Proceedings of the Southern Weed Science Society 73rd Annual Meeting

The Beau Rivage Resort and Casino
Biloxi, MS

January 27-30, 2020

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

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

ABSTRACT

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Outstanding Young Weed Scientist - Industry
Kelly Backscheider

Kelly grew up on a corn and soybean farm in southern Indiana where she spent a lot of time chopping weeds. She did not intend on pursuing a career in agriculture and instead went on to attend Saint Mary's College in Notre Dame, Indiana to pursue a BS in Biology. After an internship with Dow AgroSciences, Kelly found her passion in weed science and decided to pursue a MS in Crop and Soil Sciences (Weed Science) at Michigan State University with Dr. Christy Sprague. In 2010, she moved to west Tennessee to complete her PhD in Plant Sciences (Weed Science) under the direction of Dr. Larry Steckel. Kelly has been very involved with the SWSS since she started her PhD almost 10 years ago. She's presented at several meetings and competed in the SWSS Weed Contest and won 1st place individual in 2012. She also competed in both the SWSS graduate student paper and poster contest and won 1st place Oral Paper in 2011, 1st place Poster in 2012, and the SWSS Outstanding Graduate 8 Student Award in 2013. She was also the SWSS Graduate Student Representative in 2012. Since then, Kelly has continued to stay involved in the SWSS and has moderated, judged the graduate student paper and poster contests, and been an active member of the Sustaining membership committee and the Graduate student contest committee (chair – 2020). In 2019, she also started the first SWSS women's event where female graduate students, professors, and industry colleagues gathered to network at the annual meeting. After completing her PhD 6 in 2012, Kelly took a position as a field development representative with DuPont Crop Protection covering Indiana and Kentucky. She was heavily involved with several discovery and development projects in corn, soybean, wheat, and tobacco. In this role, she not only conducted several trials each year, but also spent time in commercial support for her sales teams and Pioneer agronomists. In December 2018, she transferred to the Data Management & Information Management Strategy Team with Corteva AgriSciences, the Agricultural Division of DowDuPont where she conducts several tasks for Integrated Field Sciences. This includes assisting with IFS data management tools and being a lead for North America IFS related to data manage as well as managing data management contractors. Kelly resides in southern Indiana on the farm that she grew up on with her husband (Mark) and son (Rhett). She enjoys "hobby farming" with her family, hunting, working out, and teaching fitness classes at a local church.

Previous Winners of the Outstanding Young Weed Scientist Award

Year	Name	University / Company
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1982	Lawrence R. Oliver	University of Arkansas
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2003	Scott A. Senseman	Texas A & M University
2004	David L. Jordan	North Carolina State University
2004	James C. Holloway	Syngenta
2005	Eric Prostko	University of Georgia
2005	no nomination	--
2006	Todd A. Baughman	Texas A & M University
2006	John V. Altom	Valent USA Corporation
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2007	no nomination	--
2008	Stanley Culpepper	University of Georgia
2008	no nomination	--
2009	Jason K. Norsworthy	University of Arkansas
2009	no nomination	--
2010	Bob Scott	University of Arkansas
2010	no nomination	--
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2012	Jason Bond	Mississippi State University
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2013	Greg Armel	BASF Company
2013	Shawn Askew	Virginia Tech
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2014	Vinod Shivrain	Syngenta
2015	Jim Brosnan	University of Tennessee
2015	no nomination	--
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2016	Drew Ellis	Dow AgroSciences
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Outstanding Educator Award
Stephen Enloe

Stephen Enloe is an Associate Professor in the Agronomy Department at the University of Florida. A native of Franklin, North Carolina, he was raised on a small mountain farm that produced vegetables, dairy products and meat. While growing up, one of his primary tasks was hand-weeding acres of vegetable gardens and this served to spark his interest in agriculture and weed science. He received his BS in Agronomy in 1994 from N.C. State University and his MS in Bioagricultural Sciences and Pest Management from Colorado State University in 1997 under the direction of Drs. Phil Westra and Scott Nissen. His PhD in Plant Biology from the University of California Davis in 2002 was under the direction of Dr. Joseph DiTomaso. He served as a Post-Doctoral Associate with USDA-ARS in Davis, CA for one year before beginning his professional career at the University of Wyoming as an Extension Weed Specialist in 2003. Dr. Enloe moved to Auburn University in 2008, where he spent 7 years as an Invasive Plant Extension Specialist before taking his current position at the Center for Aquatic and Invasive Plants at the University of Florida in 2015. Over his career, Dr. Enloe's research and extension responsibilities have centered around the biology, ecology, and management of invasive plants in pasture and non-crop systems. He was worked across numerous ecosystems, including cold desert rangelands, high plains grasslands, southeastern forests, warm season pastures, and lakes, rivers, and wetlands. He has developed a wide diversity of extension programs and materials tailored to public and private land management from the local to the national level. He is very grateful to his wife (Heather) and children (Samuel, Ava, and Gabriel) for their love and support. He is also very grateful to his father (Robert), who was a wonderful public speaker and sewed into him a desire to help others. When he has time, he enjoys gardening, being outdoors, and competing in disc golf.

Previous Winners of the Outstanding Educator Award

Year	Name	University
1998	David R. Shaw	Mississippi State University
1999	Ronald E. Talbert	University of Arkansas
2000	Lawrence R. Oliver	University of Arkansas
2001	James L. Griffin	Louisiana State University
2002	Thomas F. Peeper	Oklahoma State University
2003	Daniel B. Reynolds	Mississippi State University
2004	William Vencill	University of Georgia
2005	John W. Wilcut	North Carolina State
2006	Don S. Murray	Oklahoma State University
2007	Thomas C. Mueller	University of Tennessee
2008	James M. Chandler	Texas A&M University
2009	William W. Witt	University of Kentucky
2010	Peter Dotray	Texas Tech. University
2011	Eric Prostko	University of Georgia
2012	Gregory Mac Donald	University of Florida
2013	Tim Grey	University of Georgia
2014	Scott Senseman	University of Tennessee
2015	Nilda Roma-Burgos	University of Arkansas
2016	Katie Jennings	North Carolina State
2017	Jason Norsworthy	Univesity of Arkansas
2018	Stanley Culpepper	University of Georgia
2019	Larry Steckel	University of Tennessee

Outstanding Graduate Student Award (MS)
Lawson Priess

Lawson grew up west of Dallas, TX, and was raised by his father and mother, Grant and Dina Priess. Lawson spent multiple summers working in the Panhandle of Texas as Crop Scout, Independent Research Assistant, and interned for DuPont Crop Protection under Dickie Edmund. He graduated from Stephen F. Austin University in 2016 with a B.S. in Agronomy. Lawson completed his M.S. in Weed Science from the University of Arkansas in 2019 and is currently working on his Ph.D. under the advisement of Dr. Jason Norsworthy. His thesis research evaluated the impact of herbicides on soil-borne diseases and soybean canopy formation. During his time at the University of Arkansas, Lawson successfully presented his research, winning multiple awards at the Beltwide Cotton Conference and Arkansas Crop Protection Association. Lawson has also competed in the Southern Weed Contest, winning fifth-place overall individual in 2017 and 2018. In 2019, he was the highest individual in the Weed Identification portion of the contest. During his time as an M.S. student, Lawson has served as Vice President of the SWSS graduate student organization and is currently serving as President this term. Lawson has been recognized for his academic and extracurricular achievements with awards such as the 2019 Department of Crop, Soil, and Environmental Sciences Outstanding M.S. Student Award, the Ron and Alice Talbert Distinguished Weed Science Scholarship, University of Arkansas Doctoral Academy Fellowship, and the Arkansas Soybean Promotional Board Fellowship. Lawson has made advances to science outside of his M.S. research where he is co-inventor on a recent provisional patent. Lawson's current Ph.D. project is focused on optimization of dicamba in XtendFlex® systems.

Previous Winners of the Outstanding Graduate Student Award (MS)

Year	Name	University
1998	Shawn Askew	Mississippi State University
1999	Patrick A Clay	Louisiana State University
2000	Wendy A. Pline	University of Kentucky
2001	George H. Scott	North Carolina State University
2002	Scott B. Clewis	North Carolina State University
2003	Shawn C. Troxler	North Carolina State University
2004	Walter E. Thomas	North Carolina State University
2005	Whitney Barker	North Carolina State University
2006	Christopher L. Main	University of Florida
2007	no nomination	--
2008	no nomination	--
2009	Ryan Pekarek	North Carolina State University
2010	Robin Bond	Mississippi State University
2011	George S. (Trey) Cutts, III	University of Georgia
2012	Josh Wilson	University of Arkansas
2013	Bob Cross	Clemson University
2014	Brent Johnson	University of Arkansas
2015	Garret Montgomery	University of Tennessee
2016	Chris Meyer	University of Arkansas
2017	John Buol	Mississippi State University
2018	Zachary Lancaster	University of Arkansas
2019	Swati Shrestha	Mississippi State University

Outstanding Graduate Student Award (PhD)

John Brewer

John is a native of Pulaski, Tennessee, where he grew up on a small cattle farm. He was introduced to agriculture through is father and grandfather who instilled in him a love and respect for plant and animal production and environmental preservation. John received his B.S. degree in Agriculture with a concentration in golf course and landscape management from the University of Tennessee at Martin where he graduated Summa Cum Laude. At this time, he found his passion in turfgrass and weed science as he competed at multiple GCSAA Turfbowl competitions and his first SWSS summer weed contest as an undergraduate. During the contest, he met his present graduate advisor Dr. Shawn Askew from Virginia Tech. He then moved to Blacksburg to pursue his Ph.D. degree in Turfgrass Weed Science at Virginia Tech in which he focused on optimizing topramezone and other herbicide programs for weed control in 7 bermudagrass and creeping bentgrass turf. John's dissertation research is only a small part of his graduate responsibilities at Virginia Tech. He has conducted over 200 field and greenhouse studies that encompass weed science research in turfgrass, industrial vegetation management/roadside management, and invasive weed management. He also is involved in confirming and characterizing herbicide resistance in turfgrass systems in Virginia.

During his time at Virginia Tech, John has authored or co-authored 2 peer-reviewed papers, 2 magazine articles, and 44 abstracts from scientific presentations, and he has also given 47 extension presentations and guest lectures. John has been actively involved in the SWSS, NEWSS, and WSSA. He has served as the president, vice president, and secretary for the SWSS GSO, as graduate representative on the NEWSS executive council, and also leadership roles for both departmental and university level organizations. He is presently serving as the turfgrass section chair at the SWSS annual meeting. He has received the SWSS Endowment Fellowship, PPWS departmental Webber graduate student award, VSGA Turfgrass Research Scholarship, Louis and Ginger Brooking Sod Research Scholarship, and Chester L and Betty Foy Scholarship. John has actively competed in different regional student paper and poster presentations where he has won 4 poster presentation awards at scientific meetings and 3 awards at the MidAtlantic Turfgrass Expo student presentation competition. He has also competed in multiple national and regional summer weed contest. John competed in the 2019 North American Weed Science Contest where his team won 1st place overall and he was the highest scoring individual in weed ID, and he was also the 2nd place overall scoring individual at the 2015 National weed contest. In 2017, John was the highest scoring individual and team member of the 1st place team at the SWSS summer weed contest in Vero Beach, FL. He was also a member of two 2nd place teams where he was awarded 4th and 8th place overall individual. John was the highest scoring individual and 1st place team member at the NEWSS weed contest for three separate competitions as well. He also helped coach a 2nd place team at the SWSS contest and a 1st and 3rd place team at the NEWSS contest. John plans to continue his involvement in the SWSS after he graduates especially the student contest and events since he understands the importance and influence, they can have on future students and their careers.

Previous Winners of the Outstanding Graduate Student Award (PhD)

Year	Name	University
1998	Nilda Roma Burgos	University of Arkansas
1999	A. Stanley Culpepper	North Carolina State University
2000	Jason K. Norsworthy	University of Arkansas
2001	Matthew J. Fagerness	North Carolina State University
2002	William A. Bailey	North Carolina State University
2003	Shea W. Murdock	Oklahoma State University
2004	Eric Scherder	University of Arkansas
2005	Ian Burke	North Carolina State University
2006	Marcos J. Oliveria	Clemson University
2007	Wesley Everman	North Carolina State University
2008	Darrin Dodds	Mississippi State University
2009	Sarah Lancaster	Texas A&M University
2010	Tom Eubank	Mississippi State University
2011	Sanjeev Bangarwa	University of Arkansas
2012	Edinalvo (Edge) Camargo	Texas A&M University
2013	Kelly Barnett	University of Tennessee
2014	James McCurdy	Auburn University
2015	Sushila Chaudhari	North Carolina State University
2016	Reiofeli Algodon Salas	University of Arkansas
2017	Misha Manuchehri	Texas Tech University
2018	Sandeep Rana	Virginia Tech
2019	Nicholas Basinger	North Carolina State University

Fellow Award

Greg MacDonald

Greg MacDonald was raised in the Finger Lakes region of upstate New York where he spent his time working on dairy and row crop farms. He received an Associate of Applied Science in agricultural engineering from Alfred State University and a Bachelor's of Science from Cornell University in vegetable crop production in 1986. He received his Master of Science in Agronomy/Weed Science at the University of Florida in 1991 and PhD from the same institution in 1994. From 1994 to 1998 he was employed as a weed extension specialist for The University of Georgia, based in Tifton, GA. In December 1998 he returned to Gainesville as a faculty member in Agronomy at the University of Florida. He is a professor of Weed Science and teaches undergraduate and graduate weed science and crop production courses, including on-line, distance education courses. His research focus is weed physiology and the interactions of herbicides with plants in terrestrial and aquatic ecosystems and research on perennial invasive grass management. In addition, he conducts international research and development through USAID in Haiti, Endowment Foundation Trustee. Greg and his wife Mickey have two boys, George and Joey. He enjoys spending time with his family, camping, traveling, home projects and is a volunteer Boy Scout leader.

Fellow Award
Cletus Youmans

Clete grew up in southern Alabama and Georgia where most of his relatives allowed him to work in tobacco and veterinary medicine as a youngster and teenager, before attending college at Auburn University as an Agronomy major, and later receiving his PhD in Weed Science at the University of Arkansas in 1985 under Dr. L.R. Oliver.

He has a great interest in the SWSS family and has been affiliated with the SWSS over 40-years, attending his first SWSS meeting in 1979. In 1980 he competed in the first SWSS Weed Contest in Albany, GA where his team from Auburn Univ. won first place, followed the next year with a 2nd place showing. Clete moved to Arkansas and participated on the UAR weed team, which received a 3rd place finish in 1982. Clete was assistant coach with Arkansas in 1983 and 1984 when Arkansas won its first two SWSS Weed contests. Over the years, Clete has been on the SWSS board as an Industry rep, a site chairperson, an SWSS local arrangements food coordinator, the calibration coordinator at the SWSS weed contest five times, assisted in several other SWSS weed contests, judged over a hundred student papers and posters, was an agronomic section chairperson, a moderator at annual SWSS meetings many times, and personally presented over twenty papers or posters at the SWSS. Clete is currently the SWSS Vice President.

In college, in 1984 he won first place for the graduate level presentation at the Arkansas Crop Protection Assoc. The same year, he was voted by his peers as the recipient of the first "Top PhD graduate student in the Dept. of Plant and Soil Science at the Univ. of Arkansas". 9 In 1985 he began work as a field researcher for American Cyanamid Co. in Little Rock, AR, and transferred to Tifton, GA, where his territory included AL, GA and SC. In 1987 he transferred to Princeton, NJ where he worked at a national level managing Assert herbicide when it received registration in 1989. In 1989 he was the AMCY herbicide resistance manager, attended the International Weed resistance meeting in Bristol, England as a representative for the imidazolinone chemistry, and was instrumental in developing the HRAC. In 1990 Clete transferred to Dyersburg, TN as the Agriculturalist covering TN, AL, and the MO bootheel and worked developing imi-resistant corn and imazapic for peanuts. In the late 90's he was working on saflufenacil before transferring back to Georgia for a year. In 2000 he returned to Tennessee as the BASF Southern Regional Research manager. Since 2000, Clete has resided in Tennessee where he has developed the BASF TN Research Farm. Clete conducted over 1260 personal internal weed science trials during his career and contributed directly to over 825 external weed science studies.

Outside of Weed Science, Clete has twice been the president of the Tennessee Entomological Soc., and once the President of the TN Agric. Production Assn. Clete has supported the local community efforts by being the high school Quarterback Club President, assistant high school soccer coach, and working with the local FFA. Clete is a former marathoner, scuba diver, sky diver, assistant Scout Master, and attended Philmont and Seabase. Today, other than rating plots, he enjoys kayaking, fishing and travel. Clete is an active member of his church, a deacon, member of the church financial and physical plant committees, and helps on Wed. nights at the Logos training.

Clete's wife of thirty-one years is Deidra Youmans from Stockton, GA. His son Kyle, is a graduate of the Univ. of TN and currently lives in Colorado Springs, CO. His daughter Claire is a senior in high school, loves hip hop and jazz dancing, soccer, tennis, and plans on attending the Univ. of AR this fall.

Previous Winners of the Distinguished Service Award

(Renamed Fellow Award in 2015)

Year	Name	University/Company
1976	Don E. Davis	Auburn University
1976	V. Shorty Searcy	Ciba-Geigy
1977	Allen F. Wiese	Texas Agric. Expt. Station
1977	Russel F. Richards	Ciba-Geigy
1978	Robert E. Frans	University of Arkansas
1978	George H. Sistrunck	Valley Chemical Company
1979	Ellis W. Hauser	USDA, ARS Georgia
1979	John E. Gallagher	Union Carbide
1980	Gale A. Buchanan	Auburn University
1980	W. G. Westmoreland	Ciba-Geigy
1981	Paul W. Santelmann	Oklahoma State University
1981	Turney Hernandez	E.I. DuPont
1982	Morris G. Merkle	Texas A & M University
1982	Cleston G. Parris	Tennessee Farmers COOP
1983	A Doug Worsham	North Carolina State University
1983	Charles E. Moore	Elanco
1984	John B. Baker	Louisiana State University
1984	Homer LeBaron	Ciba-Geigy
1985	James F. Miller	University of Georgia
1985	Arlyn W. Evans	E.I. DuPont
1986	Chester G. McWhorter	USDA, ARS Stoneville
1986	Bryan Truelove	Auburn University
1987	W. Sheron McIntire	Uniroyal Chemical Company
1987	no nomination	--
1988	Howard A.L. Greer	Oklahoma State University
1988	Raymond B. Cooper	Elanco
1989	Gene D. Wills	Mississippi State University
1989	Claude W. Derting	Monsanto
1990	Ronald E. Talbert	University of Arkansas
1990	Thomas R. Dill	Ciba-Geigy
1991	Jerome B. Weber	North Carolina State University
1991	Larry B. Gillham	E.I. DuPont
1992	R. Larry Rogers	Louisiana State University
1992	Henry A. Collins	Ciba-Geigy
1993	C. Dennis Elmore	USDA, ARS Stoneville
1993	James R. Bone	Griffin Corporation
1994	Lawrence R. Oliver	University of Arkansas
1994	no nomination	--
1995	James M. Chandler	Texas A & M University
1995	James L. Barrentine	DowElanco
1996	Roy J. Smith, Jr.	USDA, ARS Stuttgart
1996	David J. Prochaska	R & D Sprayers

1997	Harold D. Coble	North Carolina State University
1997	Aithel McMahon	McMahon Bioconsulting, Inc.
1998	Stephen O. Duke	USDA, ARS Stoneville
1998	Phillip A. Banks	Marathon-Agri/Consulting
1999	Thomas J. Monaco	North Carolina State University
1999	Laura L. Whatley	American Cyanamid Company
2000	William W. Witt	University of Kentucky
2000	Tom N. Hunt	American Cyanamid Company
2001	Robert M. Hayes	University of Tennessee
2001	Randall L. Ratliff	Syngenta Crop Protection
2002	Alan C. York	North Carolina State University
2002	Bobby Watkins	BASF Corporation
2003	James L. Griffin	Louisiana State University
2003	Susan K. Rick	E.I. DuPont
2004	Don S. Murray	Oklahoma State University
2004	Michael S. DeFelice	Pioneer Hi-Bred
2005	Joe E. Street	Mississippi State University
2005	Harold Ray Smith	Biological Research Service
2006	Charles T. Bryson	USDA, ARS, Stoneville
2006	no nomination	--
2007	Barry J. Brecke	University of Florida
2007	David Black	Syngenta Crop Protection
2008	Thomas C. Mueller	University of Tennessee
2008	Gregory Stapleton	BASF Corporation
2009	Tim R. Murphy	University of Georgia
2009	Bradford W. Minton	Syngenta Crop Protection
2010	no nomination	--
2010	Jacquelyn "Jackie" Driver	Syngenta Crop Protection
2011	no nomination	--
2011	no nomination	--
2012	Robert Nichols	Cotton Incorporated
2012	David Shaw	Mississippi State University
2013	Renee Keese	BASF Company
2013	Donn Shilling	University of Georgia
2014	Tom Holt	BASF Company
2014	Dan Reynolds	Mississippi State Univ.
2015	Bobby Walls	FMC Corporation
2015	John Harden	BASF Corporation
2016	No award	--
2017	James Holloway	Syngenta Crop Protection
2018	Scott Senseman	University of Tennessee
2018	Jerry Wells	Syngenta Crop Protection
2019	John Byrd	Mississippi State University

Previous Winners of the Weed Scientist of the Year Award
(Renamed Fellow Award in 2015)

Year	Name	University
1984	Chester L. Foy	VPI & SU
1985	Jerome B. Weber	North Carolina State University
1986	no nominations	--
1987	Robert E. Frans	University of Arkansas
1988	Donald E. Moreland	USDA, ARS, North Carolina
1989	Roy J. Smith, Jr.	USDA, ARS, North Arkansas
1990	Chester McWhorter	USDA, ARS, Mississippi
1991	Ronald E. Talbert	University of Arkansas
1992	Thomas J. Monaco	North Carolina State University
1993	A. Douglas Worsham	North Carolina State University
1994	Stephen O. Duke	USDA, ARS, Mississippi
1995	Lawrence R. Oliver	University of Arkansas
1996	William L. Barrentine	Mississippi State University
1997	Kriton K. Hatzios	VPI & SU
1998	G. Euel Coats	Mississippi State University
1998	Robert E. Hoagland	USDA, ARS, Mississippi
1999	James H. Miller	U.S. Forest Service
2000	David R. Shaw	Mississippi State University
2001	Harold D. Coble	North Carolina State University
2002	no nominations	--
2003	John W. Wilcut	North Carolina State University
2004	Gene D. Wills	Mississippi State University
2005	R. M. Hayes	University of Tennessee
2006	James L. Griffin	Louisiana State University
2007	Alan C. York	North Carolina State University
2008	Wayne Keeling	Texas A&M University
2009	W. Carroll Johnson, III	USDA, ARS, Tifton
2010	Don S. Murray	Oklahoma State University
2011	Krishna Reddy	USDA, ARS, Mississippi
2012	Daniel Reynolds	Mississippi State University
2013	Barry Brecke	University of Florida
2014	no nominations	--
2017	James Holloway	Syngenta Crop Protection

Excellence in Regulatory Stewardship Award
Robert Nichols

Since 1992, Bob Nichols has managed research in crop production and pest protection for Cotton Incorporated and has served in advisory and leadership roles on several cotton industry and agricultural action groups. He has broad experience in crop agriculture and pest management, including experience in agronomic research, agrichemical product development, management of products, staff, research stations, and of regional, national and hemispheric development programs in the crop protection industry. Before joining Cotton Incorporated, Dr. Nichols held positions in research with USDA-ARS, in product development with PPG Industries, in research management with F. Hoffmann La Roche Company, and in marketing management with Agri-Growth Research. He has conducted agricultural research in the Northeast, Mid-West, and Southern Regions of the U. S.

Dr. Nichols has worked in plant biology, crop production, and pest management for 45 years. He is a member of the American Chemical Society, the American Society of Agronomy, the American Phytopathological Society, the Society of Nematologists, and the Weed Science Society of America (WSSA). He is a Fellow of the Southern Weed Science Society and of Pierson College of Yale University and a long-time member of the WSSA Science Policy Committee. He is an author of more than 140 scientific papers.

Dr. Nichols has a B.A. from Yale University with emphasis in economics and political science, and a Master of Science and Doctorate of Agronomy from the University of Connecticut where he worked in the 1970s 8 on use of the then experimental herbicide glyphosate for no-tillage systems. He served four years with the U.S. Army Security Agency, volunteered for and served three consecutive combat tours in Vietnam. He is married and has five children and five grandchildren. He has lived in eight U.S. states, including New Jersey, Connecticut, New Hampshire, Texas, Georgia, Florida, Minnesota, and North Carolina; he and his wife reside in Wake County, North Carolina.

