plants just starting to release pollen. Nonionic surfactant at 0.25% v/v was included with all treatments, except quinclorac (Facet L 1.5 lb ae/gal), which was applied with 32 oz/A crop oil concentrate. Temporary electric fencing was installed around the perimeter of the test area to exclude livestock grazing. Lanceleaf ragweed plant density (plants per m²) was counted the day treatments were applied. Density counts will be taken summer of 2018 to determine residual effect of applications. Visual response to treatments was estimated 23, 34, and 49 days after treatment (DAT) using a scale of 0 indicative of no control and 100 indicative of complete control. While all treatments controlled lanceleaf ragweed better than the untreated control, only hexazinone (Velpar 2 lb ai/gal) provided 100% control. Hexazinone applied at either 0.38 or 0.75 lb ai/A provided 100% visual control at all three evaluations. Lanceleaf ragweed control with all other herbicide applications improved as evaluation intervals advanced. At 34 and 49 DAT, lanceleaf ragweed control with 2,4-D+dicamba (Weedmaster 3.87 lb ae/gal) applied at 1.9 lb ae/A and 2,4-D+picloram (Grazon P+D 2.54 lb ae/gal) applied at 2.54 lb ae/A was equal to that provided by hexazinone. However, these treatments provided only 78% visual control at 49 DAT. None of the other treatments provided more than 52% lanceleaf ragweed control at 34 DAT or 60% control at 49 DAT. Seven herbicides labeled for use in forage systems did not provide acceptable (>80%) lanceleaf ragweed control in this study. Based on these results, these treatments cannot be recommended for lanceleaf ragweed control: 2,4-D+aminopyralid (GrazonNext HL 3.74 lb ae/gal) applied at 0.56 or 0.99 lb ae/A, 2,4-D+dicamba applied at 0.96 lb ae/A, 2,4-D+picloram applied at 0.64 or 1.3 lb ae/A, aminopyralid (Milestone 2 lb ae/gal) applied at 0.1 lb ae/A; dicamba (Banvel 4 lb ae/gal) applied at 0.5 or 1.0 lb ae/A, picloram (Tordon 2 lb ae/gal) applied at 0.5 lb ae/A, quinclorac applied at 0.38 or 0.76 lb ae/A. These treatments will be applied to smaller lanceleaf ragweed in 2018 to determine if plant maturity impacted control in 2017.
MULTIPLE-HERBICIDE RESISTANT WEEDS IN TENNESSEE AND INVESTIGATION INTO POSSIBLE HERBICIDE METABOLIC-RESISTANT PALMER AMARANTH. L. Steckel*, J. Copeland; University of Tennessee, Jackson, TN (274)

ABSTRACT

Weeds with stacked or multiple-herbicide resistance continue to evolve in Tennessee and throughout the southern U.S. Just in the last few years, for example, Palmer amaranth (Amaranthus palmeri) has been reported to have populations with resistance to ALS inhibitors (group 2), the EPSP synthase inhibitor (group 9) and PPO inhibitors (group 14). Reports of other troublesome broadleaf weeds such as horseweed (Conyza canadensis) and common ragweed (Ambrosia artemisiifolia) have also been confirmed resistant to two or more herbicide sites of action. Furthermore, multiple-resistance in grass weeds such as goosegrass (Eleusine indica) Italian ryegrass (Lolium perenne spp. multiflorum), annual bluegrass (Poa annua), and barnyardgrass (Echinochloa crus-galli var. crus-galli) have become more prevalent. Mississippi has reported some barnyardgrass populations have resistance to ACCase inhibitors (group 1), ALS inhibitors (group 2), PSII inhibitors (group 7) and cellulose inhibitors (group 26). Additionally, researchers there in 2017 confirmed a glyphosate-resistant (group 9) barnyardgrass biotype.

Multiple herbicide-resistant weed populations, like the aforementioned, can be difficult to control. All the above history would suggest that weed management tactics that solely rely on herbicides are not sustainable. Furthermore, populations that exhibit the potential for metabolic resistance present a serious concern where cross-resistance to other sites of action is a potential threat.