Past Presidents of the Southern Weed Science Society

1948-49	C.A. Brown	1984-85	W.S. McIntire
1949-50	E.C. Tullis	1985-86	R.E. Talbert
1950-51	O.E. Sell	1986-87	H.M. LeBaron
1951-52	G.M. Shear	1987-88	R.L. Rogers
1952-53	D.A. Hinkle	1988-89	L.B. Gillham
1953-54	W.B. Ennis, Jr.	1989-90	L.R. Oliver
1954-55	W.C. Shaw	1990-91	J.R. Bone
1955-56	G.C. Klingman	1991-92	J.M. Chandler
1956-57	W.B. Albert	1992-93	J.L. Barrentine
1957-58	E.G. Rogers	1993-94	A.D. Worsham
1958-59	R. Behrens	1994-95	P.A. Banks
1959-60	V.S. Searcy	1995-96	S.O. Duke
1960-61	R.A. Darrow	1996-97	B.D. Sims
1961-62	W.K. Porter, Jr.	1997-98	R.M. Hayes
1962-63	J.T. Holstun, Jr.	1998-99	R.L. Ratliff
1963-64	R.F. Richards	1999-00	D.S. Murray
1964-65	R.E. Frans	2000-01	L.L. Whatley
1965-66	D.E. Wolf	2001-02	J.E. Street
1966-67	D.E. Davis	2002-03	J.W. Wells
1967-68	R.A. Mann	2003-04	W.W. Witt
1968-69	W.L. Lett, Jr.	2004-05	J.S. Harden
1969-70	J.B. Baker	2005-06	D.R. Shaw
1970-71	D.D. Boatright	2006-07	J.A. Driver
1971-72	J.R. Orsenigo	2007-08	D.W. Monks
1972-73	T.J. Hernandez	2008-09	A.M. Thurston
1973-74	A.F. Wiese	2009-10	D.B. Reynolds
1974-75	W.G. Westmoreland	2010-11	T.J. Holt
1975-76	P.W. Santlemann	2011-12	B.J. Brecke
1976-77	A.J. Becon	2012-13	T.C. Mueller
1977-78	G.A. Buchanan	2014-15	S.A. Senseman
1978-79	C.G. Parris	2015-16	B. Minton
1979-80	M.G. Merkle	2016-17	P. Dotray
1981-82	J.B. Weber	2017-18	G. Schwarzlose
1982-83	J.E. Gallagher	2018-19	B. Scott
1983-84	C.G. McWhorter	2019-20	James Holloway

Dedication of the Proceedings of the SWSS

Year	Name	University or Company
1973	William L. Lett, Jr.	Colloidal Products Corporation
1975	Hoyt A. Nation	Dow Chemical Company
1978	John T. Holstun, Jr.	USDA, ARS
1988	V. Shorty Searcy	Ciba-Geigy
1995	Arlen W. Evans	DuPont
1997	Michael & Karen DeFelice	Information Design
1999	Glenn C. Klingman	Eli Lilly and Company
1999	Allen F. Wiese	Texas A&M University
2004	Chester G. McWhorter	USDA-ARS
2004	Charles E. Moore	Lilly Research Laboratories
2008	John Wilcut	North Carolina State University
2008	Larry Nelson	Clemson University
2012	Jacquelin Edwards Driver	Syngenta Crop Protection
2015	Paul Santelmann	Oklahoma State University
2016	Tedd Webster	USDA-ARS
2017	Dennis Elmore	USDA-ARS
2018	Timothy R. Murphy	University of Georgia
2019	Dr. John Ray Abernathy	Texas Tech University

List of SWSS Committee Members
January 31, 2020 - January 31, 2021

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

100. SOUTHERN WEED SCIENCE SOCIETY OFFICERS AND EXECUTIVE BOARD

100a. OFFICERS

President	Eric Webster	2020-2021
President Elect	Clete Youmans	2020-2021
Vice-President	Darrin Dodd	2020-2021
Secretary-Treasurer	Hunter Perry	2020-2023
Editor	Paul Tseng	2020-2023
Immediate Past President	James Holloway	2020-2021

100b. ADDITIONAL EXECUTIVE BOARD MEMBERS

Member-at-Large - Academia	Shawn Askew	2020-2022
Member-at-Large - Industry	Kelly Backscheider	2020-2022
Member-at-Large - Academia	Todd Baughman	2018-2021
Member-at-Large- Industry	Eric Castner	2018-2021
Representative to WSSA	John Byrd	2020-2023

100c. EX-OFFICIO BOARD MEMBERS

Constitution and Operating Procedures	Carroll Johnson	2020-2021
SWSS Business Manager	Kelley Mazur	
Student Representative	Lawson Priess	2020-2022
Newsletter Editor	Susan Scott	

101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

President	Hunter Perry	2020-2021
Secretary	Gary Schwarzlose	2020-2023
	Mike Lovelace	2020-2024
	Greg MacDonald	2020-2025
	Jason Bond	2020-2026
Graduate Student Rep	Hannah Wright	2020-2022

101b. BOARD OF TRUSTEES - EX-OFFICIO

Donnie Miller	Past President of Endowment Foundation Board of Trustees
Kelley Mazur	SWSS Business Manager

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

James Holloway*	2021	Brad Minton	2021	Peter Dotray	2021
Hunter Perry	2021	Nicholas Basinger	2021	Cherilyn Moore	2021

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

Brad Minton	2021	John Byrd	2022	Greg MacDonald	2023
Scott Senseman	2021	Neil Rhodes	2022	Cletus Youmans	2023

102b. Outstanding Educator Award Subcommittee

Peter Dotray	2021	Larry Steckel	2022	Stephen Enloe	2023
Nilda Burgos	2021	Tim Grey	2022	Doug Spaunhorst	2023

102c. Outstanding Young Weed Scientist Award Subcommittee

Hunter Perry	2021	Peter Dittmar	2022	Kelly Backscheider	2023
Ramon Leon	2021	Jim Bronson	2022	Todd Baughman	2023

102d. Outstanding Graduate Student Award Subcommittee

Nicholas Basinger *	2023	Sandeep Rana	2022	Matt Griffin	2023
Muthu Bagavathiannan	2021	Frank Carey	2022	Kelly Backscheider	2023

102e. Excellence in Regulatory Stewardship Award Subcommittee

Cherilyn Moore	2021	Robert Nichols	2022	Matt Goddard	2023
David Jordan	2021	Drew Ellis	2022		

103. COMPUTER APPLICATION COMMITTEE

Shawn Askew *	2021	Jim Brosnan	2022	Shandrea Stallworth	2023
Dan Reynolds *	2021	Matt Goddard	2022	Gary Schwarzlose	2023
Kelley Mazur – SWSS Business Manager					

104. CONSTITUTION AND OPERATING PROCEDURES COMMITTEE (STANDING)

W. Carroll Johnson *	2020-2021

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.

Darrin Dodd*	2020-2021
Cletus Youmans	2020-2021
Jacob Reed	2020-2021
Larry Steckel	2020-2021
Jim Brosnan	2020-2021
Muthu Bagavathiannan	2020-2021
Phil Banks	2020-2021
John Schultz	2020-2021
Tom Barber	2020-2021
Kelley Mazur – SWSS Business Manager	

106. GRADUATE STUDENT ORGANIZATION

President	Lawson Preiss	Univ Arkansas
Vice President	John Peppers	Virginia Tech
Secretary	Cynthia Sias	Texas A&M
Weed Resistance & Technology Committee Rep	Pamela Carvalho	Univ Arkansas
Endowment Committee	Hannah Wright	Univ Georgia
Social Chair/Student Program Committee	Jake Patterson	Univ Arkansas

107. WEED RESISTANCE AND TECHNOLOGY STEWARDSHIP (STANDING)

Alabama	Steven Li		North Carolina	D. Spak
Arkansas	N. French J. Norsworthy		Oklahoma	T. Baughman
Florida	Pratap Devkota		South Carolina	M. Cutulle
Georgia	E. Prostko C. Johnson		Tennessee	L. Steckel A. Mills

Kentucky	J. Green		Texas	P. Dotray
Louisiana	D. Stephenson		Virginia	M. Flessner
Mississippi	Connor Fergusson*		Puerto Rico	W. Robles
Missouri	J. Heiser		Grad. Student Representative	P. Carvalho

108. HISTORICAL COMMITTEE (STANDING)

John Byrd *	2021
Andy Kendig	2022

109. LEGISLATIVE AND REGULATORY COMMITTEE (STANDING)

Todd Baughman*	Chair & Member-at-Large - Academia	2020-2023
Lee Van Wychen	(ad hoc) WSSA Science Policy Executive Director	2020-2021
Janice McFarland	(ad hoc) Chair of the WSSA Science Policy Committee	2020-2021
Greg Kruger	(ad hoc), EPA liaison	2020-2021
Shawn Askew	Member-at-Large - Academia	2020-2023
Kelly Backscheider	Member-at-Large - Industry	2020-2023
Todd Baughman	Member-at-Large - Academia	2019-2021
Eric Castner	Member-at-Large - Industry	2019-2021

110. LOCAL ARRANGEMENTS COMMITTEE - (STANDING)

Jim Brosnan *	2021	Knoxville, TN (SE)
Luke Etheridge	2022	Austin, TX (SW)
TBD	2023	TBD

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

Bob Scott	2021
James Holloway	2022
Eric Webster	2023
Cletus Youmans	2024

112. MEETING SITE SELECTION COMMITTEE (STANDING) - Shall consist of six members and the SWSS Business Manager. The members will be appointed by the President on a rotating basis with one member appointed each year and members shall

serve six-year terms. The Chairmanship will rotate to the senior committee member from the geographical area where the meeting will be held.

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

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

James Halloway*	2021

114. PROGRAM COMMITTEE – 2021 MEETING (STANDING)

Clete Youmans	2021
Darrin Dodd	2022

115. PROGRAM COMMITTEE - 2021 MEETING (STANDING)

Clete Youmans *	2020
Darrin Dodds	2021

116. RESEARCH COMMITTEE (STANDING)

Darrin Dodds	2021			
Alabama	S. Li		North Carolina	W. Everman
Arkansas	N. Burgos		Oklahoma	T. Baughman
Florida	P. Dittmar		Puerto Rico	W. Robles
Georgia	E. Prostko		South Carolina	M. Marshall
Kentucky	T. Leglieter		Tennessee	L. Steckel
Louisiana	D. Miller		Texas	P. Dotray
Mississippi	J. Byrd		Virginia	S. Askew
Missouri	K. Bradley			

117. RESOLUTIONS AND NECROLOGY COMMITTEE (STANDING)

David Black *	2022	Michael Flessner	2020	Ryan Edwards	2021

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

Mississippi	D. Dodds **		Missouri	J. Heiser

Alabama	S. Li		North Carolina	W. Everman
Arkansas	N. Burgos		Oklahoma	T. Baughman
Florida	G. MacDonald		South Carolina	M. Cutulle
Georgia	W. Vencill		Tennessee	T. Mueller D. Ellis *
Kentucky			Texas	P. Dotray
Louisiana	E. Webster		Virginia	S. Askew
Mississippi	D. Reynolds		Puerto Rico	W. Robles
Ad Hoc - Current	B. Kirksey		Ad Hoc - Previous	Cheryl Dunne

119. STUDENT PROGRAM COMMITTEE (STANDING)

Peter Eure*	2021	
Tommy Butts	2022	
Matthew Wiggins	2023	
Connor Webster	2021	Graduate Student Organization Rep. – Ex-officio member

120. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

Jacob Reed*	2021	Andy Kendig	2022	Luke Etheridge	2023
Bob Scott	2021	Kelly Backscheider	2022	Chris Meyer	2023

121. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

AL - Steve Li	2021		MO – Jim Heiser	2021
AR - Tom Barber	2021		NC – Angela Post	2021
FL - Calvin Odero	2021		OK - Todd Baughman**	2021
GA - Scott Tubbs	2021		SC - Alan Estes *	2021
KY – Travis Legleiter	2021		TN – Bruce Kirksey *	2021
LA – Daniel Stephenson	2021		TX - Jacob Reed	2021
MS -Te-Ming Paul Tseng	2021		VA – Shawn Askew**	2021

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

SWSS Board of Directors Meeting

Sunday, January 26th, 2020
The Beau Rivage Resort and Casino, Biloxi, MS
Azalea D; 4:00-5:00pm

Attendees:

Jim Brosnan, Jordan Craft, Eric Webster, Cletus Youmans, Carroll Johnson, Bob Scott, Greg Stapleton, Todd Baughman, John Byrd, Kelley Mazur, James Holloway, Kelly Backscheider (incoming At-Large, industry), Donnie Miller, Eric Castner, Hunter Perry (incoming Secretary)

Meeting called to order by Holloway at 4:00pm sharp

Motion to approve agenda made by Holloway, Seconded by Scott. MP passed unanimously

Program Update – Webster

The 2020 Annual Meeting had over 268 presentations submitted. This includes 126 poster submissions and 142 oral presentations. To date, there have been four posters withdrawn (21, 40, 119, 122) and three oral presentations (144, 171, 174). There was one title change after the program went to print (176). There will be 2 MS and 2 PhD oral contest session being conducted concurrently Tuesday morning in Magnolia E, F, G, and H with 100-person seating. Following the morning sessions on Tuesday afternoon and all-day Wednesday presentation will be conducted in Magnolia EF and GH with 100-person seating. There will be a full break Wednesday from 10:15 to 10:45 am in the poster display area.

No titles were submitted for Invasive Species, Vegetation Management in Utilities, Railroads and Highways, Weed Management in Aquatics.

The symposium is entitled "The Collision Between Wildlife Management and Weed Science: Challenges and opportunities. We have 4 speakers including Carroll Johnson, James Cummins, Jon Cooner and Glen Gentry. Carroll Johnson help organize this session.

There is a graduate student reception Sunday evening from 5 to 7 pm, a graduate student luncheon on Tuesday from 12 to 2:00 pm, and a SWSS Women's networking Event.

We will have an awards luncheon Wednesday from 12 to 2:00 pm for professional awards, as well as outstanding graduate student awards and passing of the gavel. Wednesday night there will be an awards reception for Graduate student contest.

Pre-Registration: Members 157; Students 91; Total 248

Webster reports that no graduate student talks will be edited at the meeting. Content uploaded at the deadline will be final. Additionally, all presentations for all sessions are pre-loaded on computers in each room to simplify things for section chairs.

Endowment Update – Miller

No report back on endowment scholarship winner experiences. They will be presented at the meeting.

Golf tournament had 25 players. Bob Scott and Schwarzlose have items for the silent auction. $7,100 in donations and $800 in entry fees from the golf tournament. BASF, Syngenta, and Corteva donated product for the tournament so SWSS had no expenses for golf. Only expense is small reception at clubhouse which Gary Schwarzlose paid for and will be reimbursed from Endowment Update

Local Arrangements – Dodds

Poster room ready to go. Team will setup computers and projectors in the morning. Encourages BOD to contact them if needed.

Business Manager Update – Mazur

Sponsors have helped for longer breaks and auxillary events (Graduate Student Mixer, Women's Networking Event, Quiz Bowl, etc).

Membership database in-use was originally built by Apex. Other regional societies are discussing a new database (move away from Apex). NCWSS and WSWS have tasked IMI to look at new software and Mazur asks BOD if there would be SWSS interest in making this change. If so, IMI will research options and make a recommendation to BOD at Summer Meeting. Currently SWSS pays Apex $4000 ($1000 for abstracts, $3000 for website and database maintenance) and Mazur reports that service for that fee is not being delivered as promised. Mazur will provide breakdown of expenses paid to Apex.

Typically, SWSS keeps three years of data in the system. Non-active members (that are not fellows) would be removed every three years.

Old Business

Lee Van Wychen MOP – C. Johnson – Distributed a draft of a new position description for Director of Science Policy position. Draft is based on WSSA MOP and modified for SWSS use. Rationale was to outline the exact duties of this position and to reflect that some federal agencies have moved to Kansas City and are not exclusively in Washington, DC. Johnson motions to include this document for inclusion in SWSS MOP. Seconded by Scott. Discussion about compensation ensued and whether to list a specific dollar amount or a vague percentage of his salary relative to other associations. Suggestion to edit opening paragraph to read "In a formalized agreement, the SWSS annually supports the EDSP in the amount approved SWSS Executive BOD. This commitment will be reviewed annual at the BOD meeting immediately following the Annual Meeting. Additionally, the SWSS will only pay travel expenses for the EDSP to attend the annual meeting."

Motion passes unanimously.

Awards Committee – Scott – Thanks sub-committee chairs for help with judging packets this year. SWSS received only 1 applicant for Outstanding Educator and Outstanding Young Weed Scientist-Industry awards. There were 0 applications for Outstanding Young Weed Scientist-Academia

Four fellow nominations and two were awarded.

Overall applications for graduate student awards were lower than expected.

Zach Lancaster was nominated for Outstanding PhD student but he was disqualified because he won the Outstanding MS student award previously.

Scott encourages Craft to have all students attend SWSS graduate student functions at the meeting.

Scott reports that Johnson asked about posthumously nominating Ted Webster for fellow but this did not move forward because Ted was not older than 50 years old when he died and that is written in the qualifications for the award. There was lengthy discussion about this BOD fall conference call. The motion brought to the Awards Committee and was essentially tabled. Scott mentioned there was discussion within the committee about potentially changing the qualifications or creating a new award.

New Business

Scott motion to adjourn. Second by Holloway. Meeting adjourned at 5:07 pm

SWSS Board of Directors Meeting

Monday, January 27th, 2020
The Beau Rivage Resort and Casino, Biloxi, MS
Azalea D; 11:00 am – 12:00 pm

Attendees:

Jim Brosnan; Carroll Johnson; Eric Webster; Clete Youmans; Lee Van Wychen; Jacob Reed; Todd Baughman; Jordan Craft; Shawn Askew; Darrin Dodds; Eric Castner; Jacob Reed; James Holloway; John Byrd; Kelley Mazur; Bob Scott; Greg Stapleton; Jason Bond; Paul Tseng;

Holloway called meeting to order at 11:01 am

Motion to approve agenda by Bond. Second by Johnson. Motion passes unanimously

Holloway reports that SWSS gavel will be passed Wednesday at lunch. Shawn Askew made new box for the gavel and it will be presented on Wednesday. Holloway thanked Askew for his efforts.

Program Update – Webster

No update on program. Webster reports that things are progressing well. Some minor issues with select talks on the website for the student presentations in the general session.

Local Arrangements – Dodds

Holloway reports no concerns have been placed. Thanks them for their work.

Awards Program Update – Scott

Scott will announce election winners at the Business Meeting even though they were in the newsletter. Other awards will be presented on Wednesday.

Sustaining Membership – Reed

In 2018 committee raised $29,500. In 2019, they raised $41,750 and this doesn't include new option for approaching universities. Committee will ask BOD for an MOP change to begin soliciting sustaining membership funds in March instead of May. Reed read the edited verbiage for the BOD. Johnson motions that change presented be included in the MOP. Second by Castner. Motion passes unanimously.

Science Policy – Van Wychen

Will approach science policy committee at WSSA about trying to re-distrubute entomology research dollars for weed science. Feels that this could be contentious but is probably something that we need to given that the discrepancy in funding between disciplines has been in place for a long time. Van Wychen reports we will only see at 0.4% increase in federal budget. Suggests that linkage be put in place with IR-4 regarding research funding for weed control in hemp,

considering there are no labeled products for use. Aim is to have IR-4 budget at $20 million. Van Wychen reports that there have been several regulatory fights during 2019, including glyphosate, atrazine, dicamba, and herbicide mixture synergy pertaining to ecological risk assessment.

Van Wychen commented that the NIFA move to Kansas City has halted the progress of several granting agencies. Many positions are currently open and could be filled with weed scientists. Historically these positions have been filled with individuals from other disciplines. Van Wychen reported that former Michigan State weed scientist (Matt Nagiano) is a national science liaison at NIFA that will handle weed science related issues.

Van Wychen reports that top scientists were brought to DC to discuss dicamba. Hope this will make an impact but the future is uncertain given the political climate in DC. Currently there is a stalemate between EPA and registrants about this issue. Hope for re-registration decision by August or September 2020.

Van Wychen reported that the Science Policy Fellow program already has four applications and there is still over a week before the deadline. Additionally, the Weed Bingo game has been viewed positively in DC. However, he will need to check to see if it exceeds that national limit for a congressional gift. Van Wychen thanked John Byrd for his assistance with producing this document.

Van Wychen thanked Youmans for assistance in national weed survey data analysis. Goal is to have this dataset written up for publication in Weed Technology. Muthu Bagavathiannan has been charged with leading this effort.

Van Wychen commented that we need to update a membership brochure and may request BOD for review of materials.

SWSS president to Washington, DC is targeted for May 18-23, 2020

*These comments will all be presented at the Business Meeting and included in the minutes from that Business Meeting.

IMI Contract – Youmans

Finance committee reviewed contract and made suggested editorial revisions to the document. Request for IMI to accept/reject those changes and send back a clean copy. Overall fee for service is expected to increase 7.5%. Finance committee approved contract pending their proposed revisions. This will be discussed at summer BOD meeting once a clean document has been returned for review.

Old Business

None to report

New Business

Finance committee recommends increased registration fees for conference to $400 for members and $200 for students. Charge of $50 for late registration for either category. Also recommends

increase for membership be increased from $40 to $75 for those who can't attend meeting but would like to be a member. Baughman moves to accept recommendation. Second by Johnson. Motion passes unanimously.

Site Selection committee is proposing change to MOP verbiage regarding location for annual meeting. Youmans reads proposed change to BOD. Motivation is to allow SWSS to aim to keep region rotation but investigate locations outside of the region rotation that might be of interest to membership in hopes of encouraging attendance. Johnson motions to approve proposed new verbiage. Second by Youmans. Motion passes unanimously.

Motion to adjourn meeting by Castner. Second byStapleton. Motion passes unanimously.

Meeting adjourned at 11:56 am

SWSS Annual Meeting

Monday, January 27th, 2020
The Beau Rivage Resort and Casino, Biloxi, MS
5:00-6:00pm

Meeting Called to Order by Holloway at 5:05pm

Finance Committee Report – Youmans

Gross income $154K with total expenses totaling $190K. Net income loss of $36K. $4K came in end of year. Total assets come to $319K.

Site Selection Committee Report – Holloway

Present: James Holloway (Chair), Luke Etheredge, Bob Scott, Ben McKnight, Angela Post, Jim Bronson, Cletus Youmans

Absent: Andrew Price, Kelley Mazur

James Holloway called the meeting to order at 9:00 AM

2023 Suggested locations for Kelley to ask for bids: Baton Rouge LA; Little Rock AR; Memphis TN

Suggested dates: Jan 23-26

Do not use the following dates due to the fact the GCSS convention (Golf Course Superintendents) will be: Feb 6-10, 2023 and Jan 29-Feb 1 2024

Motion form Jim Brosnan and seconded by Angela Post and voted on by the committee to send to the Executive Board, was unanimous.

Verbiage: Change the MOP to allow for the annual meeting to be anywhere in the SWSS area. This was brought up to the Executive Board and passed. See the new MOP for exact verbiage.

Motion made by Luke Etheredge and seconded by Jim Brosnan and unanimous by the committee to adjourn at 9:40 AM

Awards Committee Report – Bob Scott

2023 – choice will be between Memphis, Baton Rouge and Little Rock

2024 – WSSA has contacted SWSS about a joint meeting

Nominating Committee Report – Bob Scott

Nominating committee – Bob stressed the importance of volunteering. James and Eric will be looking to fill open spots on committees, so volunteers are greatly appreciated. For 2020 awards,

Bob mentioned a "fair" number of votes to represent the society. New BOD positions are as follows: Vice president – Darrin Dodds, Kelly – industry member at large, Askew – academia member at large, Bond – Endowment.

The awards luncheon for outstanding awards will be Wednesday at noon, not the night meeting. Further encourages society to nominate members for awards. No nominations this year for outstanding young academic scientist and only one nominee for another award.

SWSS Endowment Report – Miller

None

SWSS Weed Contest Report – Ellis

Contest will be hosted by Corteva agriscience in Leland, MS.

Graduate Student Report- Craft

None

Legislative and Regulatory Affairs Report – Post

Quite a bit of time spent this morning discussing trying to transition entomology funding to more weed science funding. 6 members present at committee meeting. Angela offered to allow interested parties to attend the meeting. Several folks rotating off and new members needed. Todd Baughman will be 2021 chair.

Science Policy Report – Van Wychen

Papers and Comments on Weed Science Policy Issues During the Past Year:

- WSSA Position on Glyphosate
- National and Regional Weed Science Societies Comments on Proposed Interim Review Decision for Glyphosate
- WSSA Comments on APHIS Proposed Rule on Regarding the Movement of Certain Genetically Engineered Organisms
- National and Regional Weed Science Societies Comments on EPA's Interim Process for Evaluating Potential Synergistic Effects of Pesticides During the Registration Process
- WSSA Concerns about USDA-NIFA Relocation
- National and Regional Weed Science Societies Comments on EPA's Proposed Application Exclusion Zone (AEZ) Requirements
- WSSA Comments on Registration Review of Paraquat
- National and Regional Weed Science Societies Support for America Grows Act (S. 2458)

- Newsletter Reports/Washington Updates submitted to each of the following societies: WSSA- 4; APMS- 2; NCWSS- 3; NEWSS- 3; SWSS- 3; and WSWS- 3

2019 Weed Science Meeting/Events Attended and Presentation(s) Given

Jan. 7 - 10 2019: Northeastern Weed Science Society (NEWSS), Baltimore, MD

Feb. 3 - 7, 2019: Southern Weed Science Society (SWSS), Oklahoma City, OK

Feb. 11-14, 2019: Weed Science Society of America (WSSA), New Orleans, LA

Mar. 11-14, 2019: Western Society of Weed Science (WSWS), Denver, CO

Jul. 11 - 14, 2019: Aquatic Plant Management Society (APMS), San Diego, CA

Aug. 5-6, 2019: Weed Science Society of America Summer Board, Blackhawk, CO

Sep. 16 - 18, 2019: National Roadside Veg. Mang't Assoc. (NRVMA), Louisville, KY

Dec. 10 - 13, 2019: North Central Weed Science Society (NCWSS), Columbus, OH

Dicamba: EPA requested the most recent dicamba research from our members. WSSA-EPA Liaison Greg Kruger and I worked with the Agency to host a meeting on Jan. 16, 2020 for 11 weed scientists to present their work. A summary of the comments is as follows:

- Dicamba will likely be re-registered for over-the-top use in cotton and soybeans
- Possible volatility band-aids include restrictions on temperature and spray solution pH
- Resistance is documented and growing
- Poor grass control due to antagonism with glyphosate/clethodim a serious, growing issue.
- Choline formulation of dicamba looks very good for reduced volatility

Next step- WSSA coordinates a meeting between the heads of dicamba registrants and EPA Administrators to generate dialogue to improve future dicamba use

USDA-NIFA Move: NIFA still significantly understaffed, especially program staff who work on funding grants. Months behind on grant money distribution. Hiring as quickly as possible. Jim Kells, WSSA-NIFA Fellow, will be going to KC a couple times this spring, probably after WSSA annual meeting. He's working on a presentation of weed science funding history for last ten years. Funding Letter of Intent (LOI) for weed genomics conference this year that was submitted by Tranel, Gaines, Patterson et al. was not selected for funding because NIFA is overwhelmed right now. However, unlike regular grants, conference LOI's can be submitted at any time, as long as its 135 days prior to the event. Thus, there is still a good chance that they will receive NIFA money for a weed genomics conference when they resubmit an LOI.. The new National Science Liaison (NSL) that covers weed science issues is Mathieu (Mat) Ngouajio.

USDA-ARS: Still no word on who will be the National Program Leader (NPL) overseeing weed science research. Steven Mirsky has been serving as acting NPL in Beltsville, MD. A Weed

Science NPL position will likely be advertised this spring and we are trying to recruit qualified candidates to apply. Please see me if you are interested. Weed science was very well represented in April 2019 during the USDA-ARS Crop Protection and Quarantine (NP 304) five year review.

WSSA Rep for TAG-BCAW: Dr. Te-ming Paul Tseng, Mississippi State University, has been representing WSSA on the APHIS Technical Advisory Group (TAG) for the Biocontrol of Weeds (BCAW).

2020 International Year of Plant Health- USDA APHIS will host a conference in Washington, DC on Aug. 18-20, 2020 to focus attention on plant health issues. I'm on the academia steering committee and am pushing them to include invasive species and phytosanitary trade issues related to herbicide-resistant weed seed.

Syncing USDA Plants Database with WSSA Composite Lists of Weeds: the USDA Plants Database is now considered the official source of weed nomenclature and taxonomy. However, there are still a few issues that need to be resolved. The USDA Plants Database gets 50,000 hits a day off the internet and is undergoing a major overhaul of its infrastructure and search capabilities. It's run by the USDA-NRCS out of Greenville, NC. Carroll Moseley and I are working with the NRCS Plants Database team to get them to adopt the 3,000 plus "official" weed names on WSSA's Composite List as the primary common name for that weed species. In most cases, they are the same, but notable differences exist. For example the USDA Plants Database primary common name for Palmer amaranth is 'carelessweed'. For waterhemp, its 'roughfruit amaranth'. For giant foxtail, its 'Japanese bristlegrass'.

Weed Science Policy Fellow (WSPF)- 2019 was the first year for the WSPF and was excellent. John Schramski, Michigan State, and Haleigh Summers, Penn State have completed their fellowships and their last task is reporting to the WSSA Board at their annual meeting in Maui. I am currently soliciting applications for 2020 WSPFs. Applications are due Feb. 1, 2020.

WEED BINGO: A stunning success and excellent public outreach and educational tool for weed science. This was 3 yrs in the making and I want to specifically thank John Madsen for his contributions of photos and trivia for many of the SWSS designated weeds. Each of the 42 weed cards included in the game includes the weed's common and scientific name of a weed, photo, and description/trivia. (My kids love it ☺). You can buy it for $14.95 + $5 S&H at: https://wssa.memberclicks.net/index.php?option=com_mcform&view=ngforms&id=24090#/

"Executive Visits Day" for Weed Science Society Presidents in DC: This was a success in April 2019 and I plan to do it again in 2020. Tentative dates are May 18-22, 2020 during NISAW.

2020 National Invasive Species Awareness Week (NISAW): https://www.nisaw.org/nisaw-2020/ We have gone through a major overhaul and rethinking of strategy and purpose over the past year. Belle Berger, Exec. Director for NAISMA has agreed to take over coordination role. There will be a "Legislative Advocacy week" with no Feds involved during Feb. 24-28, 2020. We will likely lobby on restoring NISC budget and ISAC. The traditional NISAW (Local events and Awareness) will be **May 16 – 23, 2020** and will focus on "in the field" events at the state

and local levels. We are looking to raise $25K in sponsorships for staff time and resources to advertise and coordinate. $1000 webinar series sponsor or $2500 NISAW "Leader" sponsor.

National Survey of Common and Troublesome Weeds: The 2019 survey results for weeds in broadleaf crops, fruits & vegetables are posted at http://wssa.net/wssa/weed/surveys/. Thank you for your participation and for Clete Youmans for summarizing the weed survey data for the SWSS region. The 2020 weed survey will survey weeds in grass crops, pastures, and turf and be sent out to Weed Science members around Memorial Day.

Hemp – Do we need a position paper on weed control in hemp? No herbicides approved for use, but EPA is working with IR-4 and many weed scientists to generate tolerance data for:

bromoxynil, clethodim, clomazone, flumioxizin, pyroxasulfone, s-metolachlor, sulfentrazone

Membership Brochure- Would the SWSS be interested in working with WSSA and the other weed science societies in developing some membership marketing material? If so, the **SWSS Board should designate a member** to serve on the Weed Science Membership Brochure committee that I'm putting together. Thanks.

Sustaining Membership Committee Report- Jacob Reed

Receipts for the 2019 SWSS Sustaining Membership Fund totaled $41,750.00. Several contributors gave to the Fund who had not previously given in 2018. Additionally, several contributions totaling $10,000 already have been received for 2020.

Student Program Report – Kelly Backshleider

55 students – oral, up 43 from last year

23 students – poster

2 Masters sections and 2 Ph.D. sections

All student contest completed by noon Tuesday

Judges breakfast 6:00 am Tuesday

Awards handed out on Wednesday evening at the grad student reception

Research Committee Report – Youmans

Information gathered from Lee Van Wychen. He provided all weeds of U.S. Committee determined and ranked most common or most troublesome. Palmer pigweed was #1. Henbit was #2. Some differences in opinion occurred so Clete checked on #3 and it was yellow nutsedge. Most troublesome brought in nutsedge and threw out henbit.

Newsletter Committee Report – Scott

Bob is looking for someone to take over Newsletter responsibilities this next year.

Local Arrangements Committee Report – Dodds

None

Weed Resistance and Technology Stewardship – Barapour

None

Long Range Planning Committee Report – Dotray

None

Education Units – Estes

None

WSSA Report – Byrd

None

New Business

Lee – looking for create talents to upgrade outreach materials. Lee is pulling together a special Ad Hoc committee along with other branch orgs of WSSA…looking for volunteers.

Motion to adjourn by Bob Scott and seconded by Carroll Johnson.

SWSS Executive Board Meeting

Thursday, January 30th, 2020
The Beau Rivage Resort and Casino, Biloxi, MS

SWSS Board Meeting called to order at 7:31 by Eric Webster.

Attendees:

James Holloway, John Byrd, Kelly Backscheider, Shawn Askew, Kelley Mazur, Clete Youmans, Carroll Johnson, Lawson Priess, Eric Castner, Hunter Perry

Motion to approve agenda made by Eric Webster and seconded by John Byrd.

Financial Overview and Meeting Report – Mazur

249 pre-registered, 277 at end of meeting. 101 students (169 2020) 172 regular members. 131 folks engaged meeting app vs. 88 in 2019. $26,000 deposit placed with hotel prior to meeting. Financials will be provided at summer board meeting. Kelly ordered 300 printed programs and 277 showed up. All were gone except 5 that Kelly kept. Recommendations for downloading the app. Maybe put instructions by registration table. $2200 were spendt on the app and rumor was many folks adopted it. Most of the socieities are using the app now. Lots of pros to using the app….push notifications to users is one of them. Kelly feels we are still a way to go to app fully since so many members are married to the printed program. Clete questions if folks would buy a program with their own money since it essentialy costs $25/person. Internet connectivity was a problem for the meeting. Wifi access purchase per person would have been $35/person. Holloway requested the app come out considerably earlier if we want more people to use it. Abstracts and past award winners were requested to be loaded in the app. Clete was curious of the annual meeting cost but Kelly doesn't have everything finalized yet. Askew suggested having a more abbreviated program each year to drive people towards the app. Kelly mentioned some examples of the direction some of the other societies are moving that would lead folks towards the app. Members can be contacted through the app as well.

Local arrangements – Dodds

Very smooth. Thanked Eric for everything his group did because it made his life easy this week. Darrin paid $3600 for all poster boards and they were in rough shape. The worst ones were placed around the wall. Kelly attempted to get them from NO where WSSA had got them from but the company said they don't service Biloxi. Carroll suggested reminding local arrangements earlier in the year about locating hardware for the posters. Poster boards came assembled…the only thing we had to do is line them up. All showed up except 5. Carroll discussed being more diligent on handling ancillary costs. Eric and others mentioned the trouble with traveling around with poster hardware and not wanting to go that route. One year, WSSA had half the number of

poster boards needed and posters alternated days being on display. Is a one-time purchase and just storing and shipping each year a feasible option? Based on storage costs and shipping costs, not sure if that is the way to go. Carroll further stressed putting greater thought into these types of costs due to the current situation with meeting costs. No motions

Program Committee Update – Holloway and Webster

5 posters didn't show + 3 presentations not showing = 8 total presentations short.
David was open and happy to assisting Eric and Kelly B get presentations downloaded as well as provided other assistance. Eric's guys utilized their 4 laptops. 5 projectors were broad. Darrin brought HDMI cords as well as other materials and supplies. We used our own LED projectors which helped to save on costs compared to renting from the resort. Eric to-date hasn't received any criticism, but opens the floor so we can button up any cares or concerns about the meeting. Kelly said the hotel lost boxes she had shipped here. The person receiving them put his name on the box, but he wasn't here and nobody could find him. It was found 30 minutes prior to registration opening. Many frustrations around the topic and getting the run around by some staff. Kelly let the resort staff know of the frustrations.

Constitution and Operating Procedures Update – Carroll

Reconfiruring of newletter editor role. It will take some effort, but a proposal will be discussed this summer regarding the "communication" role. Changes will need to be made to the bylaws. The goal constitutional is to have the MOP revised prior to the August newsletter.
Carroll and James discussed back and forth what would be the requirements ….board member? Member of the society? Employee of the society?
In a social media context, what does this person need to do or be required to do in that role. James recommendation is to get someone for Carroll's replacement and have a one-year overlap to insure no gaps left behind. James recommendation is to get someone for Carroll's replacement and have a one-year overlap to insure no gaps left behind. James recommendation is to get someone for Carroll's replacement and have a one-year overlap to insure no gaps left behind and Carrol can "train" his replacement.

Grad student update – Lawson

Great turnout for the mixer. Grad students enjoyed it. Luncheon went well….great speaker (Ashford). Complete turnover in offices. New officers are as follows….

President –
Vice president –
Secretary –

Some folks didn't know who was invited to the Sunday night event, but it's a graduate student event. There are always a few members that trickle in, but it's for the graduate students. Clarity was made that the Endowment pays for the graduate student luncheon. Eric recommended all new board members to read through the MOP to further familiarize.

Endowment - Perry

Askew suggested the academics team up to see multiple facets of the ag research arena in order to be able to compete with industry hosts.
Byrd asked if Gylling expects for the award to be named after him. Hunter doesn't known, but the details will be clarified. Hunter will ask for Gary to get details around the award.
Carroll suggests for individual members to contribute to the Endowment and Kelly suggests spending more time and effort. Hunter needs to discuss with the committee about a change to the operating procedures to reflect alternating industry and academia on the committee.

Old Business

Discussion on whether or not the election deadline needs to be changed. Consider keeping current dates and abiding by it. Discussion regarding getting in nominees. James has his ready, but Hunter needs to reach out to Endowment Committee.
Eric brought up the IMI contract, but will be tabled to the summer board meeting.
Under sustaining membership committee MOP change dates from June to March.
SWSS branding – Lee is convinced the society logo needs to be updated. Darrin suggested reaching out to the talented members and asked for 8-10 logo recommendations as a starting point. Get those samples and come to the summer board meeting as a starting point.
Recommendation to send out branding request to the membership and offer a monetary award as decided on by the BOD. Due date of June 1st. Winner would be recognized or rewarded at the 2021 meeting. Darrin makes a motion to solicit new logos for the SWSS and give the winning entry a $500 VISA gift card. Carroll seconded the motion.

New Business

Plan is to meet in Knoxville within the first two weeks of July (week of 6th or 13th).
BOD conference call is set for April 21st 9:00 am central.

Kelly B. suggested opening an undergraduate poster competition. Schools like UT Martin and Abraham Baldwin would get involved. BOD is receptive and Knoxville would be a great location to bring in students….especially from the aforementioned schools. Carrol suggests revising the MOP to indicate an undergraduate student contest. BOD agrees that the undergraduates wanting to participate would have to conduct the research or at least be involved in the research.
Motion to adjourn by Webster. Seconded by Askew. – 9:33 am

2020 Program Report – Eric Webster

Committee Chair: Eric P. Webster

The 2020 Annual Meeting had over 268 presentations submitted. This includes 126 poster submissions and 142 oral presentations. To date, there have been four posters withdrawn (21, 40, 119, 122) and three oral presentations (144, 171, 174). There was one title change after the program went to print (176). There will be 2 MS and 2 PhD oral contest session being conducted concurrently Tuesday morning in Magnolia E, F, G, and H with 100-person seating. Following the morning sessions on Tuesday afternoon and all-day Wednesday presentation will be conducted in Magnolia EF and GH with 100-person seating. There will be a full break Wednesday from 10:15 to 10:45 am in the poster display area.

No titles were submitted for Invasive Species, Vegetation Management in Utilities, Railroads and Highways, Weed Management in Aquatics.

The symposium is entitled "The Collision Between Wildlife Management and Weed Science: Challenges and opportunities. We have 4 speakers including Carroll Johnson, James Cummins, Jon Cooner and Glen Gentry. Carroll Johnson help organize this session.

We will have an awards luncheon Wednesday from 12 to 2:00 pm for professional awards. Wednesday night there will be an awards reception for Graduate student contest. There is also a graduate student reception Sunday evening from 5 to 7 pm, a graduate student luncheon on Tuesday from 12 to 2:00 pm, and a SWSS Women's networking Event.

Pre-Registration:

Members 157

Students 91

Total 248

Submitted by: Eric Webster

Poster: 21, 40, 119, 122

Talk:144, 171, 174

Title change: 176

Sustaining Membership Committee Report – Jacob Reed

Receipts for the 2019 SWSS Sustaining Membership Fund totaled $41,750.00. Several contributors gave to the Fund who had not previously given in 2018. Additionally, several contributions totaling $10,000 already have been received for 2020.

The Board approved a new Sustaining Membership Dues structure which will allow companies to contribute to the Fund in better alignment with their annual sales. An additional Sustaining

Membership Tier of $3000 was created for companies with sales >$500 million. Additionally, Universities will be allowed and encouraged to contribute up to $1000 to the Fund. Flexibility in contribution amount up to $1000 was suggested to allow Universities to contribute as their administrative and program guidelines allow.

The board also approved a change in the MOP to allow the Committee to begin asking for contributions in March rather than June/July to allow for more time to engage donors.

Nominating Committee Report – Bob Scott

Elections were held on schedule this year. Numerous positions were filled. The new officers were presented at the business meeting. They include: Vice President Clete Youmans, Secretary/treasurer Hunter Perry, Member-at-large industry Kelly Backsheider, Member-at-large academia Shawn Askew, WSSA Representative John Byrd, Endowment Board Trustee Jason Bond, Proceedings Editor Paul Tseng. Names of those who did not get voted in this year as well as other prospects were submitted to the President.

Awards Committee Report – Bob Scott

Award	Nominator	Nominee	Result	SubCommitee Chair
SWSS Fellow	Peter Dittmar	Greg McDonald	Winner	Barry Brecke
	352-273-4771			
	Greg Stapleton	Cletus Youmans	Winner	
	731-589-2629			
	Tim Grey	Henry McClain	Not Awarded	
	229-886-6573			
	Melissa Siebert	Bo Braxton	Not Awarded	
	662-347-8583			
Oustanding Educator	Jason Ferrell	Steve Enloe	Winner	Tom Mueller
	jferrell@ufl.edu			
	352-273-3685			

Oustanding Young Weed Scientist - Industry	Craig Alford	Kelly Backscheider	Winner	D. Stephenson
	303-501-0217			
Oustanding Young Weed Scientist - Academia	No Applicants			D. Stephenson
Graduate Student - MS	Jason Norsworthy	Lawson Preiss	Winner	Nick Basinger
	Stanley Culpepper	Taylor Randell	Not Awarded	
Graduate Student - PhD	Shawn Askew	John Brewer	Winner	Nick Basinger
	Muthu Bagavathiannan	Seth Abugho	Not Awarded	
	David Jordan	Dennis Mahoney	Not Awarded	
	Jason Bond	Ben Lawrence	Not Awarded	
	Jason Norsworthy	Zach Lancaster	Not Eligible*	
Excellence in Regulatory	Larry Steckle	Bob Nichols	Winner	J.D. Green
	731-499-0120			
*Zach won oustanding MS				B. Scott
				J. Holloway

Legislative and Regulatory Committee Report - Angela Post, Chair

The Committee Legislative and Regulatory Meeting was held January 27th 2020 from 10AM-12PM. Six SWSS members were present for the committee meeting (5 of them serve on the official committee): Lee Van Wychen, Angela Post, Eric Castner, Todd Baughman, Jason Bond and Andy Kendig. Most are rotating off the board this year and we will need some replacements. Andy Kendig has attended for the last couple of years. I suggest he be added to the official committee if he is willing. Also, Eric Castner suggested Matthey Wiggins of FMC might be

interested in serving. For 2021, Todd Baughman of Oklahoma State University will rotate into the Chair position for the next term. (todd.baughman@okstate.edu)

We discussed all of the topics in Lee's Science Policy Update to the Society briefly and spent additional time on a few of these items.

Lee provided a brief synopsis of his work on the following items:

1. Pesticide re-registrations- making comments on behalf of the societies

2. Resistance issues ore only getting worse and has become an issue in trade because of resistant weed seeds: China has refused soybeans and listed species they do not want to see in imported beans; As a committee we are still up against resistance management to protect our export market. We discussed which tools we have available to combat the problem: harvest weed seed control, cover crops, etc. Are there new herbicides on the way?

3. Protect what we have and prevent additional regulation

4. Dicamba has been a political hot-button issue. Lee says we have provided the best science our industry is conducting. Registration decision is due by December 20th 2020. WSSA could play a role as a non-profit entity in the education part of this discussion stating: We need to keep this chemistry in the toolbox; how can we do that? We need to address off-target movement for the product.

5. How do we prioritize which chemistries we spend more time educating on?

The floor was opened for discussion:

Eric Castner mentioned states lack the ability to enforce pesticide law. Farmers are making an economic decision and they will apply this product whether they have a registration or not. This problem could impact our ability to export products and asked if this has changed the opportunity for funding in Weed Science? Lee responded that this money is as competitive as ever and we have been able to increase the pot of money, but haven't moved the needle far enough.

Todd asked has there been any talk of redirecting funding from other disciplines into weed science. Lee discussed the politics involved in directly requesting a redirect of funding. He talked about strategies we can do to make these asks more subtle. We discussed the discrepancy between the three pest disciplines and how to move more of that funding toward our discipline.

6. Weed Science policy fellow—There were great applicants and Lee ended up with two excellent folks. They work 10 hours a week and travel to DC a few times to visit with policy makers. This has been positive for Lee in having a group to take with him to visits. He hopes to continue this fellowship moving forward and we support that as a committee. He discussed additional items they can assist with such as doing research for position papers.

7. Invasive species awareness week has moved from February to May

8. Is there a need for a hemp position paper linked with a discussion on IR4 funding which is currently at 11.9 million. Can we move it toward 20 million?

Meeting adjourned 10:55AM. Most members had board responsibilities and needed to get to the board meeting.

Endowment Committee Report – Donnie Miller

Kelly Mazur briefly covered the Endowment budget items. Based on incoming and outgoing, the Endowment is in the green.

Annual golf tournament was held at the Preserve Golf Club in Vancleave, MS. Weather was awful, but turnout was great. Tournament specs: 25 registered golfers, Approximately, $800 raised from registration fees, Approximately $7,100 raised from Endowment donations, VIK donations from Syngenta and Corteva have been received to cover the tournament greens fees and cart rental expenses.

Gary Schwarzlose was contacted by Steve Gylling regarding his company's interest in sponsoring an Endowment-related award geared specifically towards undergraduate students. Gary will reach out for more details regarding the funding Gylling has in mind (one-time, annual award, etc.).

Nominations for 2020 Endowment Election are being requested through email and will be noted. In an effort to achieve a good balance of industry and academic members on the committee, nominations this year will focus on an industry inductee (Jason Bond, MSU was latest member to be added).

$840.05 is total earned from Silent Auction

Weed Contest Committee Report – Drew Ellis

Opening remarks:

Announced Drew Ellis as Chair.

Announcement of location and date for 2020 Weed Contest. Corteva agriscience will host in Stoneville, MS on August 4th.

Team of Corteva employees in the near vicinity of the station have been assembled to take lead for each event. There will be an email calling for outside volunteers during the spring.

Review of proposed rules and possible changes.

Chair questioned the need for giving plaques out for individuals ranked 6 through 10?

- Justification for removal is that some have questioned if the expense although not truly great in scale is it needed beyond 5th place.

Comments from the society members in attendance included the following:

- Some students take pride in being in the top 10 out of the total 60 some odd contestants.
- Perhaps announce and congratulate the numbers 6 through 10 but not give plaques.
- Some indifference.

Overall, there was not enough support for moving on with such reduction in awarding plaques that the issue was dropped and for 2020 no changes will be made.

Chair proposed to add language under the Weed ID guidelines to "Plants could either be grown in a field weed nursery or pots or presented in digital picture form (must be of good quality and clarity) and may be in any stage of growth or development within reason."

- Justification is that previous contest utilized this method of identification as it represented a significant reality in the current digital age.
- The addition of the specific language doesn't mandate that pictures have to be used only gives the option for such.

Comments from attendees:

- Pictures should not be more than 3 to 5 in total number.
- Only can be of plants and not seeds.
- Proper attention by host to show good quality pictures and multiple inset pictures of key identifying structures (ex. grasses and ligules/stem shape/etc or ocrea for polygonum spp)
- A comment was made that this is not truly meeting the intent of weed identification training.
- A couple of comments that this is a very valid method for students to become comfortable with as many weed scientist answer such daily in their career.

Resolution: Language will be added but guidance to host will be that keep the number at a minimum (<6), include only quality and supportive plant structure pictures. Also be prepared that the overall sentiment of coaches during event walkthrough may bring up concern and request the pictures not be used and therefore the host should have a backup plan (preferably a live specimen).

Chair added the word "not" to the rules on students bringing their own calculators. This will require the host to supply a standard type calculator for all individuals. Justification is that many times the calculators have been supplied by the host and this prevents use of calculators that have advanced features that allow for saving and displaying of certain formulas or resources that give an unfair advantage.

- No objection was given to this addition/change.

Chair proposed the idea of reviewing and possibly updating the reference literature for individual calibration.

- Suggestion was made to reference the latest edition of the herbicide handbook.
- Suggestion that the Chair review (google search) for the current items on the list and if still
  available then leave alone if not find another source or item to replace.

Unknown Herbicide (Symptomology Plots)

Changes shown highlighted.

Potential Herbicide Families and Herbicides	
Amide 1. propanil (4.0 lb ai/A POST)	**Isoxazoline** 12. pyroxasulfone (0.106 lb ai/A PRE)
Sulfonanilide 2. diclosulam (0.0236 lb ai/A PRE)	**Phenoxy** 13. 2,4-D (0.5 lb ae/A POST)
Benzoic acid 3. dicamba (0.25 lb ai/A POST)	**N-Phenylphthalimide** 14. flumioxazin (0.064 lb ai/A PRE)
Bipyridylium 4. paraquat (0.5 lb ai/A POST) + NIS	**Phosphinic acid** 15. glufosinate (0.54 lb ai/A POST) + NIS
Chloroacetamide 5. acetochlor (1.75 lb ai/A PRE)	**Pyrimidinedione** 16. saflufenacil (0.0223 lb ai/A POST) + MSO
Arloxyphenoxypropionate 6. quizalofop-P (0.085 lb ai/A POST) + COC	**Arylpicolinate** 17. florpyrauxifen-benzyl (0.0261 lb ae/A POST) + MSO
Dinitroaniline 7. pendimethalin (1.0 lb ai/A PRE)	**Substituted urea** 18. diuron (0.5 lb ai/A POST) + COC 19. fluometuron (1.0 lb ai/A PRE)
Diphenylether 8. fomesafen (0.25 lb ai/A POST) + COC	**Sulfonylurea** 20. chlorimuron (0.0156 lb ai/A POST) + NIS 21. trifloxysulfuron (0.007 lb ai/A POST) + NIS
Glycine 9. glyphosate (0.77 lb ae/A POST) + NIS	**Triazine** 22. atrazine (1.5 lb ai/A PRE) 23. metribuzin (0.375 lb ai/A PRE)
Imidazolinone 10. imazethapyr (0.063 lb ai/A POST) + NIS	**Triazolinones** 24. carfentrazone (0.023 lb ai/A POST) + COC
Isoxazolidinone 11. clomazone (0.375 lb ai/A PRE)	**Triketone** 25. mesotrione (0.094 lb ai/A POST) + MSO

Finally, Chair added Rice and Peanut to crops for Farmer Problem, removed Sunflower and Tomato.