Fortunately, our knowledge and ability to determine resistance rapidly via DNA sequencing has broadened in recent years. We now have the advantage of characterizing and confirming target-site resistance mechanisms quickly. The rapid diagnosis and confirmation of resistance helps growers make informed weed control decisions within the current and future growing seasons. If growers have weed populations with multiple-herbicide resistance or metabolic resistance, weed management programs that are only herbicide-based should be altered. Integrating cultural or mechanical weed control tactics is crucial for control of potential metabolic-resistant or multiple-herbicide resistant weed populations where herbicides alone are no longer effective.
MULTIPLE-HERBICIDE RESISTANT WEEDS IN TENNESSEE AND INVESTIGATION INTO POSSIBLE HERBICIDE METABOLIC-RESISTANT PALMER AMARANTH. L. Steckel*, J. Copeland; University of Tennessee, Jackson, TN (274)

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MESOTRIONE + S-METOLACHLOR APPLIED PREEMERGENCE FOR CONTROL OF MULTIPLE HERBICIDE RESISTANT WEEDS. D. Bowers*; Syngenta, Greensboro, NC (275)

ABSTRACT

Syngenta Seeds and Bayer Crop Science are jointly developing a novel HPPD inhibitor herbicide tolerance event for soybeans. This molecular stack (SYHT0H2) will facilitate preemergence application of mesotrione and isoxaflutole as well as postemergence application of glufosinate in soybeans.

HPPD inhibitor herbicides have become foundational to weed management programs in corn because of their effectiveness in controlling a wide spectrum of broadleaf weeds. Of particular importance, these herbicides are effective for control of weeds resistant to herbicide Site of Action Groups 2, 5, 9, and 14. In soybeans there is a need for additional herbicides for control of *Amaranthus tuberculatus* and *Amaranthus Palmeri* due to widespread resistance to several herbicide sites of action. The ability to apply HPPD-inhibiting herbicides in soybeans, a crop routinely grown in rotation with corn, magnifies the importance of utilizing best resistance management practices. The Herbicide Resistance Action Committee’s HPPD Working Group recommendations to manage HPPD resistance include use of full labeled rates and combinations with other Sites of Action either in tank-mixture or premixes.

Syngenta is developing a premix formulation of s-metolachlor + mesotrione, A22089B, for use in HPPD tolerant soybeans. A22089B will be labeled for preemergence use only and should be used as one component of two pass weed management programs. Additional herbicides will be recommended as tank-mix partners to bolster herbicide resistance management.

Field studies were conducted at multiple locations in 2017. Results show that A22089B provided effective preemergence control of *Amaranthus tuberculatus, Amaranthus Palmeri*, annual grasses, and many large seeded broadleaf weeds. Crop tolerance and yield studies show excellent tolerance of soybeans containing SYHT0H2 to A22089B alone and in mixture with metribuzin.

ABSTRACT

Trifludimoxazin [1,5-dimethyl-6-thioxo-3-(2,7-trifluoro-3,4-dihydro-3-oxo-4-prop-2-ynyl-2H-1,4-benzoxazin-6-yl)-1,3,5-triazinane-2,4-dione] is a new inhibitor of protoporphyrinogen IX oxidase (PPO or Protox). This is the first PPO inhibitor containing a triazinone heterocycle. Trifludimoxazin is very active when applied PRE or POST on dicot/broadleaf weeds including PPO resistant *Amaranthus* biotypes which are not controlled by currently registered PPO inhibitors like the diphenylether herbicides (e.g., fomesafen, lactofen, etc.), sulfentrazone, or flumioxazin. Trifludimoxazin has also demonstrated activity on key monocot/grass weeds including *Lolium* spp. The combination of trifludimoxazin plus saflufenacil improved the burndown and spectrum of weed control over solo trifludimoxazin and therefore will be a key mix partner along with other non-PPO inhibitor chemistries as part of a resistance management strategy. Trifludimoxazin is expected to receive registration in key countries for use in multiple crops and total vegetation management by the middle part of the next decade. Given its unique ability to control several resistant weed biotypes, trifludimoxazin will be an important tool for future PPO hericide tolerant crops.
MANAGING WEEDS WITH MULTIPLE HERBICIDE RESISTANCE IN THE MID-SOUTH. T. Barber*1, J. Norsworthy2, M. Houston2, R.C. Scott3, L. Steckel4, J. Copeland4, J. Bond5; 1University of Arkansas, Lonoke, AR, 2University of Arkansas, Fayetteville, AR, 3University of Arkansas - Extension Service, Lonoke, AR, 4University of Tennessee, Jackson, TN, 5Delta Research and Extension Center, Stoneville, MS (277)