No further business, adjourned.

Computer Application Report – Askew

Shawn respectfully reports there is nothing to report.

Research Committee Report – Clete Youmans

TITLE: 2019 Most Common and Troublesome Weeds in Broadleaf Crops, Fruits and Vegetables in the Southern U.S. (states of SWSS Research Committee members)

COMMENT: Data for this summary were provided by the WSSA and this report is based on values specifically collected from respondents inside the SWSS area. Any weed could be listed on the survey. Recipients of the survey were asked to rank weeds from first to fifth in two categories (Most Troublesome and Most Common). See attached .xls spreadsheet for SWSS specifics. [A .ppt is available which covers all information provided by the WSSA.]

COMBINED MOST TROUBLESOME + COMMON WEEDS:

The most listed "top 10" troublesome + common SWSS weeds including all top five rankings and the percent of the time mentioned: (n = 836 weeds)

Genus	# of respondents	% (ranked from 1 to 5)
Amaranthus	152	17
Ipomoea	122	14
Cyperus	82	9
Erigeron	52	6
Portulaca	36	4
Echinochloa	30	3
Urochloa	30	3
Eleusine	28	3
Sorghum	26	3
Digitaria	26	3

MOST COMMON WEEDS:

#1 ranked "Most Common" Weed: These weeds were ranked as the #1 "Most Common" and the percent of the time they were mentioned #1 is listed (n=88).

Genus	..%..

Amaranthus	53%
Lamium	8%
Echinochloa	6%
Cyperus	6%
Digitaria	5%
Erigeron	3%
Setaria	2%

Mentioned once (<1%) were: *Andropogon, Bidens, Eclipta, Galinsoga, Ipomoea, Lepidium, Medicago, Megathyrsus, Parthenocissus, Portulaca, Rottboellia, Senna, Sesbania, Sida*, and *Triticum*.

A *Combined Grouping* of the "Most Common" Weeds: A combined group of the #1, #2, and #3 most commonly ranked weed and the percent of the time they were mentioned is listed.

Genus	**..%..**
Amaranthus	23%
Ipomoea	9%
Cyperus	7%
Echinochloa	6%
Digitaria	5%
Urochloa	4%
Conyza	3%
Sorghum	3%
Lamium	3%
Eleusine	2%

To better understand these data of common weeds an example is: *Ipomoea* was only rated by one person as the #1 most common weed, however Ipomoea is listed more often than any other genus as the second and third most common weed, resulting in *Ipomoea* being the second most common weed when evaluating the top three combined rankings.

MOST TROUBLESOME WEEDS:

#1 ranked "Most Troublesome" Weed: These weeds were ranked as the #1 "Most Troublesome" and the percent of the time they were mentioned #1 is listed.

Genus	..%..

Amaranthus	50%
Cyperus	13%
Ipomoea	6%
Lamium	3%
Bassia	2%

Ambrosia, Bidens, Crepis, Cynodon, Echinochloa, Erigeron, Raphanus, and *Toxicodendron* were listed twice (<2% of the time).

Allium, Andropogon, Arachis, Chenopodium, Cirsium, Descurainia, Ipomoea, Lepidium, Medicago, Oenothera, Parthenium, Senna, Setaria, and *Sorghum* were listed once (<1% of the time)

A *Combined Grouping* of the "Most Troublesome" Weeds: A combined group of the #1, #2, and #3 most troublesome ranked weeds and the percent of the time they were mentioned is listed.

Genus	..%..
Amaranthus	25%
Cyperus	14%
Ipomoea	6%
Erigeron	6%
Echinochloa	4%
Portulaca	3%
Bassia	2%

Other weeds mentioned more than once (occuring <1% of the time) included: *Ambrosia, Chenopodium, Commelinia, Lamium, Mollugo, Portulaca, Raphanus, Sida, Solanum*, and *Sorghum.*

These "most troublesome weed" data indicates *Amaranthus* was judged as being not only the #1 most troublesome weed from 25% of the responses but was also considered troublesome when considering what was a combined group of the #1, #2, and #3 most troublesome weeds. *Lamium* was ranked as the #1 most troublesome weed by 3% of the respondents. *Lamium* didn't rank high as the second or third most troublesome weed, and therefore doesn't' appear in the top seven weeds ranked in a combined group of 1st, 2nd, or 3rd most troublesome.

2020 SWSS Research Committee Members:

Alabama:	S. Li
Arkansas:	N. Burgos

Florida:	P. Dittmar
Georgia:	E. Prostko
Kentucky	T. Legleiter
Louisiana:	D. Miller
Mississippi:	J. Byrd
Missouri:	K. Bradley
North Carolina:	W. Everman
Oklahoma:	T. Baughman
Puerto Rico:	W. Robles
S. Carolina:	M. Marshall
Tennessee:	L. Steckel
Texas:	P. Dotray
Virginia:	S. Askew
Chairperson:	C. Youmans

Minutes of committee meeting: Communications were via email prior to the annual SWSS meeting ending Jan. 30, 2020. A motion was made by L. Steckel to approve this report and seconded by J. Byrd. After no discussions a vote was held which approved this report on Jan. 20, 2020.

Graduate Student Contest Committee Report – Kelly Backsheider

1. **MS/PhD Posters – 22 students in 2020** (30 total in 2019 – 15 Masters and 15 PhD)
   - Of the 22 students in 2020…
     - 13 students in MS posters (2 sections)
     - 9 students in PhD posters (1 section)

   MS/PhD Oral Papers – 55 total students in 2020 (43 total students in 2019 - 26 students in MS contest and 17 students in PhD contest)

   - Of the 55 students in 2020…
     - 29 students in MS papers (4 sections)
     - 26 students in PhD papers (4 sections)

2. Issues with the submission system with students accidentally being double entered in both contests (6 students double entered and only one meant to do that). Other issues with the submission system at times.

3. Handful of students dropped or switched contests between November and the meeting.
4. Graduate student awards will be given at a society reception on Wednesday evening at 6:30PM. Scoresheets will be returned to the students at this time.
5. Discussed implementing digital scoresheets for judging for the poster contest. Jim Brosnan created a google form that follows the scoresheet listed in the MOP.
   - Current challenges:
     - Can only have one form open at a time. You have to fill in the form and then click submit before starting another student's form (Question for Jim….can you create a document with multiple scoresheets that only has to be submitted once?).
     - Harder to write comments on a device vs. paper and the comments are helpful for students to see.
     - Does everyone have a device that they feel comfortable judging with and being able to see well enough or would renting/buying devices be a better option.
     - Internet/cellular service was extremely poor at this meeting location and it's likely that judges would have had trouble accessing and submitting forms.
6. Pete Eure will be the chair of the graduate student contest committee in 2021. Tommy Butts will assist and follow as the chair in 2022.
7. The committee would like to recommend Matthew Wiggins (Matthew.Wiggins@fmc.com) for the graduate student contest committee.

Finance Committee Meeting Minutes – Clete Youmans

Monday Jan. 27, 2020 10-11:00am

Members present: Eric Webster (President-Elect), Jacob Reed, Larry Steckel, Jim Brosnan, Phil Banks, Tom Barber, and Kelley Mazur (Business Mgr.), Clete Youmans (Chair).

Non-Members present: Darrin Dodd

Members absent: J. Schultz and M. Bagavathiannan

J. Reed agreed to collect the minutes. A meeting agenda was handed out and approved. Finance committee responsibilities were covered by C. Youmans.:

1. J. Reed (Sustaining Membership Chairperson) covered the Sustaining Membership Committee request to change the MOP: "The Sustaining Membership Committee is requesting a change to the SWSS MOP under section SUSTAINING MEMBERSHIP COMMITTEE on page 67 and **asking that this change be voted on during one of the board meetings of the 2020 SWSS Meeting in Biloxi.** We are asking for this change to be voted on during the 2020 meeting so that it can be implemented early in 2020.

A. In March prepare a letter for the Business Manager to mail to current sustaining members requesting continued support for the SWSS and payment of fees including

an invoice. In June and September send follow-up letter to those unpaid. (A complete, up-to-date file on sustaining members is maintained by the Business Manager.)

Note that Sustaining Members can have an exhibit booth at the annual meeting at no extra charge if space is available.

B. In March and June solicit new members by letter, including an application for sustaining membership.

The finance committee approved the request from the Sustaining Membership Committee and will present this request to the SWSS Board later in the week (Monday or Thursday).

2. C. Youmans discussed the SWSS Profit and Loss Sheet as well as the Balance Sheet provided by K. Mazur. All expenses were in order and there was no necessary action on the CD's at this time. There were discussions about the Tulsa meeting expense as well as the Weed Contest expenses and movement of money to the Endowment for repaying 2018 Weed Contest overrun. The Profit/Loss and Balance sheets were approved by the committee. A summary of the Financial report for 2019 is below which will be presented at the Business Meeting on Monday Jan. 27:

Financial Reports presented for Jan. 1, 2019 through Dec. 31, 2019.

Gross income:	$154,330.72
Total expenses:	$190,195.79

[Comment: Approximately $26,000 was applied in late 2019 as a down payment for the Beau Rivage Hotel for the Jan. 2020 annual meeting.]

Net income:	$- 35,865.07
Bank accounts total	$315,765.31
(checking, savings, RBC account, money market account and CDs)\	
Accounts receivable:	$ 4,000.00
Total assets:	$319,298.35

3. The IMI contract was reviewed and several amendments were requested from IMI/K. Mazur.

Financial Mgt. Section 1.0

1.C) Add to preparing monthly, customized financial statements… to add "and send or email monthly statements to the Financial Chairperson"

1.G) Delete the line "Preparing and dispersing an annual budget"

1.H) Remove the words "*of surplus*" from the line "Consult with the SWSS Finance

Committee to determine a strategy on the investment of surplus funds."

1.U) Change the work "Work with the Chair of the Sustaining Membership Committee to send the notice of dues renewal to Sustaining Members each May" to indicate the month of March.

Board Meeting Support Section 2.0

2.C) change the word "suspended" to "lapsed"

Annual Meeting Management Section 3.0 / Attendee Registration Administration:

3. ARA F) Change the line to "Print programs for the annual meeting, mail or email or make available on the website, a copy for each registered member prior to the meeting.

Based of these changes being made, the finance committee voted to recommend the SWSS BOD accept the contract which requests an annual fee of $27,624 to be paid in monthly installments of $2302.00 from Jan. 1 2021 to Dec. 31, 2025.

4. The Finance Committee had a motion and approved the motion to recommend to the SWSS BOD a change in registration fees as follows in the MOP (p. 18).

Preregistration from $325 to $400

Walk in Registration fee from $375 to $425

Student preregistration fee for the entire conference from $100 to $200

Student walk-in registration fee for the entire conference, from $100 to $250

Submitted by the Finance Committee to the SWSS BOD on Thursday Jan. 30, 2020.

Long Range Planning Committee Report

No report.

Business Managers Report

Report by: Kelley Mazur

Please see the previous report provided on 1/30/2020

Annual Meeting Summary:

The total number of registered were 282 – 102 students, 175 Regular, 5 Spouse Registration – 28 registered on site. Complimentary registration was given to Joe Omielan for his photographic recording of the event. Registration income totaled $67,772.44 with additional meeting support of $2553.35 for Break sponsorship and Student Mixer food and beverage. The SWSS Endowment raised $4605.65, which includes funds from Sustaining Membership, golf tournament registrations and the silent auction.

Final Bill Comparison:

Biloxi		**OKC**
Banquet and Catering - $45,894.41	vs.	Banquets and Catering: $51,156.63
Exhibitor Services (AV) - $7,396.42	vs.	PSAV: $13,636.73
Room & Tax - $2898.88	vs.	Room & Tax - $923.00
----------	vs.	Room Set-Up/Keys/Rental:
$2,743.41		
Business Center Charges - $60.50	vs	----------

Comps applied:

Complimentary Services: $1,779.81
Rebate on Rooms: $3,190.00

Additional costs incurred are Poster Boards and printed programs. There is an outstanding payment from WSSA and WSWS for $2220.41 for the Crowd Compass meeting app. Costs from 2019 in OKC also include poster boards, programs, supplies and honorariums.

Below is a summary of past meeting registration for reference.

	Biloxi	*Oklahoma City*	*Atlanta*	*Birmingham*	*San Juan Joint*	*Savannah*
	2020	*2019*	*2018*	*2017*	*2016*	*2015*
Members	172	169	246	224	652	270
Students	101	97	95	98	72	98
Total	249	237	341	322	724	362
Final	282	266	376	420	724	362

There were 268 title/abstract submissions. 126 of them were posters and142 papers. SWSS was the official launch of the Weed Science Meeting abstract system, funded by WSSA and regional weed science societies, and the first to use the system.

Financial Reports:
P&L and Balance Sheet attached. CD 5 was cashed and $21,335.74 deposited into the Money Market. $6,000 from the Money Market has been moved to checking to cover deposits for the 2021 meeting. This transfer will reflect on
the next reconciliation report.

Membership Numbers:

There are currently 408 members with current membership status. See the breakdown here:

Government – 9
Industry – 124
Member (Non-Descript) – 8
Retired – 3
Student – 65
University – 192
Other – 7

Fellows did not pull from the database so I will be working on defining them in the database as well as clearing out old data. The SWSS database holds information for members going back to 2016 and typically holds 3 years of membership data, so clearing out older accounts will be our next task.

Sustaining Membership invoices are in process in will be going out later this week or early next week.

Respectfully submitted by Kelley Mazur, SWSS Business Manager

Local Arrangements Committee Report

Report by: Darrin Dodds

Local arrangements were carried out by Darrin Dodds, Bradley Norris, William Rutland, Joey Williams, Steven Hall, and Jacob McNeal. Hotel staff at the Beau Rivage were very accommodating and no issues were noted with respect to speaking room organization, audio/visual, signage, etc. The SWSS has signs that are typically placed outside of each room denoting which sections that ongoing presentations represent – these were not needed in 2020 as the Beau Rivage accommodated all signage needs. In addition, Dr. Eric Webster as well as his staff and students were very helpful in transporting projectors, computers, etc. to the annual meeting.

The poster room was somewhat cramped given the number of poster presentations in 2020 and the poster boards were very poor quality. If the SWSS annual meeting returns to Biloxi, an alternate source of poster boards is recommended.

As a whole, Biloxi and the Beau Rivage were accommodating of the SWSS annual meeting.

Graduate Student Report

Report by: Kelly Backscheider

We had a total of 22 student participate in the MS and PhD poster contest and 56 students participate in the paper contest. We were able to have 2 MS and 2 PhD sessions on Tuesday morning of the annual meeting so that only students were presenting during that time. Pete Eure and Matthew Wiggins moderated the PhD paper sessions and Tommy Butts and Tom Barber moderated the MS paper sessions. We also had several volunteers that helped with judging and scoring so thank you to everyone that helped make the contest a success!

Masters Poster Contest Session 1:

1st Place: Cynthia Sias – Texas A & M University

2nd Place: Ruby Tiwari – University of Florida

Masters Poster Contest Session 2:

1st Place: Mason Castner – University of Arkansas

2nd Place: Mason House – Texas A & M University

PhD Poster Contest Session:

1st Place: Maria Zaccaro – University of Arkansas

2nd Place: Ranjeet Randhawa – University of Florida

Masters Oral Paper Contest Session 1A:

1st Place: Tristen Avent – University of Arkansas

2nd Place: Amy Wilber – Mississippi State University

Masters Oral Paper Contest Session 1B:

1st Place: Jake Patterson – University of Arkansas

2nd Place: Brooklyn Schumaker – Mississippi State University

Masters Oral Paper Contest Session 2A:

1st Place: Joshua Joyner – North Carolina State University

2nd Place: Matthew Taylor – Mississippi State University

Masters Oral Paper Contest Session 2B:

1st Place: Kyle Russell – Texas Tech University

2nd Place (tie): Taylor Randell – University of Georgia

2nd Place (tie): Delaney Foster – Texas Tech University

PhD Oral Paper Contest Session 1A:

1st Place: Lavesta Hand – University of Georgia

2nd Place: Frances Browne – Auburn University

PhD Oral Paper Contest Session 1B:

1st Place: Sam Rustom – Louisiana State University

2nd Place: Lucas Webster – Louisiana State University

PhD Oral Paper Contest Session 2A:

1st Place: Lawson Priess – University of Arkansas

2nd Place: Loida Perez – Mississippi State University

PhD Oral Paper Contest Session 2B:

1st Place: John Brewer – Virginia Tech University

2nd Place: Bishwa Sapkota – Texas A & M University

WSSA Representative Report

Report by: John Byrd

Report of the WSSA Board Meeting for SWSS Board

02/29-03/01/2020 Board Meeting

WSSA 2019 Board of Directors

President: Larry Steckel lsteckel@utk.edu (731) 425-4705

President-Elect: Bill Curran wcurran@psu.edu (814) 574-0202

Vice-President: Anita Dille dieleman@ksu.edu (785) 532-7240

Past-President:Scott Senseman ssensema@utk.edu (865) 974-8033

Secretary: Darrin Dodds dmd76@pss.msstate.edu (662) 325-4072

Treasurer: Phil Banks marathonag@zianet.com (575) 649-7157

Director of Publications: Sarah Ward sarah.ward@colostate.edu (970) 491-2102

Chair, Const. & Operating Proc: Mark Bernards ML-Bernards@wiu.edu (309) 313-5918

Member-At-Large Dawn Refsell: dawn.refsell@valent.com (816) 284-5615

Member-At-Large: Bryan Young BryanYoung@purdue.edu (618) 713-6471

Graduate Student Rep: Nick Steppig nsteppig@purdue.edu (618) 719-1315

Regional Reps

APMS: Rob Richardson rob_richardson@ncsu.edu (919) 515-5653 (absent)

CWSS: Francois Tardif ftardif@uoguelph.ca (519) 824-4120

NCWSS: Greg Elmore greg.a.elmore@monsanto.com (314) 694-1744

NEWSS: Rakesh Chandran rakesh.chandran@mail.wvu.edu (304) 293-2603

SWSS: John Byrd Jbyrd@pss.msstate.edu (662) 325-4537

WSWS: Marty Schraer marty.schraer@syngenta.com (208) 250-0937

Executive DSP (ex-off): Lee Van Wychen Lee.VanWychen@wssa.net (202) 746-4686

Executive Secretary (ex-off): Eric Gustafson eric@imigroup.org (720) 318-0567

Program Chair Curran questioned what had been updated by Apex. Gustafson indicated the update was part of the system that allows program chair to arrange presentations in meeting program and was much improved over the old system. The updated part of Apex is not visible for individuals submitting titles. Printed program should be discontinued as corrections and updates can be posted.

Director Gustafson indicated future WSSA meetings will be February 15-18, 2021 in San Antonio, TX; joint with Canadian Weed Science Society in Vancouver, Canada, February 21-24, 2022; joint with Northeastern Weed Science Society in Arlington, VA January 30-February 2, 2023; potential joint with SWSS 2024.

Code of Conduct has been added to registration website, printed program and CrowdCompass mobile app. Still some questions whether registrants should have to acknowledge Code of Conduct to proceed with registration. Constitution chair Bernards added Code of Conduct to MOP (copy sent to Carroll Johnson 02/29/2020). In event issues arise at meeting, IMI CEO Gary Leeper, WSSA Director Gustafson and WSWS/SWSS Director Kelley Mazur will be available to assist, but Gustafson will be initial point of contact. Gustafson said approach would be to isolate parties (ie send to room; if necessary, get hotel property/local security to assist); conduct preliminary independent investigation with parties involved and attempt to resolve and change negative behavior without involvement of external assistance.

Banks reported finance committee recommendation when assets exceed $1.5 M, RFP for projects not currently supported by WSSA should be made; should not exceed $100,000 funding. Motion passed. Motion passed for external review every 3 years and external audit every 6 years. Board warned of phishing attempts. Gave example of bills emailed to committee chairs that required urgent payment or past due. Question asked if WSSA carried insurance to cover phishing scams; Gustafson to check. Stock market reaction to COVID-19 has depressed WSSA net value.

GSA report by Steppig. Wykle Greene (wykle@vt.edu) will be incoming GSA President and WSSA representative. Social media use is topic for luncheon with panel of Andew Kniss (Univ. Wyoming), Lynn Sosnoskie (Cornell Univ.), Meaghan Anderson (Iowa State Univ.), and Joe Ikley (North Dakota State Univ.).

Student contests report by Dodds: WSSA poster and 3-minute verbal. Good student participation in both poster (42) and verbal (55) contests. There will be two rounds of the 3-minute verbal competition to determine winners. M.S. and Ph.D. students will be in separate contests.

Science Policy report by Van Wychen. There were many regulatory issues in 2019. Science Policy Fellows had many opportunities to see real issues and how agencies respond. He felt very positive experience and hopes WSSA will continue the program. EPA reaches out to WSSA to help make decisions. There was a private meeting with EPA a month ago at which EPA requested comments on dicamba; they want to avoid bandage approach to label changes, such as temperature restrictions or tank mix additives. EPA and manufacturers/suppliers are not communicating on the issue. Should WSSA board reach out to encourage dialogue between EPA and dicamba registrants? Board was reminded WSSA should not be lobbyist for industry; Crop Life America plays that role, but WSSA can encourage open communication.

Publications Report by Ward. Authors can now find the raw manuscript once it is accepted with the DOI number, although has been formatted and proofed. There are 3 sources of journal income from Cambridge: 75% of the projected income based on journal use, the additional 25% at end of year, and income from BioOne based on pay per view journal access. Travis Gannon has been asked to consider coordinating revisions of the Herbicide Handbook. Still trying to decide if Handbook should be electronic or print. Motion was made and passed to go with electronic.

MOP report by Bernards. Several minor edits to clarify. GSA by-laws will be added to the appendix for archiving.

Webmaster report. 43% of users access WSSA web from mobile phone based on Google analysis data. Design of the web page is outdated and should be more conducive for mobile access. To update the design will require $10K ± 20%; with approximately 50% spent to move content and 50% to develop new website.

Executive Director of Science Policy intern Fellows John Schramski and Haleigh Summers were introduced to the Board.

EPA liaison report by Kruger. EPA is moving to new building which has less space than current facility; are currently at 60% of the staff compared to 5 years ago. The Liaison position was impacted by the government shutdown 2019. He was able to conduct a drone demonstration and how it could be used in weed science. Meeting location of WSSA annual meeting is crucial to get EPA participation. If near Arlington vicinity, will see better participation compared to distant locations (50 EPA people when meeting was in Arlington, compared to maybe 1 in Maui). Was asked about getting regional EPA office personnel to attend distant locations.

NIFA Fellow report by Kells. NIFA is in temporary location in Kansas City. They will have to move again once renovations are completed at permanent location in KC. Approximately 80% of NIFA employees did not move to KC, so there is an opportunity for weed science hires in that agency. A small staff was kept in DC to communicate with KC office. Jim was discouraged to visit KC frequently due to staff focused on settling in new location, rather than duties. He is working with a statistician at Michigan and has old NIFA data to determine the number of weed science proposals that have been submitted and funded over the last 10 years.

HRAC report by Rex Liebel. The new updated herbicide mode of action poster has been completed and can be found on the HRAC website.

03/05/2020 Board Meeting

WSSA 2019 Board of Directors

President: Bill Curran wcurran@psu.edu (814) 574-0202

President-Elect: Anita Dille dieleman@ksu.edu (785) 532-7240 (absent)

Vice-President: Stanley Culpepper stanley@arches.uga.edu (229) 392-5202

Past-President: Larry Steckel lsteckel@utk.edu (731) 425-4705

Secretary: Darrin Dodds dmd76@pss.msstate.edu (662) 325-4072

Treasurer: Phil Banks marathonag@zianet.com (575) 649-7157

Director of Publications: Christian Willenborg chris.willenborg@usask.ca (306) 966-8354

Chair, Const. & Operating Proc: John Lindquist jlindquist1@unl.edu (402) 472-2771

Member-At-Large: Dawn Refsell dawn.refsell@valent.com (816) 284-5615

Member-At-Large: Lynn Sosnoskie lms438@cornell.edu (229) 326-2676

Graduate Student Rep: Wykle Green wykle@vt.edu (334) 618-9490

Regional Reps

APMS: Rob Richardson rob_richardson@ncsu.edu (919) 515-5653 (absent)

CWSS: Francois Tardif ftardif@uoguelph.ca (519) 824-4120

NCWSS: Greg Elmore greg.a.elmore@monsanto.com (314) 694-1744

NEWSS: Rakesh Chandran rakesh.chandran@mail.wvu.edu (304) 293-2603

SWSS: John Byrd Jbyrd@pss.msstate.edu (662) 325-4537

WSWS: Marty Schraer marty.schraer@syngenta.com (208) 250-0937

Executive DSP (ex-off): Lee Van Wychen Lee.VanWychen@wssa.net (202) 746-4686

Executive Secretary (ex-off): Eric Gustafson eric@imigroup.org (720) 318-0567

Webmaster (ex-off): Sarah Ward sarah.ward@colostate.edu (970) 491-2102

Science Policy: Janice McFarland janisemcfarland@gmail.com (336) 707-5873

Quarterly conference call will be April 23 8 am Central time. Summer board meeting will be in San Antonio. Date dependent on availability at hotel.

There were 3 funding requests made to the Finance Committee: Add the $10,000 that goes to GSA as a line item in the budget; $2500 to support National Invasive Species Awareness Week; $10,000 for the Herbicide resistance action committee. Gustafson estimated $119,000 budget deficit; will not have final financial figures until end of year in November. Motion to approve budget passed.

There were approximately 700 attendees. Poster session was very expensive because boards had to be shipped to island. Some discussion about number of presentations with same first author. Call for presentations limits first author to one oral and one poster presentation, unless there is also an invited presentation.

Motion passed to move into Executive Session: EDSP job description will be rewritten by April conference call. Some discussion on salary adjustment based on behavior at NCWSS adjusted to 1.5% rather than standard 3%. Executive Session closed.

Culpepper briefly discussed regionalized pesticide labels. EPA would ultimately like to develop "smart" labels which would be more pertinent to applicators and specific to use. EPA suggested WSSA draft letter to initiate meeting of registrants and specialists with EPA to discuss regional labels.

Weed Resistance and Technology Stewardship

Report by: Taghi Bararpour

Note: The comments below represent casual conversations of investigative work and do not constitute a report of herbicide resistance. The objective is communication within the industry of where resistance may be occurring but is not yet confirmed.

Attendee: Taghi Bararpour and Jason Bond (MS), Jim Heiser (MO), Nilda Burgos, Jason Norsworthy, Pamela Carvalho, Gulab Rangani, and Maria Zaccaro (AR), Eric Jones (NC), Matthew Cutulle (SC), Hunter Perry (Corteva), Lee Van Wychen (WSSA), Peter Dotray (TX), Andy Kendig (ADAMA), Shawn Askew (VA).

Reporting by Ag Companies:

- Once a resistance case is documented, stop reporting
- Use weedscience.org as repository of resistance information

What is the role of the SWSS HRC?

- Coordinate with companies also in reporting and monitoring resistance cases
- Coordinate with WSSA on resistance matters and weed surveys
- Collate on-going resistance investigations and recent updates. Reports to weedscience.org are delayed. Not everybody submits information there.

Resistance reports by State

- TX
  - False ragweed (ragweed parthenium?) - paraquat
  - Annual bluegrass - broad screening with 10 MOA; may have multiple resistance; at least resistant to ALS inhibitors; suspects are being characterized
- VA
  - Annual bluegrass - two populations resistant to 6 MOAs
  - Buckhorn plantain - resistant to 2,4-D and triclopyr
  - Green kylingga - may have resistance to ALS inhibitors
  - Cress (bittercress, hairy cress?) - resistant to ALS and glyphosate
  - Horseweed - glyphosate
  - Ryegrass - ACCase- and ALS-inhibitors
  - Common lambsquarters - glyphosate and ALS
- MO
  - Palmer amaranth pop surviving 20-30% with dicamba
  - Strong resistance to PPO inhibitors
- NC
  - Palmer amaranth - glyphosate, HPPD, ALS, PPO
  - Waterhemp - glyphosate, ALS, HPPD, atrazine
- SC
  - Palmer amaranth - glyphosate, ALS
- AR
  - Echinochloa - florpyrauxifen

Newsletter Committee Report

Report by: Bob Scott

2019-2020 Committee Members:
Bob Scott, Chair
Susan Scott, editor
Kelley Mazur
James Holloway

2020-2021 Committee Members:
Bob Scott
Susan Scott
Kelley Mazur
Eric Webster

No committee meeting was held in Biloxi. Three annual newsletters were completed during 2019, these were submitted for May, August and December. Articles were received in general on-time by all the key members, President, committee chairs, and our Washington liaison. Editor Susan Scott was paid $100 per issue by the Executive Secretary out of the Presidents discretionary funds. In one of the board meetings it was determined that the newsletter would continue on in 2020 under the same system as 2019.

Submitted by, Bob Scott.

Proceedings Editor Report

Report by: Muthu Bagavathiannan

Proceedings Editor's Report of the 2019 Meeting

The 2019 meeting was held at Renaissance Convention Center Hotel and Spa, Oklahoma City, OK during February 3-6, 2019. The 2019 Proceedings of the Southern Weed Science Society contained 357 pages, including 241 abstracts. By comparison, the 2018 Proceedings of the Southern Weed Science Society contained 429 pages, including 293 abstracts (Birmingham, AL); the 2017 Proceedings ot the Southern Weed Science Society contained 425 pages, including 229 abstracts (Birmingham, AL); the 2016 Proceedings of the Southern Weed Science Society contained 639 pages, including 505 abstracts (San Juan, PR); the 2015 Proceedings of the Southern Weed Science Society contained 397 pages, including 253 abstracts (Savannah, GA); the 2014 Proceedings had 398 pages, including 259 abstracts (Birmingham, AL); the 2013 Proceedings had 387 pages, including 274 abstracts (Houston, TX); the 2012 Proceedings had 277 abstracts and 375 pages (Charleston, SC); the 2011 Proceedings had 342 abstracts and 515 pages (San Juan, Puerto Rico); the 2010 Proceedings had 245 abstracts and 365 pages; the 2009 WSSA/SWSS joint meeting, contained 588 pages; the 2008 Proceedings had 315 pages; 2006 Proceedings contained 325; and the 2005 Proceedings contained 363 pages.

A total of 357 titles (105 posters and 252 oral presentations) were submitted.

The 2019 Proceedings was dedicated to Dr. John Ray Abernathy, 73, of Lubbock who passed away Tuesday, September 18, 2018. He was born in January 4, 1945 to the late George Raymond and Tommy Loys (Fewell) Abernathy in Altus, Oklahoma. John graduated from Altus High School in 1963. He married Cynthia Sue (Canady) Abernathy May 24, 1969 in Tulsa, Oklahoma. John had a passion for agriculture, graduating from Oklahoma State University in 1969, where he received his Bachelor of Science and his Master of Science in Agronomy. He continued to further his education at the University of Illinois receiving his Ph. D. in Agronomy in 1972. John held several positions over the years, he worked at Texas A&M Agricultural Experiment Station in Lubbock as a Weed Scientist and as the Resident Director for a total of 24 years. Those left to cherish his memory are his wife of 49 years, Cindy; daughters, Larisa Abernathy Weldon of Keller, Christy Diann Liles and husband Larry of Frisco; siblings, Larry and wife Lynn Abernathy of Vernon, Frances Abernathy and husband Craig Sterling of San Angelo; five grandchildren, Grayson, Peyton and Megan Weldon, Abigail and Alexis Liles.

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 2019.

Section	Number of Pages
SWSS 2019 Awardees	16
Past Presidents	1
List of Committees and Committee Members Jan 31, 2019– Jan 31, 2020	6
Minutes of Executive Board, Committee Reports, etc	44
Posters abstracts	107
Oral abstracts	141
Survey of Herbicide-Resistant Weeds	1
Registrants of the Annual Meeting	8

Finances (if any) Requested: None

Respectively submitted,

Muthu Bagavathiannan, Proceedings Editor

End of report

Necrologies and Resolutions
Report by: David Black

Four necrology reports were submitted, Mr. Perry Lloyd Hipkins, Dr. Dudley Templeton Smith, Dr. Chester Larrimore Foy.

Mr. Perry Lloyd Hipkins, 73, died on March 30, 2019. He was born on August 26th, 1945 in Frederick, Maryland. Lloyd attended high school in Gaithersburg, Maryland and later joined the United States Army, serving in Vietnam. After leaving the service Lloyd attended Hood College in Frederick, Maryland where he obtained his Bachelor of Science degree in Biology. Lloyd then attended Virginia Polytechnic Institute and State College in Blacksburg, Virginia where he obtained his Master of Science degree.

Following completion of his Master of Science degree Lloyd began his employment with Virginia Polytechnic Institute and State College. Lloyd remained with Virginia Tech. until his retirement in 2017 serving as a Senior Research Associate and Extension Weed Scientist.

Lloyd is survived by his wife Patricia Ann; his sons D. K. Hipkins (Crystal) and Perry Hipkins (Ana Maria); three grandchildren Duane, Evan, and Sabrina; and his siblings, John Walter Hipkins, Charlotte Naomi Miller, and Thomas Scott Hipkins.

WHEREAS Mr. Hipkins served with distinction at Virginia Polytechnic Institute and State College and,

WHEREAS Mr. Hipkins provided numerous contributions to weed science and the Southern Weed Science Society,

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

Mr. Rolf Jesinger, 85, died on May 18, 2019. He was born on September 29th, 1933 in Esslingen Germany. Rolf grew up in Germany during World War II and was driven his whole life to overcome adversity. After the war he lived both in England and in Germany and attended agricultural school in Geisenheim, Germany. Rolf became a life-long member of the Rhenania Fraternity. Rolf worked his entire life in agricultural research.

In the 1960s, Rolf completed a Bachelor of Science degree in horticulture at Cornell University in Ithaca, NY followed by a Master of Science degree from the University of Vermont in Burlington, VT. He became a Unites States citizen in 1969. He worked for Rohm & Haas in

Philadelphia, PA in the late 1960s and overseas in Singapore all through the 1970s. He also spent many years with BASF in Research Triangle Park, NC in the 1980s and 1990s. Rolf was well known in the School of Agriculture at NC State University as well as by many in the farming industry throughout North Carolina.

Rolf is survived by his son Col. Robert Jesinger, MD of Vacaville, CA, and his daughter Meta Penwell, RN of Cheshire, CT.; his brother Dieter Jesinger of Esslingen, Germany; and five grandchildren, Ben, Megan, Claire, Rena, and Aaron.

WHEREAS Mr. Jesinger served with distinction at Rohm & Hoss and then BASF and,

WHEREAS Mr. Jesinger provided numerous contributions to weed science and the Southern Weed Science Society,

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

Dr. Dudley Templeton Smith, age 79, died June 8, 2019. He was raised on a tobacco and beef cattle farm in Southern Maryland, where he was active in 4-H and FFA crop and livestock projects and received the FFA State Farmer degree. In 1965 he married Angela Remsberg, formerly from Middletown, MD, who was the love of his life and steadfast partner in graduate school, travels, and business partner. Dudley earned a Bachelor of Science degree in Agricultural Economics and a Master of Science degree in Agronomy at the University of Maryland, a Ph.D. in Weed Science/Crop Science at Michigan State University in 1968, and an Executive MBA from the University of Houston in 1982.

Dr. Smith had three careers spanning 38 years with the Texas A&M University System (AgriLife Sciences) and a total of 47 years in USDA and Land Grant programs. Upon retirement, the Smiths endowed several scholarships for graduate student travel in agronomy and horticulture, funded a fellowship for a Ph.D. student and undergraduate scholarships for Endowed Opportunity Award, aggieTEACH (STEM) in the College of Science, STEM teaching at Towson University, Baltimore, Maryland and the Department of Criminal Justice at Sam Houston State University.

In 1968 Dr. Smith established a weed research program in cotton in the High Plains at the Texas A&M Center at Lubbock, with emphasis on weed biology and competition, herbicide efficacy, and environmental studies. In 1973 Dr. Smith began serving as Assistant Director, and later Associate Director, of the Texas Agricultural Experiment Station at College Station, TX until 1996. He provided administrative oversight for state-wide research programs in crops, livestock

and natural resources. He also served as board chairman for international research consortiums on sorghum and later, peanuts.

In 1996, Dr. Smith assumed a faculty position in the Department of Soil and Crop Sciences at Texas A&M University. He worked closely with US EPA, USDA, and commodity groups to obtain pesticide registrations for specialty crops. He prepared numerous assessment/white papers on pests and pesticides on environmental and regulator issues at the request of industry groups and USDA. These papers provided objective research perspectives and outlined modified use patterns on otherwise contentious issues for use by US-EPA. Much of his work culminated in a book "The crops of Texas", which described the production, pest problems, and marketing niches of 200 crops of economic importance to Texas and southwestern agriculture. Other research included sustainable agriculture and IPM, economic impacts of chemical use, and international agriculture. He published over 100 scientific articles and papers, plus invited presentations at European conferences.

However, Dr. Smith's most important contribution was in the classroom teaching, where he excelled in helping undergraduate students to discover their potentials as he empowered them to strive for excellence. For a decade he taught an undergraduate course on career opportunities in agronomy, including turf. He met with each student individually at the beginning of each semester to better assist them in achieving their goals. Local and regional field trips helped students expand their horizons and career opportunities. A senior-level program focused on career orientation, enabling students to develop competitive resumes, research firms, and develop interview skills. Dr. Smith received Achievement Awards for classroom teaching. He was a member of several societies and was selected as a Fellow in the American Society of Agronomy. Dr. Smith retired May 31, 2006 as Professor Emeritus.

Dr. Smith was preceded in death by his parents. He is survived by his wife, Angela Remsberg Smith, steadfast companion of nearly 54 years; a son, Gresham R. Smith and wife, Barbara S. Smith; daughter, Beth R. Glasshoff; one grandson, 2 granddaughters; and two sisters.

WHEREAS Dr. Smith served with distinction at Texas A&M and the USDA and,

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

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

Dr. Chester Larrimore (Larry) Foy, 91, died on November 12, 2019. Larry was born on July 8th, 1928 near Dukedom, Kentucky. He grew up living on the Kentucky/Tennessee state line in

a country store operated by his parents. His family later moved to Martin, Tennessee where he attended high school. Upon graduation, Larry entered the Army's Specialized Training Reserve Program. As a commissioned officer, he led an Army Corps of Engineers platoon in the construction of runways during the Berlin Airlift following World War II.

Upon returning to the United States, Larry completed his Bachelor's Degree in Agronomy in 1952 from the University of Tennessee. While in Knoxville, Larry met his future wife Betty Reed, while she was attending nursing school. Larry then attending the University of Missouri, where he attained his Master of Science degree in Field Crops. Following completion of his M.S. degree he and Betty were married. From there, the couple moved to California where Larry completed a Ph.D. in Plant Physiology from the University of California-Davis in 1958. Following completion of his Ph.D. Dr. Foy was invited to remain at UC-Davis as a faculty member in Botany.

In 1964, Dr. Foy took a one-year sabbatical leave in Frederick, MD to work on the development of chemical defoliants for the Army at Fort Detrick. In 1966, Dr. Foy accepted a position as a faculty member at Virginia Polytechnic Institute as a professor in the Plant Pathology and Physiology Department. Dr. Foy remained at Virginia Tech for 36 years, six of those years serving as department head. While at Virginia Tech his responsibilities entailed research and teaching in weed science and related subjects. As an internationally recognized expert on the physiology and biochemistry of herbicide mechanisms of action and adjuvants, he was widely published. He played leading roles on projects to eliminate crop devastation due to parasitic weeds.

Dr. Foy was a long standing an active member of the SWSS and WSSA. Dr. Foy was recognized by the Southern Weed Science Society as its very first Weed Scientist of the Year/Fellow in 1984. He was also recognized by the Weed Science Society of America as its Outstanding Researcher, the International Weed Science Society with an Outstanding Achievement Award, and the Sigma Delta International Award for Distinguished Achievement in Agriculture. Dr. Foy served as president of the WSSA and later as president of IWSS, and was affiliated with several other professional organizations.

Dr. Foy is survived by his family: son Richard Foy (Cindy); daughter Martha Foy; grandson Steven Foy (Caity DiSanza), three granddaughters; 2 great granddaughters; and several nephews and nieces. He was preceded in death by his loving wife, Betty Reed Foy; parents Charles Clinton Foy and Zylphia Gertrude Foy; and siblings Charles Foy, Paul Foy, and Evelyn Foy.

WHEREAS Dr. Foy served with distinction at Virginia Polytechnic Institute and,

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

THERFORE BE IT RESOLVED that the officers and membership of the Southern Weed Science Society do hereby take special note of the loss of our coworker, Dr. Chester Larrimore

(Larry) Foy, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

2020 MEETING ABSTRACTS

CONTROLLING WEEDY RICE USING REDUCED RATES OF QUIZALOFOP. DC Walker*, EP Webster, BM McKnight, SY Rustom, LC Webster, WB Greer; LSU AgCenter, Baton Rouge, LA (12)

ABSTRACT

A current weed management issue in rice-producing areas throughout the world is the management of weedy rice (*Oryza sativa* L.), more particularly, imidazolinone-resistant (IR) weedy rice. With concerns around IR weedy rice resistance, BASF developed a new herbicide resistant-rice sold under the trade name Provisia®. The herbicide targeted for use is quizalofop, which will also be sold under the trade name Provisia®. Quizalofop is a Group 1 herbicide, which inhibits the acetyl-coA carboxylase (ACCase) enzyme. The targeted single quizalofop application rate in ACCase-resistant rice production is 92 to 155 g ha^{-1}, not to exceed 240 g ha^{-1} yr^{-1}. Research was conducted at the Rice Research Station near Crowley, Louisiana to evaluate the activity of quizalofop at different rates for management of weedy rice. Quizalofop was applied at 23.2, 46.2, 69.2, 92.4, and 116 g ha^{-1} to weedy rice at the two- to three-leaf stage and at panicle initiation to determine the rate needed for control. Quizalofop was applied with a crop oil concentrate at 1% v v^{-1}. All herbicide applications were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 93.5 L ha^{-1}. Plot size was 3 m by 11.3 m with 16, 19.5 cm drill-seeded rows of weedy rice planted at 67 kg ha^{-1}. The study was a randomized complete block with three replications. In order to have an accurate representation of a weedy rice population, four separate studies were conducted using four different types of weedy rice: a conventional line, an imidazolinone-resistant hybrid line, an inbred imidazolinone-resistant hybrid line, and red rice. Weedy rice control was recorded at 7, 14 and 28 days after treatment (DAT) and plant heights were recorded at 7 and 28 DAT and at crop maturity. Results indicated that 93 g ai ha^{-1} of florpyrauxifen adequately controlled Cl-111, ClXL-745 and red rice while 46 g ai ha^{-1} adequately controlled Mermantau weedy rice at least 28 DAT. Therefore, reduced rates can be used to manage weedy rice and minimize the amount of applied active ingredient throughout the growing season.

EFFECT FLORPYRAUXIFEN-BENZYL ON DIFFERENT RICE CULITVARS. HM Edwards*[1], JD Peeples[1], TL Sanders[1], B Lawrence[1], H Bowman[2], JA Bond[1]; [1]Delta Research and Extension Center, Stoneville, MS, [2]University of Arkansas, Fayetteville, AR (13)

ABSTRACT

Florpyrauxifen-benzyl is a postemergence (POST) herbicide developed by Corteva Agrisciences for control of broadleaf, grass, and sedge weeds, and it is a member of the synthetic auxin herbicide family, the arylpicolinates. The arylpicolinates have a unique site of action within susceptible broadleaf, grass, and sedge weed species. Postemergence applications may be made from the two- to three-leaf rice stage up to 60 d before harvest, and flooding within 5 d of application improves weed control. Previous research in Mississippi has demonstrated that rice cultivars respond differently to florpyrauxifen-benzyl; however, that work only evaluated a limited number of cultivars. Therefore, research was initiated to evaluate the response of commercial rice cultivars to sequential POST applications of florpyrauxifen-benzyl applied at different rates. The study was conducted in 2019 at the Mississippi State University Delta Research and Extension Center in Stoneville. Individual plots measured 1.4 m in width and 3.8 m in length. 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 'Diamond', 'RTXL753', 'CL153', and 'RT7321-FP'. Factor B was florpyrauxifen-benzyl treatment and consisted of no florpyrauxifen-benzyl treatment, single applications of florpyrauxifen-benzyl at 0.029 and 0.059 kg ai/ha, and a split application of florpyrauxifen-benzyl at 0.029 followed by (fb) 0.029 kg ai/ha. Single applications were applied to rice in the two- to three-leaf growth stage. Split applications were applied to rice at the EPOST stage fb the sequential treatment 14 d after EPOST application timing (LPOST). Visible estimates of rice injury on a scale of 0 to 100% (0 = no injury and 100 = total plant death) were recorded at 7, 14, and 28 d after the LPOST treatment by comparing treated plots with control plots for the respective cultivar in each replication. Plant heights were recorded 14 d after LPOST treatment. The number of days to 50% heading was recorded as an estimate of rice maturity and was converted to delay in days to 50% heading by subtracting data from the nontreated plot from that in the treated plot for the respective cultivar in each replication. Rice height and rough rice yield were collected at maturity, and these data were converted to a percent of the control for the respective cultivar in each replication by dividing data from the treated plot by that in the nontreated plot and multiplying by 100. All data were subjected to ANOVA, and estimates of the least square means were utilized for mean separation with $p = 0.05$. Rice injury from florpyrauxifen-benzyl was rolling of leaves, minor discoloration, and less dense canopy in treated plots compared with the nontreated control for the same cultivar. Injury 14 and 28 d after LPOST treatment was similar among all florpyrauxifen-benzyl treatments for each cultivar. Although injury 14 d after LPOST for Diamond was less with split applications of florpyrauxifen-benzyl compared with either rate applied as a single application, injury was = 5% for all florpyrauxifen-benzyl treatments. Diamond was injured less than other cultivars 14 and 28 d after LPOST following florpyrauxifen-benzyl in a single application at 0.059 kg/ha and with the split application. Pooled over florpyrauxifen-benzyl treatments, rice height 14 d after LPOST was lower for Diamond compared with CL153 and RT7321-FP. Additionally, RTXL753 height was less than that for Diamond. Florpyrauxifen-benzyl treatment did not influence rice maturity or rough rice yield. Delay in days to 50% heading was = 2 d, and rough rice yields were = 94% of the nontreated for all cultivars and florpyrauxifen-benzyl treatments. Current labeling only allows florpyrauxifen-benzyl application at 0.029 kg/ha. Furthermore, it is unlikely that multiple applications of florpyrauxifen-benzyl will be applied at a single site. 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. In the current research, Diamond was injured less than other cultivars with florpyrauxifen-benzyl 14 d after LPOST treatment. Despite observed differences in injury, rice maturity and rough rice yield were not affected for any cultivar. This demonstrates that florpyrauxifen-benzyl can safely be applied to Diamond, RTXL753, CL153, and RT7321-FP.

AQUATIC WEED RESPONSE TO HERBICIDE APPLICATION IN LOUISIANA RICE PRODUCTION. BM McKnight*, EP Webster, SY Rustom, LC Webster, WB Greer, DC Walker; LSU AgCenter, Baton Rouge, LA (14)

ABSTRACT

Rice fields are typically rotated with crawfish (*Procambarus clarkii* Girard) aquaculture production systems in South Louisiana. Extended periods of inundation with flood irrigation water can select for the growth habit of aquatic weeds. A field study was conducted at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate herbicide activity on troublesome aquatic weeds common to Louisiana rice/crawfish rotational systems. Plot size was 1.5 m by 5.2 m and experimental design was a randomized complete block design with four replications. A 91-cm diameter galvanized metal ring was installed within each plot for herbicide treatment containment and to provide a defined area for transplanting aquatic weeds. Grassy arrowhead (*Sagittaria graminea* Michx.), pickerelweed (*Pontedaria cordata* L.), and ladysthumb (*Polygonum persicaria* L.) were transplanted 3 weeks prior to treatment to allow for plant establishment. A natural infestation of ducksalad [*Heteranthera limosa* (Sw.) Willd.], yellow nutsedge (*Cyperus esculentus* L.), and alligatorweed [*Alternanthera philoxeroides* (Mart.) Grisb.] was also present in the study area. No rice was planted in this study to minimize competition between rice plants and weeds. Herbicide treatments consisted of seven herbicides labeled for use in rice production, applied alone or in mixture. All herbicide treatments included crop oil concentrate at 1% v v^{-1}. Herbicide application consisted of treating the entire plot with a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1} spray solution and a handheld spray boom with five flat-fan 110015 nozzles at 38-cm spacing. Visual injury ratings were recorded at 14, 28, 42, and 56 DAT. Plants were hand-harvested at the conclusion of the study, 56 DAT, and grouped by species for fresh weight biomass determination. The pre-packaged mixture of halosulfuron plus prosulfuron applied at 111 g ai ha^{-1} controlled pickerelweed, grassy arrowhead, yellow nutsedge and alligatorweed 97%, 96%, 96%, and 96% at 56 DAT, respectively. No biomass of these weed species was present in containment rings 56 DAT. Florpyrauxifen-benzyl applied at the label rate of 30 g ai ha^{-1} controlled pickerelweed, grassy arrowhead, ladysthumb, and ducksalad 90%, 96%, 55%, and 80% at 56 DAT, respectively. Penoxsulam applied at 40 g ai ha^{-1} controlled pickerelweed, grassy arrowhead, yellow nutsedge, and alligatorweed 89%, 97%, 78%, and 93% at 56 DAT, respectively. Grassy arrowhead, yellow nutsedge, ladysthumb, and alligatorweed was controlled 97%, 84%, 79%, and 86%, respectively, following treatment with the pre-packaged mixture of penoxsulam plus triclopyr at 56 DAT. The results from this study indicate that several products labeled for use in rice production have activity on troublesome aquatic weeds in South Louisiana rice/crawfish rotations. These results will assist growers utilizing this rotational system in developing weed management decisions.