ABSTRACT

Palmer amaranth resistant to protoporphyrinogen oxidase inhibiting (PPO) herbicides was first identified in Arkansas in 2014. In 2015 increased state-wide sampling of Palmer amaranth populations revealed that resistance had quickly spread to 15 counties across the state, with 50% of Palmer amaranth populations in Northeast Arkansas testing positive for PPO resistance. Due to the widespread increase in PPO resistance, on-farm locations for small plot research were identified prior to the 2016 growing season. Trials were conducted in Gregory, Crawfordsville and Marion, Arkansas to determine the effect of common herbicides when applied both preemergence and postemergence on PPO-resistant populations. Palmer amaranth populations studied were also confirmed to have 4-way multiple resistance to glyphosate, acetolactate synthase (ALS), and microtubule inhibitors in addition to PPO inhibitors. Protocols were developed to determine the most effective herbicide or herbicide combination for control of these multiple-resistant Palmer amaranth populations. Bare soil plots that measured 6ft by 10ft were sprayed for residual evaluation and on 2in to 3in Palmer amaranth for POST evaluation. Plots were sprayed with a backpack sprayer calibrated to deliver 15 GPA. Additional trials were developed to determine control levels provided by multiple herbicide modes of action applied PRE. Plots were 12.67 by 30ft and designed as a randomized complete block. Twenty-six herbicide comparisons were applied PRE to either Roundup Ready, Liberty Link, Xtendflex or Enlist soybean. PRE herbicide programs were combined for analysis at 28 days after treatment (DAT) across all locations. Effect of POST programs were analyzed by technology and included 2 locations for Roundup Ready, Liberty Link, Enlist and Xtendflex cultivars. Results from bare ground PRE studies evaluated at 28 DAT indicate that PPO herbicides such as Valor continue to provide some level of control (<60%) of the Palmer amaranth population. Zidua and Balance provided the highest control (80%) of any single PRE herbicide applied at 28 DAT. Liberty, Engenia and Enlist Duo all provided similar levels of control following one POST application, however, no POST herbicide provided more than 65%. One application of Flexstar only provided 15% control 14 DAT. Sequential applications of Liberty, Engenia and Enlist Duo increased control >85% 14 DAT. The only POST rate response observed was with Enlist Duo, where 56oz/A provided only 73% control while 75oz/A increased control to 87%. When multiple herbicide modes of action were evaluated in combination PRE, an increase in overall control of PPO/multiple-resistant Palmer amaranth was achieved. The highest PRE control at 28 DAT was achieved with saflufenacil + dimethanamid + pyroxasulfone + metribuzin at 90%. Combinations of pyroxasulfone + metribuzin or metolachlor + metribuzin provided >85% control at 28 DAT. Postemergence programs utilizing only one application in any technology were not found to be successful in controlling PPO-resistant Palmer amaranth if a robust preemerge program was not used encompassing 2 effective modes of action. Liberty, Engenia and Enlist Duo were successful in controlling these multiple resistant Palmer amaranth populations if applied sequentially 14 days apart following an effective PRE program.
SMART MACHINES FOR WEED CONTROL. W. Patzoldt*1, E. Ehn2, M. Keely1, B. Chostner1; 1Blue River Technology, Sunnyvale, CA, 2Blue River Tech, Sunnyvale, CA (282)