A COMPARISON OF FOREIGN MATERIAL IN SOYBEAN GRAIN SAMPLES ALONG THE MISSISSIPPI RIVER VALLEY. RM Porter*[1], LM Lazaro[1], JT Copes[2], K LaGraize[3], G LaBiche[1]; [1]LSU AgCenter, Baton Rouge, LA, [2]LSU AgCenter, St. Joseph, LA, [3]RMG, New Orleans, LA (15)

ABSTRACT

The United States is ranked 2nd in the world when it comes to exporting soybeans, whereas Louisiana is ranked 17th for exporting agricultural products, including soybeans. China is the lead importer of United States soybeans and maintains particular standards for foreign material in soybean grain shipments. In effort to maintain such standards, the USDA has implemented the Systems Approach to help growers to ports lower the foreign material (FM) amount that is found in grain samples. So far, in nearly 80% of soybean shipments four weed species have been specifically identified: common ragweed, common cocklebur, johnsongrass, and pigweed species, such as Palmer amaranth or waterhemp. While it has been identified that changes are needed, there has been limited research on what comprises the FM, specifically weed seeds, in these samples from farm to port. Thus, the objective of the study was to determine what proportion of the FM comprised of weed seeds and to qualify those seeds. Fifty soybean samples were taken from barges travelling down the Mississippi River Valley as well as thirty-one samples from Louisiana grain elevators. Each sample was weighed and then each fraction of the foreign material was separated, weighed, and counted to determine the exact proportion of each fraction. Each sample contained FM, most of which was debris, such as dirt, stems, rocks. The overall FM level was not consistent based on where the sample was retrieved, grain elevator or barge. Additionally, all four weeds of concern were found in all barge samples and only Johnsongrass and pigweed species in the elevator samples. Weed seeds comprised of an average of 0.29 and 0.08% in elevator and barge FM, respectively. A better understanding of the FM in grain samples will allow the US to more accurately know which weed seeds are found and how to better educate those who come into contact with the samples.

BERMUDAGRASS (CYNODON DACTYLON) RESPONSE TO FALL APPLIED POSTEMERGENCE TRICLOPYR TANK-MIXTURES FOLLOWING SEED CANE HARVEST. DJ Spaunhorst*; USDA-ARS, Houma, LA (16)

ABSTRACT

Bermudagrass is a difficult to control perennial weed infesting sugarcane (*Saccharum* spp. hybrids) in Louisiana. Sugarcane, which is vegetatively propagated, is harvested for seed during the grand growth phase of crop development. During the grand growth phase, from July until September, water uptake and sugarcane biomass accumulation is high. Shading from the crop limits sunlight from reaching lower canopy levels and causes bermudagrass to enter a shade-induced dormancy in late-summer. However, once seed cane is harvested, the warm temperature and abundant sunlight facilitate bermudagrass to break dormancy rapidly and infest resprouting sugarcane ratoons. The objectives of this study were to determine the effects of herbicide application timing and triclopyr tank-mixtures on bermudagrass in seed cane. Bermudagrass densities were often greater in single herbicide treatments when comparted to mixtures with triclopyr. Triclopyr (1.1 kg ae ha^{-1}) tank-mixed with diuron (2.8 kg ai ha^{-1}), hexazinone (0.74 kg ai ha^{-1}), or topramezone (24 g ai ha^{-1}) and applied postemergence in September or October reduced bermudagrass stolon density 48 to 98% by December, when compared to the nontreated at both locations. However, fewer stolons were reported in February only with the aforementioned tank-mixtures applied in October. The mesotrione (0.1 kg ai ha^{-1}) plus triclopyr (1.1 kg ae ha^{-1}) mixture was not sensitive to application timing and reduced stolon densities 45 to 63% by February when compared to the nontreated check. Results from this study showed several herbicide mixtures, with different sites of action, applied in the fall to reemerging sugarcane could be mixed with triclopyr to reduce bermudagrass infestation levels. Sequential herbicide treatments may be necessary in spring when bermudagrass emerges from winter dormancy.

A MULTIFACETED APPROACH TO THE RECLAMATION OF BERMUDAGRASS PASTURES.

GM Henry*, NT Basinger, DW Hancock; University of Georgia, Athens, GA (17)

ABSTRACT

Abandoned or underutilized pastures are often infested with significant weed populations that may affect grazing and/or production potential of the original stand. Research was conducted in 2018 and 2019 at the Athens Turfgrass Research and Education Center in Athens, GA to evaluate the impact of several management strategies on the population dynamics of existing weed and forage species. The experimental site consisted of a 'Coastal' hybrid forage bermudagrass [*Cynodon dactylon* (L.) Pers.] pasture infested with horsenettle (*Solanum carolinense* L.), green foxtail [*Setaria viridis* (L.) P. Beauv.], yellow foxtail [*Setaria pumila* (Poir.) Roem. & Schult.], buckhorn plantain (*Plantago lanceolata* L.), and tall fescue [*Lolium arundinaceum* (Schreb.) Darbysh]. Treatment programs were initiated in late September 2018 and consisted of a non-treated check, mowing to a height of 12.7 cm in September followed by (fb) pendimethalin at 1.9 kg ai ha^{-1} (1 wk after mowing) plus mowing in March fb aminopyralid + 2,4-D at 1.1 kg ai ha^{-1} (2 wks after mowing), mowing in September fb pendimethalin at 1.9 kg ai ha^{-1} plus mowing in March, mowing in September plus mowing in March fb aminopyralid + 2,4-D at 1.1 kg ai ha^{-1}, and mowing in September plus mowing in March. Herbicide treatments were applied with a four-nozzle CO2 powered backpack sprayer calibrated to deliver 375 L ha^{-1} at 221 kPa. Percent bermudagrass cover along with % control of horsenettle, foxtail spp., buckhorn plantain, and tall fescue was determined visually throughout the duration of the trial. By mid-June 2019, the greatest increase in bermudagrass cover was observed in response to double mowing + pendimethalin (68% increase) fb the non-treated check (53% increase), and mowing twice (50% increase). Horsenettle control by mid-June was greatest in response to double mowing + pendimethalin and aminopyralid + 2,4-D (95%) fb double mowing + aminopyralid + 2,4-D (92%). All other treatments resulted in = 36% horsenettle control. Foxtail spp. control by mid-June was greatest in response to double mowing + pendimethalin (91%) fb double mowing + aminopyralid + 2,4-D (67%). All other treatments resulted in = 44% foxtail spp. control. All treatment programs containing herbicides resulted in = 97% buckhorn plantain control by mid-June, while double mowing alone resulted in a 54% reduction. Tall fescue control was minimal (= 34%) in response to all treatments by mid-June. Successful reclamation of bermudagrass pasture may take several years and can be highly dependent on weed species composition.

EVALUATION OF RESIDUAL HERBICIDES IN WATERMELON PRODUCTION ON BAREGROUND OR A CEREAL RYE COVER. MB Bertucci*[1], A McWhirt[2], A Hotz[3], LM Smith[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Little Rock, AR, [3]University of Arkansas, Alma, AR (18)

ABSTRACT

Field studies were conducted in Alma, AR to evaluate performance of pre-transplant applications of three herbicides for use in watermelon in bareground and cereal rye cover production systems. Treatments were arranged in a split-plot with cover as the whole plot factor and herbicide as the split plot factor. Cereal rye was drill-seeded in September of 2018 and terminated in March of 2019 using a roller crimper and application of glyphosate. Herbicide treatments were applied on April 29, 2019 included *S*-metolachlor (1,014 g a.i. ha^{-1}), fomesafen (175 g a.i. ha^{-1}), and clomazone (280 g a.i. ha^{-1}) + ethalfluralin (896 g a.i. ha^{-1}). 'Exclamation' triploid watermelon were initiated in the greenhouse and transplanted at the 2 to 3-leaf stage into the field one day after herbicide applications. Data were collected on control of goosegrass (*Eleusine indica* L. Gaertn.) and Palmer amaranth (*Amaranthus palmer* S. Watson), weed biomass, watermelon fruit count, and yield. In cover crop plots, weed populations were too low to conduct ANOVA; instead, data were analyzed only from the bareground plots, in response to herbicide treatments. In bareground plots, *S*-metolachlor exhibited the greatest control of goosegrass (95 to 100%) and Palmer amaranth (85 to 94%), and exhibited the lowest accumulation of weed biomass. Cover crop had an overwhelming effect on watermelon fruit counts and on yield, relative to the effects of residual herbicides. Thus, ANOVA were conducted separately for herbicide treatment levels within each level of cover crop, despite a lack of significant interaction of cover crop with herbicide. Highest yields and fruit counts were observed in plots with cereal rye and treated with fomesafen, *S*-metolachlor, or no herbicide. Results indicate that preemergent herbicides are not sufficient for season-long weed control in watermelon and that cereal rye cover crops can minimize weed infestation and maximize yields relative to bareground production.

GETTING RID OF WEEDS THROUGH INTEGRATED WEED MANAGEMENT: AN AREAWIDE APPROACH. LM Lazaro*[1], CG Rubione[2], SB Mirsky[3], ML Flessner[4], MV Bagavathiannan[5], M VanGessel[2]; [1]LSU AgCenter, Baton Rouge, LA, [2]University of Delaware, Georgetown, DE, [3]USDA ARS, Beltsville, MD, [4]Virginia Tech, Blacksburg, VA, [5]Texas A&M University, College Station, TX (19)

ABSTRACT

Integrated weed management (IWM) combines various methods to reduce or eliminate the effect of weeds on crop production over time. These weed management methods utilize various control tactics, which can be integrated into a weed management plan catered to the particular farm and problem. These tactics include preventative, biological, chemical, cultural, and mechanical strategies. IWM also considers the weed species present and tailors strategies for these species.In conventional crops, integrated weed management is not a replacement for any single control tactic. For many decades, herbicides have been the primary means of weed management due to their simplicity, effectiveness, and affordability. However, relying too much on a few herbicides has led to an increase of weed species that are not effectively controlled with the herbicide program or selecting for herbicide-resistant biotypes. IWM approaches go beyond relying on herbicide rotation and mixtures. IWM programs use all available methods that will best solve the problem.To expand the use of IWM knowledge in the USA, GROW (Getting Rid of Weeds) was developed as part of an USDA-ARS Area-Wide Project. GROW is a place to find helpful, research-based resources for integrated weed management for herbicide-resistant weeds. GROW's website, www.growiwm.org, acts as the main source of information, with highlights found on various social media accounts (Twitter, Instagram, YouTube, and Facebook). The website provides a resource for general interest content on IWM, current and ongoing research projects, and more in-depth information on specific management strategies.

IMPACT OF FOUR SUMMER COVER CROP SPECIES AND PLANTING TIMING ON WEED SUPPRESSION, SOIL MOISTURE, AND YIELD IN CORN. SL Samuelson*, MV Bagavathiannan; Texas A&M University, College Station, TX (20)

ABSTRACT

With corn and grain sorghum harvested in late July in the Southeast Texas region, the availability of long-growing season provides a niche for weeds to flourish. The potential for seedbank replenishment by such post-harvest summer annual weed recruits is a real concern for growers in the region. However, this extended growing season also provides a unique opportunity for establishing cover crops to suppress post-harvest summer annuals as well as winter annual weeds, in addition to providing soil conservation, nutrient cycling, and other ecosystem benefits. A major hesitation for growers to implement cover cropping in the region is the perceived impact on soil moisture from cover crop growth, depleting soil moisture reserves available for the subsequent cash crop. The objective of this study was to determine the effect of four summer cover crop species (sorghum sudangrass, sunn hemp, buckwheat, and cowpea) and three planting timing (mid-August, early-September, and late-September) on subsequent corn establishment, weed suppression through cover crop residues, impact on soil moisture, and corn yield. The study was established at two locations: The Texas A&M University Research Farm, College Station, TX, and the Stiles Foundation Farm, Thrall, TX during late-summer 2018 and concluded by summer 2019. Cover crop planting timing during late summer had little effect on corn stand establishment and grain yield when compared to no cover treatments. Sorghum sudangrass and sunn hemp provided substantial suppression of post-harvest summer annual recruits, and also provided suppression of winter annual weeds through residue cover after termination by winter kill. Results provide valuable insights into cover crop species selection and planting timing for achieving the most benefits for a given production goal.

INTERACTION OF A MYROTHECIUM VERRUCARIA MYCELIAL FORMULATION AND A GLYPHOSATE PRODUCT FOR CONTROL OF REDVINE (BRUNNICHIA OVATA) AND TRUMPET CREEPER (CAMPSIS RADICANS). CD Boyette*, CT Bryson, RE Hoagland, MA Weaver, KC Stetina; USDA-ARS, Stoneville, MS (22)

ABSTRACT

A mycelial formulation of the bioherbicidal fungus *Myrothecium verrucaria* (Alb. & Schwein.) Ditmar:Fr. (MV) was tested alone and in combination with a commercially available glyphosate [*N*-(phosphonomethyl)glycine] (GLY) product for controlling the invasive vines, redvine [*Brunnichia ovata* (Walt.) Shinners], and trumpet creeper [*Campsis radicans* (L.) Seem. ex Bureau] in field experiments conducted near Stoneville, MS. Several application timing regimens were evaluated (Fall, Spring, Fall + Spring, and Spring + Fall). We found that a Fall + Spring application of MV + GLY controlled redvine and trumpet creeper by 95%, 12 days after the second treatment, through a synergistic interaction of the fungus and glyphosate. Disease symptomatology was characterized by rapid necrosis of leaf and stem tissues, with mortality occurring within 72 h. Neither glyphosate alone, nor MV alone, effectively controlled either weed species under any application timing regimen. No visual disease or herbicide damage occurred on glyphosate-resistant soybean plants in the treated test plots. These results suggest that some formulations of glyphosate, mixed with the bioherbicide MV, can effectively control redvine and trumpet creeper, two of the most troublesome weeds in the row crops of the Mississippi Delta region in the mid-southern U.S.

PALMER AMARANTH SPHERE OF INFLUENCE EFFECTS ON COTTON GROWTH AND PRODUCTIVITY. LM Dyer*[1], N Basinger[1], D Weisberger[1], RG Leon[2]; [1]University of Georgia, Athens, GA, [2]NC State University, Raleigh, NC (23)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S. Watson) can significantly reduce yields in Southeastern cotton (*Gossypium hirsutum*) production scenarios. *A. palmeri* has the potential to be very competitive with cotton due to its quick establishment time, short reproductive cycle, and high degree of seed production. In general, weed population distributions within a field can vary, as can patterns of crop-weed interference. One method of understanding interference is through an evaluation of the sphere of influence, the spatial extent of a given weeds' competitive ability. To explore the sphere of influence of *A. palmeri*, studies were established at two University of Georgia research farms, Iron Horse and the J. Phil Campbell, both located in Watkinsville, GA. Two densities (1 and 10 plants m^2), and a control (0 plants m^2), of *A. palmeri* were established adjacent to a given cotton row. Cotton height, number of nodes, whole plant biomass, bolls per plant, and seed lint yield were measured at 4 distances (0, 1, 2, 3 m) from the established *A. palmeri* plants. The sphere of influence was not found at 1 plant per m^2. However, at 10 plants per m^2 the sphere of influence for boll number and seed lint yield was 0.65 m and 1.09 m, respectively. At J. Phil Campbell, the sphere of influence for cotton height was 2.66 m, while at Iron Horse there was no observable sphere of influence. Results suggest that *A. palmeri* will influence cotton yield through the reduction of plant height, cotton boll number, and seed lint yield, but that the sphere of influence may be variable across densities, sites and response variables.

CONTROL OF PALMER AMARANTH (AMARANTHUS PALMERI) WITH GLUFOSINATE AND S-METOLACHLOR IN COTTON PRODUCTION SYSTEMS. WJ Rutland*, DM Dodds, JP McNeal, LX Franca, JJ Williams, BJ Norris, SD Hall; Mississippi State University, Mississippi State, MS (24)

ABSTRACT

An experiment was conducted in Dundee, MS, to evaluate weed control programs to control Palmer amaranth (*Amaranthus palmeri*) in XtendFlex® cotton production systems. The location for this experiment (Dundee, MS) was selected due to the presence of a natural infestation of glyphosate-resistant Palmer amaranth. Four-row plots were planted to DP 1646 B2XF on 20 June 2019 at a population of 111,197 seed ha^{-1}. At this time, plots received a preemergence application of pendimethalin at 0.37 kg a.i. ha^{-1}. The specific objective of this field study was to compare Palmer amaranth efficacy with pre-mix vs. tank-mix applications of glufosinate, s-metolachlor, and acetochlor. Applications were initiated when Palmer amaranth reached an average height of 10 cm and were made with a CO_2 powered backpack sprayer while traveling at a speed of 4.8 km h^{-1}. Applications included a pre-mixed formulation of glufosinate + s-metolachlor (Intermoc®) applied at 1.1 kg a.i. ha^{-1}, vs. tank-mix applications of glufosinate (Interline®) applied at 0.66 kg a.i. ha^{-1}) + s-metolachlor (Moccasin II Plus®) applied at 1.07 kg a.i. ha^{-1}, and glufosinate (Interline®) applied 0.66 kg a.i. ha^{-1} + acetochlor (Warrant®) applied at 1.06 g a.i. ha^{-1}. Data collection included visual Palmer amaranth control at 7, 14, 21, 28, and 35 days after treatment (DAT). The center two rows of each plot were mechanically harvested with a spindle picker modified for research purposes. Data were analyzed in SAS v9.4 utilizing a PROC GLIMMIX procedure. Data were subjected to analyses of variance and means were separated using Fisher's Protected LSD at an a level of 0.05. At 21 DAT, palmer amaranth varied due to treatment ($p < .001$). All treatments resulted in greater palmer amaranth control than the non-treated control. Additionally, a tank-mix of glufosinate + acetochlor resulted in 11% greater Palmer amaranth control than the premix formulation of glufosinate + s-metolachlor and the tank-mix application of glufosinate + s-metolachlor. At 7, 14, 28, and 35 DAT, Palmer amaranth control varied due to treatment ($p < .001$). All herbicide treatments resulted in greater Palmer amaranth control than the non-treated control; however, Palmer amaranth control did not vary due to herbicide treatments. These data indicate that pre-mix formulations of glufosinate and metolachlor have utility for controlling Palmer amaranth in cotton production systems.

THE FUTURE OF THE HERBICIDE STEWARDSHIP PROGRAM AT THE UNIVERSITY OF TENNESSEE. N Rhodes*[1], TC Mueller[1], LE Steckel[2], D McIntosh[1]; [1]University of Tennessee, Knoxville, TN, [2]University of Tennessee, Jackson, TN (25)

ABSTRACT

Due to the frequency of off-target movement of auxinic herbicides to tobacco and other sensitive high value crops, we began a comprehensive educational program in 2011 that stresses the importance of proper stewardship with the use of pasture herbicides. Our goals were to reduce the occurrence and impact of off-target damage to tobacco and other sensitive, high value crops; and to create educational materials and other tools to help with the diagnosis of suspected cases of off-target damage. The initial funding was obtained via a grant and continued funding from Philip Morris International. Later, additional funding was obtained from Altria Client Services, Dow AgroSciences, DuPont Crop Protection, and Monsanto. We focused on four crops (tobacco, cotton, tomato and grape) and five herbicides (2,4-D, dicamba, aminopyralid, aminocyclopyrachlor and picloram) for the creation of educational materials and diagnostic tools. These include still images, time lapse videos and fact sheets; and we made them available through our initial website, herbicidestewardship.utk.edu; it became accessible in 2014. Later it was simplified to herbicidestewardship.com. In 2016, 2017, and again in 2018, widespread problems with dicamba drift occurred in the Midsouth on numerous sensitive crops as a result of in-crop applications of the herbicide in dicamba-tolerant cotton and soybean varieties. In 2017 we broadened our website to include additional information directly addressing stewardship of dicamba and 2,4-D tolerant crop technology. Because producers, even with their best efforts, were having difficulty keeping dicamba within target fields, we began active laboratory and field research programs looking for answers. We have actively provided herbicide stewardship training for growers and other applicators, dealers, and Extension Agents for the past 3 years; we are also educating our undergraduate and graduate students in this critical area. The importance of effective, proactive herbicide stewardship will continue to increase rather than lessen. Our future plans for the website include the following improvements: Change from a Sharepoint platform to a Word Press platform to make it easier to navigate the website; add injury diagnostic pictures for more crops such as soybean, corn and grain sorghum; add a link to the TN Pesticide Recertification Training; make the sprayer hygiene section more comprehensive; add sections on BMP's for tank mixing order, and how to calculate AE and AI.

A MULTI-STATE SURVEY TO DETERMINE THE PREVALENCE OF HERBICIDE RESISTANCE IN ANNUAL BLUEGRASS (POA ANNUA L.) IN MANAGED TURFGRASS SYSTEMS.

B Grubbs[1], D Hathcoat*[2], S Askew[3], LB McCarty[4], MT Elmore[5], J Brosnan[6], JD McCurdy[7], P McCullough[8], B Unruh[9], T Gannon[10], A Patton[11], J Kaminski[12], A Kowalewski[13], JS McElroy[14], MV Bagavathiannan[2]; [1]Texas A&M AgriLife Extension Service, College Station, TX, [2]Texas A&M University, College Station, TX, [3]Virginia Tech, Blacksburg, VA, [4]Clemson University, Clemson, SC, [5]Rutgers University, New Brunswick, NJ, [6]Univeristy of Tennessee, Knoxville, TN, [7]Mississippi State University, Mississippi State, MS, [8]University of Georgia, Griffin, GA, [9]University of Florida, College Station, FL, [10]NC State University, Raleigh, NC, [11]Purdue University, West Lafayette, IN, [12]Penn State, University Park, PA, [13]Oregon State University, Corvalis, OR, [14]Auburn University, Auburn, AL (27)

ABSTRACT

Annual bluegrass (*Poa annua* L.) is a winter annual grassy weed that exhibits high levels of genetic diversity and an ability to rapidly adapt to different climates and management programs. This weed has grown to epidemic proportions in different turf systems, causing severe economic losses to the US turf industry and its four primary systems: golf courses, athletic fields, sod production operations, and residential lawns. A team of university scientists from 13 states (AL, FL, IN, GA, MS, NJ, NC, OR, PA, SC, TN, TX, and VA) are collaborating to develop a comprehensive understanding of this species to facilitate sustainable management. A key aspect is to determine the prevalence of herbicide resistance in annual bluegrass populations in managed turfgrass systems across the national scale. During 2019, over 1000 unique annual bluegrass populations were collected from collaborating states across five broad USDA plant hardiness zones, with a targeted goal of 2000 populations by the end of 2020. In each collection site, 20-25 individual plants that escaped previous herbicide treatments were uprooted, and tiller-propagated into flats in a greenhouse. Preliminary herbicide screenings have been carried out on the tiller-derived plants to identify putative resistant biotypes for subsequent evaluations. A total of 11 herbicides were evaluated on the collected populations: trifloxysulfuron, pronamide, simazine, glyphosate, ethofumesate, paclobutrazol, mesotrione, diquat, glufosinate, prodiamine and indaziflam. A non-treated check as well as a susceptible standard were used for comparison. The aim of this presentation is to introduce the scope of the USDA-SCRI project and present select preliminary findings from the field surveys and resistance screenings.

A NOVEL FLUORESCENT COMPOUND TO MEASURE HERBICIDE PHYSICAL DRIFT. V Nandula*; USDA-ARS, Stoneville, MS (28)

ABSTRACT

Several thousands of incidents of injury to non-dicamba resistant broadleaf crops and other dicotyledonous flora across theagricultural landscape caused by dicamba drift arising from applications to dicamba-resistant soybean and cotton, have been reported across the midwestern and southeastern US from 2016-19. Additionally, drift from aerial applications of glyphosate, targeted on glyphosate resistant crops to rice, sorghum, and sometimes wheat is another issue that has plagued growers in Mississippi every year. The objective of the planned research was to evaluate a novel technique of adding a fluorescent compound to the spray carrier to measure dicamba and glyphosate drift. In field studies, addition of the fluorescent compound, Nightops®, to dicamba plus glyphosate applications in dicamba-resistant soybean, irrespective of Xtendimax® or Engenia® formulation, did not affect herbicide efficacy or cause crop injury. Further, soybean plant samples collected several feet downwind from the point of application did not indicate the presence of Nightops. In an experiment to test rainfastness of Nightops, a soybean variety resistant to both dicambaand glyphosate was treated with Nightops alone and in combination with dicamba and dicamba plus glyphosate plus a drift reducing agent (DRA). Treated plants were sprayed with simulated rainfall for a duration of 0, 30, 60, 90, and 120 sec. After each rainfall timing, plants were allowed to dry and then imaged under black light and rated for % retention of Nightops. Results indicated a decline in retention of Nightops as exposure time to rainfall increased irrespective of treatment. Dicamba plus glyphosate plus DRA tended to have the lowest retention upto 60 sec. The above results indicate that Nightops treated plants should be collected and stored for imaging before the first appreciable rain after application of herbicide treatment(s). In conclusion, Nightops is a reliable new tool for measuring herbicide drift.