ABSTRACT

Blue River Technology is bringing the next generation of smart machines to agriculture. With the use of artificial intelligence and machine learning, sprayers are being taught to recognize crops and weeds in real-time, thus allowing the application of herbicides to only weeds with a high degree of accuracy and precision. The See & Spray technology brings several advantages to agricultural producers: 1) reduction of chemical input costs since herbicides would only be used to treat weeds and not crops or soil, 2) allow cost effective herbicide mixtures containing multiple sites-of-action to combat herbicide resistance evolution, and 3) allow producers the flexibility to select from a wider array of crop varieties since selectivity and responses to herbicides would be conferred by the machine and not a genetic trait. Since See & Spray machines collect high resolution images from all parts of the field with every pass, it becomes possible to create weed maps that can be used by the producer to make informed decisions about herbicide performance. Prototype See & Spray machines were deployed in 2017 to manage weeds in cotton production. Research will continue in 2018 with expanded efforts to include both cotton and soybean weed management.
DEVELOPING ACCASE-INHIBITOR RESISTANT GRAIN SORGHUM. M. Bagavathiannan*, G. Hodnett2, W. Rooney2, J. Norsworthy3, S. Abugho2, B. Young2; 1Texas A&M AgriLife Research, College Station, TX, 2Texas A&M University, College Station, TX, 3University of Arkansas, Fayetteville, AR (283)

ABSTRACT

Grass weed control is a constant issue in grain sorghum production and there is a need for herbicide-tolerant technologies that allow for selective control of grasses in grain sorghum. In this research, resistance to the acetylcoenzyme A carboxylase (ACCase)-inhibitor herbicide fluazifop was transferred from a naturally occurring johnsongrass (*Sorghum halepense*) biotype to grain sorghum (*S. bicolor*). The *S. halepense* biotype showed considerable tolerance up to 32X the label rate (6 oz/A) of fusilade. Controlled crosses were made using male sterile version of the Tx3361iap grain sorghum line that greatly facilitated inter-specific hybridization. A tetraploid hybrid progeny that showed excellent tolerance to the herbicide was then backcrossed with an elite grain sorghum line (female). A triploid was recovered and subsequent backcrossing with diploid sorghum (male) produced a diploid progeny with tolerance to the herbicide. In greenhouse tests, the progeny survived 1X the field rate of the herbicide with growth patterns comparable to a non-treated check. The trait also appeared to be controlled by a single incompletely dominant gene. Field tests are currently underway to evaluate field tolerance of this trait under different herbicide rates and environmental conditions.
WEED SPECIES DIFFERENTIATION THROUGH HYPERSPECTRAL IMAGERY AND SPATIAL ANALYSIS FOR PRECISION AGRICULTURE. V. Singh*, J. Higby1, A. Fillipi1, M. Bishop1, N. Rajan1, M. Bagavathiannan2; 1Texas A&M University, College Station, TX, 2Texas A&M AgriLife Research, College Station, TX (284)

ABSTRACT

Field scouting for weeds serves as an important component of integrated weed management. Manual weed monitoring depends upon weather conditions and are subject to variability and human error. In this regard, UAS-based multispectral/hyperspectral imaging tools can be invaluable in diagnosing and assessing weed infestations and facilitating precision weed management. Field and greenhouse studies were carried out during 2016 and 2017 at College Station, TX to identify various weed species and determine their density in soybean, sorghum, corn and cotton fields. Hyperspectral imaging at 700 - 1150 nm wavelength could easily distinguish Palmer amaranth (*Amaranthus palmeri*), soybean, cotton and corn. However, differences between barnyardgrass (*Echinochloa crus-galli*), cotton and johnsongrass (*Sorghum halepense*) were more evident at the 1400 - 1750 nm range. Wavelet analysis was carried out on hyperspectral data and coefficients were calculated using Continuous Wavelet Transformation (CWT). The modulus maxima lines are extracted from the CWT coefficients at each scale, which highlight spectral features such as the green peak, red edge and near-infrared absorptions. These features have the potential to be used for diagnostic weed species classification.
TOLERANCE OF INZEN GRAIN SORGHUM TO MULTIPLE PREEMERGENCE AND POSTEMERGENCE APPLIED ALS-INHIBITING HERBICIDES. H.D. Bowman*1, L.T. Barber2, J.K. Norsworthy1, M.M. Houston3; 1Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, 2University of Arkansas Research and Extension Service, Lonoke, AR (285)