A SURVEY ON WEEDS PROBLEM AND MANAGEMENT PRACTICES IN ROW CROP PRODUCTION AT FLORIDA PANHANDLE. P Devkota*[1], ET Carter[2], RT Broughton[3], MJ Mulvaney[1]; [1]University of Florida, Jay, FL, [2]University of Florida, Marianna, FL, [3]University of Florida, Live Oak, FL (29)

ABSTRACT

Cotton and peanut are the major row crops in the Florida Panhandle. A survey was conducted to assess weed issues and weed management practices in these production systems. Paper survey forms were distributed at county extension meetings and 88 responses were collected. Conventional, strip-tilled, and no-till systems were adopted by 22, 58, and 20% of the respondents, respectively. Most of the growers reported Palmer amaranth (35%) and pigweed spp. (12%) as the most problematic weed. Other major weeds reported were tropical spiderwort (11%), sicklepod (12%), annual grasses (9%), and perennial weeds (21%). The response on herbicide program illustrated that burndown was implemented by 60; PRE by 48; EPOST plus residual by 49; EPOST by 41; LPOST by 27; and LPOST plus residual by 24 respondents. About 43% of the growers reported the presence of herbicide resistant weeds; 20% suspected herbicide resistant weeds; 18% reported not present; and 20% reported unknown about spread of herbicide resistant weeds in their production systems. Collectively, Palmer amaranth was listed as the major herbicide-resistant weed in this region. For herbicide resistant weed management, using PRE and POST herbicides, crop rotation, and hand weeding/hoeing were the major strategies. There was greater interest in herbicide programs (55 respondents) and less interest in mechanical (11 respondents), cover crops (18 respondents), and integrated programs (18 respondents) as weed management strategies. The response on adoption of dicamba and 2,4-D resistant crops were mixed, where 26% of respondents were not interested, 40% were moderately interested, 28% were highly interested, and 5% were only interested in seed trait but not in newer dicamba and 2,4-D herbicide formulations. The major concern for adoption of dicamba and 2,4-D resistant crops were indicated as issues with drift, cost of the technology, regulatory environment, and potential for volatility/off-target movement of these herbicides.

ALTERED TARGET SITE-BASED RESISTANCE TO MESOSULFURON, AN ALS INHIBITOR, IN ITALIAN RYEGRASS FROM MISSISSIPPI. V Nandula*[1], D Giacomini[2], JA Bond[3]; [1]USDA-ARS, Stoneville, MS, [2]University of Illinois, Urbana, IL, [3]Delta Research and Extension Center, Stoneville, MS (30)

ABSTRACT

Italian ryegrass (IR) populations in Mississippi, USA have evolved resistance to various herbicides such as glyphosate, acetyl CoAcarboxylase inhibitors, and acetolactate synthase (ALS) inhibitors. The magnitude and mechanism(s) of resistance to mesosulfuron,an ALS inhibitor belonging to the sulfonylurea herbicide family, in Italian ryegrass populations of the Mississippi Delta (the 17-county northwestern region of the state where 70% of agronomic crop production of the state is practiced), are not known. Whole-plant dose response studies and molecular analysis of ALS gene sequences were conducted. Several IR populations were unaffected even at 8X labeled rates of mesosulfuron, with the 1X rate being 0.0146 kg ai/ha. ALS gene sequence analyses of various mesosulfuronresistantIR populations indicated presence of point mutations leading to single nucleotide substitutions at codon 197 and 574,resulting in proline-to arginine/glutamine/leucine/serine/threonine and tryptophan-to-leucine replacements, respectively. These results indicate that the resistance to mesosulfuron in IR populations from Mississippi is, in part, due to an altered ALS enzyme.

APPLICATION TIMING FOR DALLISGRASS CONTROL IN BERMUDAGRASS FORAGE.

D Russell*[1], H Quick[2], JD Byrd, Jr.[2]; [1]Auburn University, Madison, AL, [2]Mississippi State University, Mississippi State, MS (31)

ABSTRACT

Dallisgrass (*Paspalum dilatatum* Poir.) has potential as a desirable livestock forage, but is often viewed as an unwanted weed in high quality bermudagrass (*Cynodon dactylon* (L.) Pers.) systems. Nonselective chemical control options are available, but the potential loss of desirable species proves too great to utilize in-season applications. Prior field observations have found dallisgrass to maintain green leaf tissue longer into the winter months compared to bermudagrass, thus providing a possible window for effective control with minimal injury to bermudagrass. Using cooling degree days (CDD) beginning July 1 and/or field observations are two methods that exist in the mid-South for determining that application window. Therefore, the aim of this study was to evaluate effects of herbicide and application timing on dallisgrass when applied following autumn frost and bermudagrass dormancy, but prior to dallisgrass quiescence. A two (application time) by four (treatment) factorial arrangement was established in a randomized complete block design with three replications near Starkville, MS in 2018. Applications were made following at least two frosts (below 0 °C) and again in mid-February before bermudagrass emergence with 840 and 1,680 g ae ha^{-1} of glyphosate (Roundup Powermax) and 105 and 210 g ai ha^{-1} imazapic (Plateau). December application was equivalent to CDD of at least 460 using a base temperature of 22 °C and the formula CDD = 22 - [(Tmax+Tmin)/2]. Visual control of dallisgrass at 113/31 DAT was greatest (>90%) from either rate of glyphosate or imazapic during December and either rate of glyphosate during February. December application of glyphosate also resulted in the largest reduction (>67%) in dallisgrass occurrence by 166/84 DAT. In order to achieve the greatest amount of bermudagrass coverage during spring emergence, at least 840 g ae ha^{-1} glyphosate could be applied in December or February or 210 g ai ha^{-1} imazapic in December. This data indicates effective dallisgrass control and bermudagrass safety are achieved when herbicide applications are made above CDD = 460. It is suggested that field observations should accompany CDD measurements to ensure bermudagrass dormancy. February applications of imazapic were ineffective.

CAN RECOVERY FROM AUXIN INJURY BE EXPEDITED? J Griffin*[1], G Morgan[2]; [1]Texas A&M University, College Station, TX, [2]Cotton Incorporated, Cary, NC (32)

ABSTRACT

Can Recovery From Auxin Injury Be Expedited? Auxin resistant traits in cotton have become widely embraced across the Cotton Belt for management of glyphosate resistant and other troublesome weeds. With the adoption of varieties with auxin traits, off target movement and spray tank contamination has become a major concern for growers and the entire industry, especially in South and East Texas where both XtendFlex and Enlist Cotton share significant market share. The objective of this project was to identify the efficacy of "recovery" treatments from induced injury of dicamba and 2,4-D. A 1/10X (56g ae/ha) dicamba rate and 1/280X (4 g ae/ha) of 2,4-D were applied separately at first bloom stage over FM 1953 GLTP over the center two rows with a CO2 hand boom. Seven days later, ten treatments of plant growth regulator, nutritional, and hormonal products were applied with a four row hand boom. Visual auxin injury ratings were conducted two weeks after the application of the "recovery" treatments and again one week prior to application of harvest aids to assess both the amount of injury and recovery. Plant height, nodes, maturity, and planting mapping were conducted on five plants/plot to identify the vegetative and reproductive physiological impacts of the various treatments. Plots were mechanically harvested, and fiber was analyzed with HVI. Visual ratings of the 2,4-D portion resulted in more overall foliage injury but dicamba treatments had more stunting. However, there were no yield improvements among the "recovery" treatments for the dicamba injured cotton. The 2,4-D "recovery" treatments did show more variation and potential for recovery in 2018; however, there were no differences between recovery treatments for 2,4-D injured cotton in 2019.

CROSS-TOLERANCE OF FLUAZIFOP-RESISTANT GRAIN SORGHUM TO ACCASE HERBICIDES. LB Piveta*[1], JK Norsworthy[1], MV Bagavathiannan[2], MM Houston[1]; [1]University of Arkansas, Fayetteville, AR, [2]Texas A&M University, College Station, TX (33)

ABSTRACT

There are few control options for selective control of grasses in grain sorghum. Therefore, a new grain sorghum breeding line was developed with resistance to ACCase-inhibitor herbicide fluazifop. However, it is essential to evaluate the level of resistance to different ACCase-inhibiting herbicides. A dose-response experiment was conducted in the greenhouse, in a completely randomized design with five replications with the ACCase-inhibitors clethodim, quizalofop, and fenoxaprop, at rates ranging from 1 to 64x label rate for ACCase-resistant grain sorghum, and from 0.03125 to 1x for susceptible grain sorghum. Plant injury was recorded at 14, 21, and 28 days after application (DAA) on a scale of 0-100% where 100% indicates complete plant death. The results showed that at 140 g ai ha^{-1} (1x) of clethodim was not selective to ACCase-resistant grain sorghum. Quizalofop showed an intermediate selectivity; at 112 g ai ha^{-1} (1x), the injury reached 19% at 28 DAA. Fenoxaprop showed high selectivity to ACCase-resistant grain sorghum, as injury at 28 DAA was not present when rates of 350 g ai ha^{-1} (4x) were applied.

DECIPHERING HERBICIDE RESISTANCE THROUGH EPIGENETICS LENS. G Sharma*, S Askew, J Barney, J Westwood; Virginia Tech, Blacksburg, VA (34)

ABSTRACT

Herbicide resistance is the result of a powerful human-driven selective pressure on weeds. Two general categories of resistance are target site resistance (TSR) and non-target site resistance (NTSR). TSR mechanisms are well understood and arise from a single point mutation in the herbicide target gene, but those involving NTSR are still poorly understood and could result from several mechanisms. The origin and genetic bases for NTSR resistance mechanisms is not known. The field of epigenetics may contribute to understanding NTSR in that it contributes to understanding how organisms are able to adapt to various abiotic/biotic stresses through non-sequence based modifications of their DNA, such as changes in methylation status or histone assembly. Herbicides and other control practices impose stress on weeds. Sub-lethal weed management practices could lead to epigenetic modifications that may facilitate evolution of resistance, but this relationship is yet untested. DNA methylation is one of the best-studied epigenetic regulatory mechanisms, which is the addition of a methyl group to. Adding or removing methyl groups to cytosine nucleotides in specific DNA regions can change gene expression. Using the model plant *Arabidopsis thaliana*, we administered sub-lethal doses of glyphosate, trifloxysulfuron, clipping and shading to determine if methylome changes are shared or unique among stress responses. Methylation occurs in all cytosine sequence contexts of plant DNA: CG, CHG and CHH (H represents A, T or C). The tissues from control and stressed plants were collected at standardized maturation levels and subjected to whole-genome, bisulfite sequencing (WGBS). The WGBS data were analyzed to understand how different stresses change the cytosine methylation levels. The total amount of methylated cytosines (mCs) ranged from 98 to 147 million depending on stress and were the most abundant in the CG sequence context. Neither the abundance nor frequency of methylated mCs in CG, CHG, and CHH contexts varied due to stress treatment. These results suggest that plants respond similarly to herbicides, clipping, and shade with respect to total methylation levels. Further analyses will elucidate how methylation patterns are influenced by stress treatment and if these patterns are heritable and stable across multiple generations in *A. Thaliana*.

DETERMINING DURATION OF RESIDUAL CONTROL OF SOIL-APPLIED HERBICIDE TO FORM TOTAL PREEMERGENCE HERBICIDE PROGRAMS IN COTTON. JS Calhoun*, JC Ferguson; Mississippi State University, Mississippi State, MS (35)

ABSTRACT

Field studies were conducted to evaluate the length of residual persistence of soil-applied herbicides commonly used in cotton production. Studies were replicated at two locations: Brooksville, Mississippi and the R.R. Foil Plant Science Research Center (PSRC) at Mississippi State, Mississippi. Treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 140 L ha^{-1} of spray solution. Herbicide treatments included acetochlor (1344 g ai ha^{-1}), s-metolachlor (1421 g ai ha^{-1}), pendimethalin (1067 g ai ha^{-1}), fomesafen (422 g ai ha^{-1}), diuron (1121 g ai ha^{-1}), fluometuron (1684 g ai ha^{-1}), norflurazone (2197 g ai ha^{-1}), pyrithiobac (59 g ai ha^{-1}), prometryn (2692 g ai ha^{-1}), and fluridone (222 g ai ha^{-1}). Experimental units were evaluated for weed control weekly beginning 7 days after application (DAA). Each experimental unit was evaluated until each treatment was a complete loss in residual control. As control was lost, weed species breaking through residual control was noted. Each location was unique in duration and weed spectrum, therefore results for each location are presented separately. Duration of control at the PSRC location was longest in treatments where fluridone was applied (49 DAA). Applications of norflurazone also resulted in long residual control with an average span of 35-40 DAA. Pyrithiobac and prometryn had the shortest length of residual control, with each ending at approximately 21 DAA. Fluometuron applications resulted in the greatest residual length of control at the Brooksville location (21 DAA). Differing lengths in control between locations could be attributed to differences in activating rainfall and/or weed species distribution. Combinations of herbicides with long residual periods could be used to create entire preemergent systems in cotton, alleviating resistance selection pressure currently on postemergent systems.

DO HERBICIDES APPLIED BEFORE SHOOT EMERGENCE CONTROL FALSE GREEN KYLLINGA? JM Craft*, S Askew; Virginia Tech, Blacksburg, VA (36)

ABSTRACT

False green kyllinga (*Kyllinga gracillima*) (FGK) is a troublesome weed that has become increasingly problematic in cool-season turfgrass in the mid-Atlantic region. As a warm-season perennial, FGK emerges from rhizomes in late spring or early summer and grows rapidly, forming a dense mat. Being a rhizomatous perennial, FGK is typically not controlled by pre-emergent herbicides. Regardless of herbicide selection, FGK is difficult-to-control and may require multiple herbicide applications. Imazofuluron (Celero®) has recently shown promise for postemergence control and residual suppression of FGK. Pyrimisulfan (Vexis®) is a new acetolactate synthase (ALS) inhibitor released by PBI-Gordon that effectively controls FGK. Since these herbicides for postemergence FGK control seem to provide residual suppression of FGK regrowth, it stands to reason these herbicides could be used prior to shoot emergence in spring. However, few research studies examined preemergence FGK control, especially when using herbicides more typically applied after shoot emergence. A research study was initiated on May 3, 2019 at the Virginia Tech golf course in Blacksburg, VA to evaluate herbicides applied before FGK shoots emerge in the spring for season-long FGK control. Treatments were applied to a fairway-height mixture of cool-season turf that included creeping bentgrass, perennial ryegrass and annual bluegrass. Treatments included dithiopyr G (granular) applied at 280 g ai/ha followed by (fb) dithiopyr G applied at 280 g ai/ha, dithiopyr G applied at 280 g ai/ha fb NB39970 G (pyrimisulfan+dithiopyr) applied at 50 g ai/ha (pyrimisulfan) and 280 g ai/ha (dithiopyr), prodiamine G applied at 420 g ai/ha fb prodiamine G applied at 420 g ai/ha, prodiamine G applied at 420 g ai/ha fb NB39970 G applied at 50 g ai/ha (pyrimisulfan) and 280 g ai/ha (dithiopyr), NB39970 G applied at 50 g ai/ha (pyrimisulfan) and 280 g ai/ha (dithiopyr) fb NB39970 G applied at 50 g ai/ha (pyrimisulfan) and 280 g ai/ha (dithiopyr), NB39493 G applied at 33 g ai/ha (pyrimisulfan) and 396 g ai/ha (dithiopyr) followed by NB39970 G applied at 33 g ai/ha (pyrimisulfan) and 396 g ai/ha (dithiopyr), NB38727 SC (soluble concentrate) (pyrimisulfan) applied at 52 g ai/ha followed by NB38727 SC applied at 52 g ai/ha, and imazosulfuron applied at 420 g ai/ha fb imazosulfuron applied at 420 g ai/ha. The follow up applications were applied 42 days after initial treatments (DAIT). The initial treatments that included pyrimisulfan (NB39970 G, NB39493 G and NB38727 SC) significantly reduced FGK cover compared to dithiopyr G and prodiamine G alone, at 42 DAIT. Prior to follow up applications at 42 DAIT, FGK was just beginning to breakthrough NB39970 G and NB39493 G plots but both treatments still controlled FGK 72 and 82%, respectively. At 98 DAIT, both NB39970 G and NB39493 G controlled FGK 93% and 97%, respectively. Two applications of dithiopyr alone reduced FKG populations but control never reach 50%. However, dithiopyr G alone fb NB39970 G controlled FGK 92%, at 98 DAIT and similar results were observed when NB39970 G was applied as a follow up application to prodiamine G. The initial application of imazosulfuron had similar FGK activity compared to NB38727 SC for the first four weeks. However, FGK control began to decrease and by 42 DAIT imazosulfuron had no FGK control. At 98 DAIT after the repeat application, imazosulfuron and NB38727 SC both controlled FGK 63% and 65%, respectively. The pyrimisulfan products that were granular formulations (NB39970 G and NB39493 G) had significantly better FGK control than the liquid formulation (NB38727 SC). Two applications of NB39970 G or NB39493 G were equivalent to or better than all other treatments at every evaluation date. Data suggest pyrimisulfan applied prior to FGK shoot emergences significantly reduces populations as FGK emerge in the spring but a follow up application would be needed for season long control. Future research should continue to examine different pyrimisulfan rates, and application timings to achieve season long FGK control.

DOES WEED SEED SHATTERING DATE INFLUENCE GERMINABILITY? SC Beam[1], ML Flessner*[1], SB Mirsky[2]; [1]Virginia Tech, Blacksburg, VA, [2]USDA ARS, Beltsville, MD (37)

ABSTRACT

Annual weed species rely on additions to the soil seed bank for survival. Studies have been conducted that examine seed shatter phenology in relation to crop harvest, which is important for harvest weed seed control and other tactics that target the soil seed bank. Little research has been conducted examining seed germinability in relation to shatter date. It is conceivable that seeds retained on the mother plant longer may acquire more carbohydrates and other resources leading to greater germinability as opposed to earlier shattered seeds. Studies were conducted in Blacksburg, Virginia in 2016 and 2017 to assess the germinability of seed shattered at different time points during the soybean growing season for redroot pigweed (*Amaranthus retroflexus* L.), common ragweed (*Ambrosia artemisiifolia* L.), and common lambsquarters (*Chenopodium album* L.). Seed germinability was highly variable across years and species. Average differences in germination were 23.4, 27.4, 21.4, 13.8, and 66.4% from the onset of seed shatter to final collection for redroot pigweed, common ragweed, and common lambsquarters in 2016 and 2017, respectively. Redroot pigweed seed germinability decreased as seed shattered later in the season in 2016 but increased in 2017. Common ragweed seed germinability had no relationship with seed shattered date in both years. Common lambsquarters seed germinability increased as seed shattered later in the growing season in 2017 but no trend was present in 2016. The variability could be due to different environmental conditions present at seed formation. We could not find a relationship between seed shattering date and germinability among the species examined, indicating that seed germinability is not influenced by seed shatter date. Soil seed bank targeted management tactics should be primarily concerned with seed shatter phenology.

EARLY SEASON SOYBEAN RESPONSE TO DRIFT RATES OF IMAZAPYR, METSULFURON, AND SULFOMETURON. MW Marshall*; Clemson University Edisto Research & Education Center, Blackville, SC (38)

ABSTRACT

Timber is the number one agricultural industry in the South Carolina. Currently, there are 5.3 million hectares of forestland with hardwood and softwoods accounting for 53 and 47% of forestland, respectively. Timber is harvested during the fall and winter months in South Carolina. After harvest, land is left fallow in preparation for new planting of trees the following winter/spring. Herbicides, such as imazapyr, metsulfuron, and sulfometuron, are used to manage the undesirable trees and weedy brush in these cleared tracts during the fallow period. These herbicides are typically sprayed in mid-summer using helicopters equipped with a spray boom. These applications frequently occur near soybean and other sensitive crops. As a result, drift emanating from these sprays is a concern. Crop injury will depend on the sensitivity, growth stage of the crop, and the amount of drift received. Research is lacking on the effect of drift rates of imazapyr, metsulfuron, and sulfometuron on early season soybean growth and development and yield. Field experiments were conducted at the Edisto Research and Education Center in 2019. Soybean variety Asgrow '74X8' was planted on June 19, 2019. The drift herbicide treatments were 1/10 X and 1/100 X of the normal use rates (X) of imazapyr at 3.36 kg/ha^{-1}, metsulfuron at 0.14 kg/ha^{-1}, and sulfometuron at 0.14 kg/ha^{-1}. An untreated check was included for comparison. Percent soybean visual injury and heights were collected 7 and 28 days after treatment (DAT). Soybeans were harvested at maturity on November 21, 2019. Percent soybean injury, height, and yield were analyzed using ANOVA and means separated at the P = 0.05 level. Metsulfuron and sulfometuron at the 1/10X drift rate severely injured soybean at 7 DAT (77 and 71%, respectively). The injury increased to 98 and 88% at 28 DAT, respectively. In contrast, soybean injury was much lower (22 and 27% at 7 and 28 DAT, respectively) in the 1/10X imazapyr rate. There was less than 10% injury observed in the 1/100X imazapyr rate. At 7 DAT, soybean heights were significantly reduced in across all treatments except the 1/100 X impazapyr rate. Soybean heights were reduced 80, 69, and 60% in the 1/10X and 1/100X metsulfuron and the 1/10X sulfometuron rates at 28 DAT, respectively. Soybean yield was reduced in 1/10X and 1/100X metsulfuron and the 1/10X sulfometuron treatments compared to the untreated check. The 1/10X drift rate of metsulfuron and sulfometuron were the most injurious to soybean of all the treatments (25 and 348 kg/ha, respectively). In conclusion, soybean at the vegetative growth stage was the most sensitive to the 1/10 and 1/100 X drift rates of metsulfuron and 1/10 X drift rate of sulfometuron. Both of these herbicides severely impacted in-season growth and productivity of soybean. Growers can expect significant yield losses when an application of metsulfuron or sulfometuron drifts onto their soybean crop.

EFFECT OF GLYPHOSATE FORMULATION ON PH OF DICAMBA SPRAY MIXTURES. LW Shoffner*, TC Mueller; University of Tennessee, Knoxville, TN (39)

ABSTRACT

The pH of spray mixtures is an important attribute that affects dicamba volatility under field conditions. This report examined the effect of different components added to water sources that ranged in initial pH from 4.6 to 8.4. Commercial products were used, which include formulations of dicamba, glyphosate, the drift retardant Intact, ammonium sulfate (AMS), and several pH modifiers. Adding BAPMA salt of dicamba always increased the mixture pH, whereas diglycolamine + VaporGrip® (DGA+VG) had a mixed response. The addition of AMS decreased pH slightly (usually <0.5 pH unit), whereas the addition of potassium salt of glyphosate (GLY-K) always decreased the measured pH (from 1.0 to 2.1 pH units). A substantial pH change could have profound effects on dicamba volatility. Moreover, the 1.0 to 2.1 pH units would not be consistent with the registrant's report stating that GLY-K decreased mixtures with DGA+VG pH by only 0.2 to 0.3 units. The drift retardant Intact had no effect on pH. There was no difference in resultant pH when comparing K salt and isopropylamine (IPA) salts of glyphosate. Spray carrier volume, ranging from 94 to 187 L ha-1, had only a minor effect on measured pH after the addition of various spray components. The addition of selected pH modifiers raised the pH above 5.0, which is a critical value according to the latest dicamba application labels. The order of mixing of various pH modifiers, including AMS, had only limited effect on measured spray solution pH.

EFFECT OF HERBICIDE ADDITIONS ON PH FOR APPROVED DICAMBA TANK-MIXTURES IN COTTON. JC Ferguson*, JS Calhoun, KL Broster, LH Merritt, MT Wesley Jr., ZR Treadway; Mississippi State University, Mississippi State, MS (41)

ABSTRACT

With the introduction of dicamba-tolerant cotton cultivars, the use of dicamba products tank-mixed with other herbicides has increased dramatically. pH values of these mixtures are crucial to monitor, as pH can greatly increase the potential for volatilization and off-target movement of dicamba containing compounds. Lab studies were conducted at Mississippi State University in Starkville, MS to determine the pH values of several commonly used tank-mixes involving dicamba. Studies were also conducted to determine the effect of glyphosate formulation and rate on pH of dicamba tank-mixtures. Results indicate that any addition of glyphosate to a labeled dicamba herbicide, resulted in a pH lower than 5.0, except for Engenia® plus Credit Xtreme®. The addition of the 25 other labeled herbicides to dicamba resulted in negligible change in pH. This research suggests that only the addition of glyphosate to tank-mixes with dicamba contribute to significant reduction in pH.

EFFECT OF HERBICIDE PROGRAM, SPRAY DROPLET SIZE, AND DRIFT REDUCTION AGENT ON GLUFOSINATE EFFICACY. BJ Norris*, DM Dodds, WJ Rutland, JJ Williams, JP McNeal, LX Franca, SD Hall; Mississippi State University, Mississippi State, MS (42)

ABSTRACT

Increasing interest has been placed on managing spray droplet size of herbicide applications to mitigate off-target movement. Drift reduction agents (DRA) have been recommended to reduce driftable fines in the spray pattern. A study was conducted in 2019 near Dundee, MS to evaluate Palmer amaranth (*Amaranthus palmeri*) control with glufosinate and with and without a DRA. The study was conducted using 2 x 2 x 6 factorial arrangement of treatments in a randomized complete block design with four replications. Deltapine 1646 B2XF was seeded at 111,000 seed ha^{-1} on June 20. Factors included: A) PRE of fluometuron at 1.1 kg ai ha^{-1} and no PRE; B) six spray droplet sizes of 150-900 microns in increments of 150 microns; and C) Intact™ at 0.5% v v^{-1} and no Intact™. All treatments received glufosinate at 0.59 kg ai ha^{-1} when Palmer amaranth reached 10-15 cm in height. Herbicide applications were made with a pulse width modulated sprayer using Wilger™ flan fan, non-venturi tips at a speed of 14.5 km hr^{-1} and carrier volume of 140 L ha^{-1}. Data were subjected to analysis of variance using the PROC GLM procedure in SAS v 9.4. Means were separated using Fisher's Protected LSD at a = 0.05. Driftable fines were reduced by 23% when Intact™ was added to the tank mix and as volume median diameter of droplet size increased, driftable fines decreased. There was a negative linear trend in Palmer amaranth control at 7 and 14 DAA ($p < 0.01$). Smaller droplet sizes provided the greatest Palmer amaranth control. Palmer amaranth density was also greatest where larger droplet sizes reduced herbicide efficacy. In conclusion, although the fine droplet size (150 micron) provided the greatest control of Palmer amaranth, a medium droplet size (300 microns) will reduce drift potential without sacrificing herbicide efficacy.