ABSTRACT

Rice and soybean are grown on a majority of Arkansas crop acres, leading to high risk for carryover of some herbicides to those producers wanting to rotate to grain sorghum. Many of the residual herbicides used in rice and soybean rely on acetolactate synthase (ALS)-inhibiting herbicides that limit rotation to grain sorghum. Typically, acetolactate synthase (ALS)-inhibiting herbicides will have a 12-18 month plant-back restriction to grain sorghum, meaning that is often not an option for rotation following these crops. Another common issue is grain sorghum’s susceptibility to off-target movement of these herbicides. Dow DuPont has announced the development of a new trait called Inzen. Inzen grain sorghum has a double mutation in the ALS gene, Val560Ile and Trp574Leu, which results in cross resistance to the ALS site of action. With this new trait field research is needed to verify the spectrum of this cross resistance when ALS-inhibiting herbicides are applied preemergence (PRE) to determine carryover potential or postemergence (POST) to evaluate susceptibility to off-target movement. Currently, the only ALS-inhibiting herbicide to be registered in Inzen™ grain sorghum is nicosulfuron. For these reasons, tests were conducted in 2016 and 2017 at the Lon Mann Cotton Research Station near Marianna, AR, the Arkansas Agricultural Research & Extension Center in Fayetteville, AR, and in 2016 at the Pine Tree Research Station near Colt, AR. Treatments were made either PRE or POST to grain sorghum at a 1X rate for other labeled crop uses. The PRE trial was set up as a split plot with herbicide (22 ALS inhibitors) as the main plot and cultivars (Inzen™ vs conventional) as the subplot factors. There was no visible injury, height reduction, or yield reduction to Inzen™ grain sorghum in the PRE trial, whereas almost all ALS-inhibiting herbicides, except halosulfuron did cause damage to conventional grain sorghum. The POST trial was set up as a randomized complete block with one factor, ALS-inhibiting herbicide applied. Generally, no visible injury, height reduction, or yield reduction occurred, except with bispyribac-sodium. These results demonstrate cross-resistance of Inzen™ to most ALS-inhibiting herbicides could offer promising new alternatives for weed control in grain sorghum.
EFFICACY OF A RINSKOR™ ACTIVE + CYHALOFOP PREMIX IN THE U.S. MID-SOUTH RICE. H. Perry*1, J. Ellis2, B. Haygood3, M. Lovelace4, M. Morell5, L. Walton6; 1Dow AgroSciences, Leland, MS, 2Dow AgroSciences, Sterlington, LA, 3Dow AgroSciences, Collierville, TN, 4Dow AgroSciences, Lubbock, TX, 5Dow AgroSciences, Indianapolis, IN, 6Dow AgroSciences, Tupelo, MS (286)

ABSTRACT

Rinskor™ active is a new herbicide by Dow AgroSciences for broad-spectrum weed control in a variety of crops. Rinskor belongs to the new ary]picolinate synthetic auxin class of herbicides that is characterized by low use rates and extremely low volatility. Loyant™ herbicide with Rinskor active is registered in the U.S. for control of key weeds in Mid-South rice including, but not limited to, barnyardgrass (Echinochloa crus-galli), broadleaf signalgrass (Urochloa platyphylla), rice flatsedge (Cyperus iria), yellow nutsedge (C. esculentus), Palmer amaranth (Amaranthus palmeri), and hemp sesbania (Sesbania herbacea). Cyhalofop-butyl is a graminicide commonly used in rice production for controlling Echinochloa spp. and Leptochloa spp., among other grass species. Dow AgroSciences is currently characterizing an experimental pre-mixture (GF-3479) containing Rinskor active and cyhalofop-butyl for use in U.S. rice. GF-3479 is formulated as an EC with 160 and 12 g ai L⁻¹ of cyhalofop-butyl and Rinskor, respectively.

In the summer of 2017, seven studies were conducted across 4 states evaluating efficacy and tolerance of GF-3479. Treatments included 6 herbicide treatments (Loyant applied at 30 g ai ha⁻¹, Clincher SF® (cyhalofop-butyl) applied at 313 g ai ha⁻¹, Loyant at 30 g ai ha⁻¹ + Clincher SF at 313 g ai ha⁻¹, Loyant at 25 g ai ha⁻¹ + Clincher SF at 333 g ai ha⁻¹, GF-3479 (Rinskor + cyhalofop-butyl, applied at 358 g ai ha⁻¹ and RebelEX (214 and 30 g ai L⁻¹ of cyhalofop-butyl and penoxsulam, respectively) applied at 357 g ai ha⁻¹) by 2 application timings (3-5 days preflood and 7-10 days postflood) and an untreated check. Treatments were applied utilizing standard small-plot methods and equipment at each location. Each study was arranged in a randomized complete block design with 4 replications. Since treatments were applied either mid- or late-postemergence, trials received a pre-emergence broadcast application of clomazone with rate based on soil type to reduce initial weed pressure. Weed spectrum and rice variety differed among locations.

Barnyardgrass (BYG) control was similar across four locations. Loyant alone and Loyant + Clincher at the high rate 3-5 days preflood provided 95% BYG control 4-5 weeks after application (WAA). All other preflood treatments provided 89 to 91% BYG control 4-5 WAA. All postflood treatments provided 85 to 89% BYG control 4-5 WAA. Rinskor-containing preflood treatments controlled all broadleaves (Aeschynomene spp., Amaranthus palmeri, Commelina diffusa, Ipomoea lacunosa andSesbania herbacea) > 98% 4-5 WAA. All Rinskor-containing postflood treatments provided 93 to 96% control 4-5 WAA. At 2 locations, all treatments containing 30 g ai ha⁻¹ Rinskor, provided 100% rice flatsedge control, while all treatments containing 25 g ai ha⁻¹ Rinskor controlled rice flatsedge 95-96%. Rice exhibited excellent tolerance to all treatments. All treatments caused <1% rice injury 2 and 4 to 5 WAA.
Rinskor at 25 to 30 g ai/ha in combinations with cyhalofop-butyl provided excellent broad-spectrum weed control in preflood and postflood application timings. The cyhalofop-butyl component of GF-3479 is intended to broaden the grass spectrum control and increase the speed of control on key grasses, while maintaining the excellent broadleaf and sedge control. The majority of the grass weeds present in this study were controlled by Rinskor alone, therefore, the full grass control capability of GF-3479 was not realized. Further GF-3479 characterization studies are warranted to demonstrate the robustness of this new herbicide premixture.

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A NEW BRAKE HERBICIDE FOR WEED CONTROL IN COTTON. K. Briscoe*; SePRO Corporation, Whitakers, NC (287)

ABSTRACT

In 2017, Brake Herbicide was federally registered for preplant and preemergence applications in U.S. cotton. Brake contains the active ingredient fluridone which inhibits the phytoene desaturase (PDS) enzyme involved in carotenoid biosynthesis. Currently, there are no other PDS inhibiting herbicides used in U.S. cotton. Thus, the use of Brake may reduce selection pressure caused by repeated use of the same herbicide families. Experiments were conducted in 2016 and 2017 to evaluate efficacy and selectivity of Brake and Brake tank-mixes with other residual herbicides. Treatments containing Brake did not cause significant cotton phytotoxicity. Further, control of annual grass and small seeded broadleaf weeds including Palmer amaranth (Amaranthus palmeri) was similar or greater than other residual herbicides used in cotton. These results suggest Brake provides a new and effective mode of action for preemergence weed control in cotton.
APPLICATION TIMING DECISION TOOLS AND ADVANCED SPRAY SYSTEM TECHNOLOGY. Y.E. Wright*; John Deere Company, Olathe, KS (288)

ABSTRACT

Tools to make application timing decisions based off of crop and weed growth stages and environmental conditions are important for maximizing herbicide product efficacy and managing risk of crop damage. Application technology that can be productive during low risk application windows and can mitigate off target drift should be considered and recommended throughout the industry. John Deere is a provider of field and crop decision tools as well as application equipment technology. Products such as John Deere Field Connect™, John Deere Mobile Weather and AgLogic™ are examples of tools available to make spray timing and location decisions. Spray system technology such as John Deere ExactApply™ nozzle control, wide-angle Ultra Low-drift (ULD) nozzles, broad (36 and 40 meter) sprayer booms, automatic boom height control, direct injection (DI) and Load Command™ are technologies available to spray during optimal, low risk time periods and reduce the amount of in-field and out of field crop damage. A comprehensive review of available decision and application technologies is needed for weed science professionals as they carry out research and extension work to balance new weed control technologies with unintended crop damage.
EFFECTS OF SIMULATED DICAMBA AND 2,4-D TANK CONTAMINATION
ON ROUNDUP READY 2 AND XTEND SOYBEAN INJURY AND YIELD. N.E. Korres*1,
J. Norsworthy2, L.M. Lazaro3; 1University of Arkansas, Fayetteville, AR, 2University of
Arkansas, Fayetteville, AR, 3Louisiana State University AgCenter, Baton Rouge, LA (289)

ABSTRACT

Soybean cultivars that have herbicide resistance to glyphosate (Roundup Ready 2); glyphosate
and dicamba (Xtend); or glyphosate, 2,4-D, and glufosinate (Enlist) are available for growers in
the Midsouth. Concerns for off-target movement of the auxinic herbicides such as dicamba and
2,4-D exist among some growers in this region. To investigate the sensitivity of soybean
herbicide technologies to dicamba and 2,4-D tank contamination in soybean, two field
experiments were conducted during 2016 and 2017 at Fayetteville, AR. Two soybean varieties
Roundup Ready 2 (AG 4730) and Roundup Ready 2 Xtend (AG 46X6) were sprayed at V2 and
R1 growth stages with Roundup PowerMax at 28.4 fl oz/A mixed with Clarity (dicamba) and/or
Weedar 64 (2,4-D) at various rates (i.e. 1.6 to 0.0016 fl oz/A and 16.8 to 0.0168 fl oz/A,
respectively). A single Roundup application at the recommended rate was also used as a control.
Visual estimates of soybean height reduction, soybean injury, and soybean growth stage were
recorded at two and four weeks after each application and continued until crop maturity. In
addition, final plant height, yield adjusted to 13% moisture, and yield components were
determined. Roundup Ready soybean treated with dicamba at V2 growth stage exhibited slight
damage two to four weeks after application at lower rates (0.016 and 0.0016 fl oz/A) compared
to more severe damage at 1.6 or 0.16 oz/A. Plants exposed to dicamba at R1 were heavily injured
(>70%) causing substantial yield reductions up to 90% at the tenth of the recommended dose
compared to 36% when the crop was exposed to dicamba at V2 stage.
GRaminicide Efficacy for Aquatic Invasive Grasses. S. Enloe*; University of Florida, Gainesville, FL (290)

Abstract

Aquatic invasive grasses are an increasing problem throughout Florida and many areas of the United States. Aquatic and natural area managers frequently struggle to achieve long-term control of problem species such as torpedo grass (Panicum repens), common reed (Phragmites australis), and para grass (Urochloa mutica). Additionally, emerging species such as West Indian marsh grass (Hymenachne amplexicaulis) and Tropical American watergrass (Luziola subintegra) are poised to become extensive problems if aggressive measures are not taken. One of the fundamental issues in aquatic grass management is a lack of selective control options. Glyphosate and imazapyr are the two principle tools used in Florida and much of the United States and can often provide twelve to thirty-six months of species specific control. However, non-target damage can be severe with both herbicides, which greatly hinders restoration efforts. In 2015 the State of Florida received experimental use permits for sethoxydim to treat emergent, invasive grasses in aquatic systems. Grass-specific herbicides provide excellent selectivity and could greatly assist aquatic managers in grass control programs. However, efficacy data is almost completely lacking in aquatic systems. This talk will focus on current research examining the biological and ecological aspects of torpedo grass control with sethoxydim.
THE INFLUENCE OF PUMP SHEARING ON THE DROPLET SPECTRUM OF SPRAY MIXTURES CONTAINING DICAMBA, GLYPHOSATE AND VARIOUS DRIFT REDUCTION AGENTS. R. Edwards*1, R. Pigati2, D. Bissell1, L. Magidow1, J.V. Gednalske1, E. Spandl1, G. Dahl3; 1WinField United, River Falls, WI, 2WinField United, Shoreview, MN, 3WinField Product Development Ctr., River Falls, WI (291)

ABSTRACT

Recent emphasis has been placed on drift reducing adjuvants (DRA) in use with dicamba herbicides for POST applications. We explored a novel method to determine the performance of polymer based DRA after repeated exposures to a pumping system. A parent solution of water with glyphosate and dicamba in addition to either two different polyacrylamide DRA or a polysaccharide DRA were evaluated. Samples were collected after 0, 10, 25 and 50 passes through a closed-loop pumping system. The samples were then sprayed and measured within a patented proprietary wind tunnel to evaluate the volume fraction of driftable droplets (≤ 150 μm). Initially, all adjuvant products demonstrated a reduction in the driftable volume fraction over the control. However, the two polyacrylamide products showed no difference in driftable content compared to the control at the conclusion of the test. The polysaccharide adjuvant still demonstrated a reduction in driftable droplets over the control at the conclusion. This approach was determined to be an effective method to identify possible deterioration of polymer based drift reduction adjuvants due to pump induced shear.
ACCUDROP™ - A NEW DRIFT CONTROL AND DEPOSITION ADJUVANT. L.A. Ruchotzke*1, G. Dahl2, R. Edwards3, J. Gillilan4, R. Pigati5, E. Spandl3, J.V. Gednalske3, R. Hayes6, T.A. Hayden7; 1WinField United, Hendersonville, TN, 2WinField Product Development Ctr., River Falls, WI, 3WinField United, River Falls, WI, 4Winfield Solutions LLC, Springfield, TN, 5WinField United, Shoreview, MN, 6West TN Expt Station, Jackson, TN, 7Winfield United, Owensboro, KY (293)

ABSTRACT

AccuDrop™ is a non-oil, surfactant based drift and deposition adjuvant formulated without nonylphenol ethoxylates from Winfield® United. AccuDrop™ is designed to maximize pesticide performance by improving spray deposition onto the intended target. Also, being surfactant based, AccuDrop™ can be used with many herbicides, fungicides or insecticides with minimal expected crop injury. The use rate of AccuDrop™ is 0.223 l ha⁻¹.

As part of the testing program, Winfield® United conducted 126 field efficacy trials as well as screening though the Winfield®United Spray Analysis System, a patented recirculating low speed wind tunnel. In numerous field trials, herbicide plus AccuDrop™ performance versus the herbicide alone showed significantly increased weed control. Field drift studies also showed significant drift reductions; 3.02 m with the addition of AccuDrop™ compared to 6.83 m with no drift control added. Wind tunnel testing was utilized to evaluate spray particle size with various pesticides and nozzle tips. AccuDrop™ added to glyphosate and sprayed through XR11003 nozzles reduced the percent of spray particle droplet fines from 16% to 6%. Likewise, with a AIXR 11004 nozzle, percent fines were reduced from 16% to 4% vs glyphosate alone.
## Survey of Herbicide-Resistant Weeds in the South

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<th>State</th>
<th>Year</th>
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### Survey of Herbicide-Resistant Weeds

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# Annual Meeting Attendees

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<tr>
<th>Name</th>
<th>Company/Institution</th>
<th>Address</th>
<th>Email</th>
</tr>
</thead>
<tbody>
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<td>Todd Baughman</td>
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<td>Matthew Bertiucci</td>
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<tr>
<td>David Black</td>
<td>Syngenta Crop Protection</td>
<td>272 Jaybird Ln Searcy 72143-6635 <a href="mailto:david.black@syngenta.com">david.black@syngenta.com</a></td>
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<tr>
<td>Amy Agi</td>
<td>DuPont</td>
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<td>Texas A&amp;M University</td>
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<tr>
<td>Brian Aynardi</td>
<td>PBI-Gordon Corp</td>
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<tr>
<td>Rhett Baker</td>
<td>Ohoopee Match Club</td>
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<td>NCSU IR-4 Field Research Center</td>
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<td>Bayer Crop Protection</td>
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<td>Ashli Brown</td>
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<td>Frances Browne</td>
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<tr>
<td>Bob Bruss</td>
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</tr>
<tr>
<td>Name</td>
<td>Affiliation</td>
<td>Address</td>
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