EFFECT OF MOWING TIMING ON JOHNSONGRASS HERBICIDE EFFICACY: THREE YEARS OF TRIALS. J Omielan*, M Barrett; University of Kentucky, Lexington, KY (43)

ABSTRACT

Johnsongrass (*Sorghum halepense*) is a perennial warm season grass, listed as a noxious weed, and a common problem on right-of-way sites. There are a number of herbicides labeled and available to control johnsongrass and most rely on translocation from the leaves to the rhizomes for greatest efficacy. However, mowing is part of roadside management and one question is how does the timing of mowing after herbicide application affect efficacy? This study was initiated August 14, 2014 and repeated August 24, 2015 to answer the questions asked above at an interchange near Bardstown KY. It was repeated August 30, 2019 on a field in Lexington. Four herbicide treatments were applied to applied to 3 m x 18 m strips at 280 L/ha. Six time of mowing treatments were applied as 3 m x 12 m strips across the herbicide treatments in a split block design, replicated three times (four times in 2015 and 2019). The herbicide treatments were Outrider (sulfosulfuron), Fusilade II (fluazifop), Acclaim Extra (fenoxaprop), and Fusilade + Acclaim. The time of mowing treatments were as follows: no mowing, same day as herbicide application, as well as 1 day, 2 days, 1week, and 2 weeks after application. Visual assessments of percent johnsongrass control were done 34 (9/17/2014), 70 (10/23/2014), and 350 (7/30/2015) days after herbicide treatment (DAT) for the 2014 trial. Assessments were done 32 (9/25/2015), 45 (10/8/2015), 53 (10/16/2015), and 298 (6/17/2016) DAT for the 2015 trial. Assessments were done 31 (9/30/2019) and 60 (10/29/2019) DAT for the 2019 trial. In the 2014 trial, while Outrider had the lowest visual control (70%) without mowing 34 DAT it had the greatest control (83%) (compared to the other herbicide treatments) when mowed the same day as application. Outrider still had the greatest control (88%) when mowed the same day 70 DAT while the other herbicides ranged from 0 to 17% control. Control in the top set of treatment combinations ranged from 88 to 100% 70 DAT. Only the no mowing and 2 weeks after combinations with Acclaim Extra were in this top group. By 350 DAT control in the top set of treatment combinations ranged from 40 to 88%. Results from this trial suggest that mowing 1 or 2 days after application will not reduce the efficacy of Outrider, Fusilade, or Acclaim + Fusilade. However, one should wait 1 to 2 weeks before mowing if Acclaim Extra was applied. Regrowth of johnsongrass after mowing was slower in 2015 than in 2014 with 89% control for the Outrider and Fusilade II treatments when mowed the same day 32 DAT and 81 to 85% control 53 DAT. Control for the other herbicide treatments mowed the same day ranged from 72 to 75% 53 DAT. At the final assessment in 2016 (298 DAT) the control varied considerably among the plots and ranged from 13 to 48% for those plots that were mowed the same day in 2015, with the least control for the Acclaim Extra treatment. Regrowth was also slower and less in 2019 as there was only 0.5 cm of rainfall in the month of September. We observed 93 to 96% control with the Outrider, Fusilade II, and Acclaim + Fusilade plots that were mowed the same day 31 DAT.

EFFECTIVE DICAMBA EXPOSURE ON ENLIST SOYBEAN. JL Reeves*[1], S Steckel[1], CM Perkins[2], LE Steckel[1]; [1]University of Tennessee, Jackson, TN, [2]The University of Tennessee, Jackson, TN (44)

ABSTRACT

In trying to manage Palmer amaranth, cotton and soybean growers in Tennessee embraced the Xtend (dicamba-tolerant crop) weed management system. In 2017 an estimated 75% of cotton and 60% of soybean acres were planted to Xtend varieties. Unfortunately, most applicators struggled to keep dicamba in the target field when applying this product. The Tennessee Department of Agriculture (TDA) fielded 136 drift complaints. Officials estimated dicamba-drift damages were spread across more than 170,000 off-target hectares – earning Tennessee the undesirable ranking of third in the nation for dicamba damages. Since 2018 there have been fewer official complaints and soybeans acres damaged by off-target dicamba mostly due to the increase in Xtend soybeans being planted in the state. In 2019 it was estimated that well over 90% of the soybeans planted in Tennessee were to an Xtend variety. In 2020 soybean growers will have the choice to plant soybeans with the Enlist trait which provides resistance to glyphosate, glufosinate and 2,4-D. One of the questions Tennessee soybean producers asked about this new trait was if it offered any plant protection against off-target dicamba drift Previous published research would indicate that yield loss from simulated dicamba exposure to Roundup Ready or Liberty Link soybeans would show that yield impact depends upon soybean growth stage at time of exposure, the herbicide rate and how often it was exposed. A study was initiated at Jackson, TN to evaluate if a simulated drift rate of dicamba would affect an Enlist soybean variety. The simulated rate was 1/200 of the field use rate. This rate was sprayed on soybeans at the V3, R1, R3 or R5 growth stages. Other treatments included all applications of that dicamba rate with all combinations of those four growth stages. The treatments were applied with a CO2 back pack sprayer with an application pressure of 275 kpa and calibrated to apply 93 L4/ha. Soybean yield loss was shown with dicamba exposure with all dicamba treatment timings and combinations. The results from this study would suggest that Enlist soybean varieties are just as susceptible to dicamba drift as other non-Xtend varieties. In fact in this study yield loss was demonstrated with the V3 treatment. Previous research has shown that V3 soybean exposed to low rates of dicamba will often not result in yield loss, yet the Enlist soybeans in this study did.

EFFECTS OF 2,4-D ON INTERSPECIFIC CHROMOSOME SUBSTITUTION LINES OF UPLAND COTTON. LM Perez*[1], IS Werle[2], S Saha[3], J Jenkins[3], DM Stelly[4], JF Dean[1], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]MISSISSIPPI STATE UNIVERSITY, Starkville, MS, [3]USDA-ARS, Mississippi State, MS, [4]Texas A&M University, College Station, TX (45)

ABSTRACT

Cotton is a natural source of fiber and a major row crop in the US, with an estimated $6.7 billion raw product value in 2018. However, it is extremely sensitive to broadleaf herbicides such as 2,4-dichlorophenoxyacetic acid (2,4-D) that is used to kill weed species. Weeds greatly reduce cotton growth, yield, harvest-ability and fiber quality, so their management is crucial to cotton production. Weed management strategies often rely on herbicides due to their simplicity, ease of application, and effectiveness. However, numerous glyphosate-resistant weeds have evolved due to intense selection imposed by excessive application of glyphosate for weed control in fields of glyphosate-resistant crops. Needing alternatives to glyphosate, growers and companies have searched for resistance genes to other herbicides. Previously, we have screened interspecific chromosome substitution (CS) lines of Upland cotton in the genetic background of *G. hirsutum* L. for tolerance to 2,4-D in order to find novel variants that can be a potential source of herbicide resistance genes. Here, we report the effects of 2,4-D treatment on the selected CS lines in terms of injury and stunting under field conditions. Seven CS lines including CS-T04-15, CS-B12, CS-B15sh, CS-T04, CS-B22sh, CS-T07, and CS-B04-15 and three control varieties including *G. hirsutum* L. Texas Marker-1 (TM-1), UA48, and Enlist cotton (Dow Agrosciences) were screened for resistance to a field-recommended rate (1.12 kg ai ha^{-1}) of 2,4-D at 4 and 7 weeks after seedling emergence (WAE) using a randomized complete block design ($r=4$) at two locations, Starkville and Pontotoc, MS. Injury from 2,4-D applied at 4 WAE ranged from 7 to 92 % after 14-21 days while 5 to 87 % at 7 WAE. Two lines including CS-T04-15 and CS-B15sh showed the lowest injury at both locations indicating some degree of tolerance to 2,4-D when applied to cotton seedlings at 4 and 7 WAE. The initial findings can be used to develop a dose-response experiment using 2,4-D to identify potential sources of genes for herbicide resistance in cotton.

EFFECTS OF MULTIPLE DICAMBA EXPOSURES TO NON-XTEND SOYBEAN. R Peterson*, TA Baughman; Oklahoma State University, Ardmore, OK (46)

ABSTRACT

Oklahoma growers are dealing with weed resistance to acetolactate synthase (ALS), proto-porphyrinogen oxidase (PPO) herbicides in addition to glyphosate. This has led to a real interest in new herbicide technology specifically Xtend Soybean Systems, which are tolerant to dicamba herbicide. However, offsite movement could hamper the adoption and use of this technology in the future. Therefore, studies were established to evaluate the effects of single and multiple exposure of dicamba on non-Xtend soybean. Trials were established during the 2018 and 2019 growing seasons at the Oklahoma State University's Mingo Valley Research Station near Bixby, OK. Liberty-Link soybean were planted on May 22, 2018 and June 13, 2019. Plots were four 30-inch rows by 25 feet long and included 4 replications. The center two rows were sprayed with Xtendimax at 1/1000X (0.022 fl oz/A) and a 1/10,000X (0.0022 fl oz/A) labeled rate of Xtendimax. Individual treatments were applied at the V2-V3 growth stage or the R1 growth stage. These treatments were either applied once or followed up with two additional applications 7-14 days apart. Plots were maintained weed free with the use of PRE and POST herbicides and hand weeding. Supplemental irrigation was added as needed. Plots were evaluated for visual injury and were harvested for yield. Visual injury was observed with all treatments of Xtendimax but varied with rate and timing. Injury never exceeded 5% with the 1/10,000X rate with any application timing in 2018, except with the 3 applications starting at the V2 growth stage at 9%. Injury only exceeded 5% with the 1/10,000X rate in 2019 with the 3 applications starting at the V2 growth stage at 11% and the V2 followed by R1 application at 8%. Injury was 5% or less in early September of both years with all treatments applied at the 1/10,000X rate. Significantly more injury was observed when with the 1/1000X rate. Injury was at least 15% with all treatments applied at the 1/1000X rate except the single application at the R1 growth stage in 2019. In fact, injury was greater than 20% with the 1/1000X rate when 3 applications were made starting at the V2 growth stage in both 2018 and 2019 when evaluated in August. Injury was 5% or less for all treatments applied at the 1/10,000X rate when evaluated in early September of each year. Injury in early September was 16 to 24% when Xtendimax was applied at the 1/1000X rate at the R1 growth stage alone, preceded by the V2 growth stage, or followed by 2 additional POST applications. Soybean yield was not affected by any of the Xtendimax treatments in 2018. Yield was also not affected by any of the Xtendimax treatments applied at the 1/10,000X rate in 2019. Yields were lower with all treatments applied at the 1/1000X rate in 2019 except when applied once at the V2 growth stage. This may have been the result of the 3-week delay with the 2019 planting. Caution should be considered to avoid drift on to susceptible soybean cultivars with delayed planting or double-crop soybean. Interestingly, even with visual injury evaluations as high as 11% no yield loss was observed with any of the treatments at the 1/10,000X rate regardless of timing or number of exposures. Visual injury evaluations as high as 20% with the 1/1000X rate did not always translate into a yield loss. However, in cases where visual injury exceeded 20% in 2019 yield losses compared to the weed-free check did result in a yield loss. This is further evidence that visual injury does not always correlate with soybean yield losses.

EFFECTS OF MYROTHECIUM VERRUCARIA ON TWO GLYPHOSATE-RESISTANT AMARANTHUS PALMERI BIOTYPES DIFFERING IN BETACYANIN CONTENT. RE Hoagland*, CD Boyette, KC Stetina, RH Jordan; USDA-ARS, Stoneville, MS (47)

ABSTRACT

We discovered two biotypes of *Amaranthus palmeri* (Palmer amaranth) that were resistant to glyphosate but differed with respect to pigmentation. One biotype was typically red-pigmented (betacyanin) while the other was green/yellow, with no red hue on any plant part at any growth stage. We have also reported that *Myrothecium verrucaria* (MV) exhibited bioherbicidal activity against several major weeds including glyphosate-resistant Palmer amaranth. In greenhouse tests, MV was applied to these two biotypes (red and green) at two ages (3-wk- and 6-wk-old) and effects monitored over a 5-day time course. Initial symptoms of MV (16 to 24 hr after inoculation) on plants were: epinasty, wilting and lesion development on leaves and stems. Generally, younger plants tended to be more sensitive to MV than older plants. Bioherbicidal damage increased with time leading to necrosis, increasing disease progression and plant mortality. Severe loss of fresh weight occurred in both biotypes as compared to untreated plants. Results showed that MV was effective on both biotypes, but effects on growth reduction and disease progression were more rapid and generally greater in the green biotype, suggesting that compounds responsible for red pigmentation may have a defense role against pathogen attack.

EFFECTS OF NOZZLE TYPE AND APPLICATION PRESSURE ON WEED MANAGEMENT IN MISSISSIPPI PEANUT (ARACHIS HYPOGEA). KL Broster*[1], JC Ferguson[1], TA Baughman[2], BJ Zurweller[1], B Rushing[1]; [1]Mississippi State University, Mississippi State, MS, [2]Oklahoma State University, Ardmore, OK (48)

ABSTRACT

Peanuts are an important cash crop for the United States, and Mississippi produced 20 million dollars of peanuts in 2018 (USDA-NASS, 2019). Peanuts have a prostrate growth pattern, making it easy for weeds to shade the crop canopy, and interfere for nutrients, water, and light. An important part of weed control is nozzle selection, and proper application methods. The purpose of this study is to determine whether nozzle type and/or operating pressure affect the season long weed control program. A field study was conducted at Mississippi State University, MAFES Coastal Plain Branch Experiment Station in Newton, Mississippi. A runner type peanut, Georgia 06G, was used and herbicide applications were made at three different timings: pre-emergent (PRE), early post-emergent (POST) (cracking), and late POST. Weed control ratings were collected 7, 14, 28, 42, and 56 days after the late POST. Yield data was collected at harvest and used to determine the most effective application method for season long weed control. Our data indicates that there is not a significant difference in nozzle and pressure in terms of weed control or yield. This indicates that a three-pass herbicide system effective across nozzle and pressure in peanuts. Spray applications should be made in a timely manner with a nozzle and pressure that the applicator is comfortable with to prevent errors and weed escapes, which is imperative with the growing amount of weed resistance in the United States.

EFFECTS OF TEMPERATURE AND GIBBERELLIC ACID ON THE GERMINATION OF POA ANNUA SEEDS IN MAINTAINED TURFGRASS OF MISSISSIPPI. EB De Castro*[1], JD McCurdy[1], TM Caputo[1], J Brosnan[2], PE McCullough[3], AJ Patton[4], DE Carroll[2]; [1]Mississippi State University, Mississippi State, MS, [2]University of Tennessee, Knoxville, TN, [3]University of Georgia, Griffin, GA, [4]Purdue University, West Lafayette, IN (49)

ABSTRACT

Annual bluegrass (*Poa annua*) is a troublesome winter annual weed in turfgrass systems of the southeastern United States. The objective of this study was to evaluate the effects of temperature and gibberellic acid treatment on speed of annual bluegrass germination. This research is part of the larger USDA-SCRI funded *Resist Poa Project* and was conducted in part to accelerate germination and seedling propagation during herbicide resistance screening studies. Annual bluegrass seed were harvested from field plots at Mississippi State University at various growing degree-day (GDD) intervals (base 0°C). Inflorescences were harvested at 300, 400, 500, 600, 700, 800, 900, and 1100 GDD accumulated since January 1, 2019. They were dried at 40°C for 7 days, screened with #10 soil sieve (2 mm) to remove chaff, and vernalized at 4°C for a minimum of 7 days. Seed were incubated in a growth chamber in separate Petri dishes with blotter paper substratum moistened with distilled water. Germination treatments (4 replicates) included: high temperature (25/20°C day/night), low temperature (18/12°C), and scarification + gibberellic acid (GA) at low temperature. Day/night -time temperatures were maintained 8/16 h, respectively. Seed of the latter treatment were lightly scarified with 220-grit sandpaper and placed in between two layers of filter paper inside of a Petri dish. A gibberellin A3 solution (1000 mg/L with deionized water) was added until both layers of paper were completely soaked (approximately 2 mL). The Petri dish was closed and incubated at room temperature (21 °C) for 24 hours. After incubation, seed were washed in a fine-mesh sieve using distilled water and dried on filter paper. All seed treatments were germinated in a Petri dish (30 seeds per dish). Germinated seed were counted 21, 30, and 48 days after incubation (DAI). Once a seed germinated, it was recorded and removed. After the final assessment, percent germination for each treatment was calculated and subject to non-linear regression using the Gompertz model, which does not require log transformation of the x-axis. Models for each treatment were compared pair-wise using a standard F-test (a = 0.05). When assessed 21 and 30 days after initiation, scarification + GA increased germination relative to both high and low treatments. By 48 DAI, germination of scarification + GA and the low treatment were similar. However, at no point were effects of the high treatment equal to those of scarification + GA or the low temperature treatment. These data suggest that the 18/12°C treatment is preferable to the 25/20°C, and that annual bluegrass germination is accelerated with scarification + GA. Future research could investigate GA solution concentration and time of GA incubation. Already, these improved methods have reduced time required to screen annual bluegrass for herbicide resistance, especially when seed number or germination rate are excessively low.

EFFICACY OF FLURIDONE (BRAKE) HERBICIDE IN MISSISSIPPI PEANUT. RR Hale*[1], T Bararpour[1], K Briscoe[2], J Gore[1], DR Cook[1]; [1]Delta Research and Extension Center, Stoneville, MS, [2]SePRO Corporation, Whitakers, NC (50)

ABSTRACT

In Mississippi, peanut (*Arachis hypogaea*) producers are limited in pre-emergence (PRE) herbicide options at planting. Fluridone (Brake) is a carotenoid biosynthesis inhibiting herbicide that is commonly used in cotton (*Gossypium hirsutum*) that offers residual control of *Amaranthus* ssp. Palmer amaranth (*Amaranthus palmeri*) is one of the most troublesome weeds in peanut and controlling it early in the season is beneficial to maximize yield potential. Other difficult weeds to control in peanut include: barnyardgrass (*Echinochloa crus-galli*), broadleaf signalgrass (*Urochloa platyphylla*), and pitted morningglory (*Ipomoea lacunosa*). A field study was conducted in 2019 at the Delta Research and Extension Center in Stoneville, MS, to evaluate the efficacy of fluridone in Mississippi peanut. Peanut (Georgia-D06G) was planted on May 9, 2019 and emerged May 25. The experiment was arranged as a randomized complete block design with six treatments and four replications. All herbicide rates are in kg ai ha-1. Treatments for the study were as follows: 1) fluridone at 0.17; 2) fluridone at 0.34; 3) fluridone at 0.67; 4) fluridone at 0.17 + flumioxazin at 0.11; 5) flumioxazin at 0.11; and 6) nontreated check. All herbicide applications were applied PRE. No injury was observed for any treatment during the study. Barnyardgrass control was 70 and 53, 83 and 61, 84 and 64, 76 and 63, 76 and 59% at 4 and 9 weeks after treatment (WAT) from treatment 1 through 5, respectively. Treatment 1 through 5 provided 71 and 51, 83 and 61, 85 and 65, 79 and 66, 80 and 63% control of broadleaf signalgrass at 4 and 9 WAT, respectively. Palmer amaranth was a difficult weed to control. At 4 and 9 WAT, Palmer amaranth control was 60 and 39, 66 and 43, 75 and 48, 89 and 68, 86 and 70%, respectively. Treatment 1 through 5 provided 76 and 54, 85 and 60, 85 and 61, 89 and 65, 89 and 70% control of pitted morningglory at 4 and 9 WAT, respectively. Based on these results, fluridone may offer another viable option for peanut producers in Mississippi.

EVALUATING THE EFFECT OF RICE GROWTH STAGE AT APPLICATION ON VARIETAL TOLERANCE TO BENZOBICYCLON. JA Patterson*, JK Norsworthy, ZD Lancaster, JW Beesinger, OW France; University of Arkansas, Fayetteville, AR (51)

ABSTRACT

Benzobicyclon is a new herbicide that is currently being evaluated for use in Midsouth rice production. Benzobicyclon must be applied post-flood for its phytotoxic form, benzobicyclon hydrolysate, to be formed. Little to no herbicidal activity has been observed from benzobicyclon when there is no continuous flood present. Benzobicyclon will be the first Group 27 (HPPD) herbicide available for Midsouth rice production. In 2018 and 2019, field experiments were conducted at the Rice Research and Extension Center near Stuttgart, Arkansas. The objectives of these experiments were to assess levels of injury across five rice cultivars when receiving an application of benzobicyclon, and to evaluate the impact of growth stage at the time of application on injury caused by benzobicyclon. The experiments were implemented as split-plot designs with four replications. The herbicides used in the experiments were Rogue (benzobicyclon) and Rogue Plus (benzobicyclon + halosulfuron) with the benzobicyclon and halosulfuron rates being 741 and 116 g ai ha-1, respectively, which are twice the anticipated labeled rate. The rice cultivars used were CL153, PVL01, Rondo, Diamond, and CLXL745. Herbicide treatments were applied post-flood at three crop stages: 1- to 2-leaf, 3- to 4-leaf, and tillering. In 2018, three weeks after the post-flood application, Rondo was severely injured (>95% injury) at all growth stages likely because of its indica background. For the four other japonica-type rice cultivars, tolerance to both benzobicyclon treatments generally increased with rice size at application. Generally, rice was more tolerant to benzobicyclon plus halosulfuron (Rogue Plus) than benzobicyclon alone (Rogue), possibly because of differences in the formulation of these two herbicides (SC vs. DF). For tillering rice, no more than 18% injury was observed, and this injury was transient, indicating rice has adequate tolerance to this herbicide. In 2019, three weeks after the post-flood application, Rondo was severely injured (>96% injury) at all growth stages, and the four other japonica-type rice cultivars were injured by less than 6% across all treatments.

EVALUATION OF ACCASE-RESISTANT GRAIN SORGHUM TO FLUAZIFOP AT DIFFERENT GROWTH STAGES. LB Piveta*[1], JK Norsworthy[1], MV Bagavathiannan[2]; [1]University of Arkansas, Fayetteville, AR, [2]Texas A&M University, College Station, TX (52)

ABSTRACT

Postemergence herbicides designed to control grass species are limited in grain sorghum. The products that are available generally do not work well in areas with large infestations of herbicide-resistant johnsongrass, broadleaf signalgrass, and barnyardgrass. However, genetic resistance to ACCase-inhibiting herbicides would provide sorghum producers options for postemergence grass control. A dose-response experiment was conducted in the greenhouse, in a completely randomized design with five replications with the following rates of fluazifop applied to ACCase-resistant (R) plants: 1, 2, 4, 8, 16, 32, and 64x (x = 105.4 g ai ha^{-1}). Susceptible (S) plants were treated with 0.03125, 0.0625, 0.125, 0.25, 0.5, and 1x rates of fluazifop. The growth stages of applications were 2-leaf, 3- to 4-leaf, and 5- to 6-leaf. Dry biomass data were collected 28 days after application. The resistant index (R/S), based on the GR_{50} was found to be 28.1 at 2-leaf stage, incalculable at the larger growth stages. This is largely due to a GR50 not applicable to these growth stages, as herbicide injury was scarce. The rate of 422 g ai ha^{-1} (4x) fluazifop did not cause significant visible injury (<15%) or biomass reduction (0%) to ACCase-resistant grain sorghum when applied at growth stages larger than 3-leaf.

EVALUATION OF ALS RESISTANT YELLOW NUTSEDGE (CYPERUS ESCULENTUS) IN GA PEANUT. FM Rigodanzo[1], NT Basinger*[1], EP Prostko[2]; [1]University of Georgia, Athens, GA, [2]University of Georgia, Tifton, GA (53)

ABSTRACT

Georgia is the largest producers of peanuts in the United States producing over 45% of the country's peanut crop. Weeds are a consistent issue for producers especially yellow nutsedge (*Cyperus esculentus*) which can reduce peanut yields and contaminate the harvested crop. Peanut producers often use imazapic to because of its efficacious control of *C. esculentus* and good crop safety. Reports of poor control of yellow nutsedge were reported in Georgia peanut after a multi-year history of continuous imazapic use for *C. esculentus* control. The objectives of this study are to determine the I_{50} and GR_{50} for the suspected resistant population and determine if the suspected population is also resistant to halosulfuron. Tubers from known susceptible and collected tubers from suspected resistant *C. esculentus* grown in a greenhouse for screening. Susceptible biotypes were sprayed with imazapic at 0, 8.8, 17.5, 35, 70, 140, 280 and 560 g ai ha^{-1}, and resistant biotypes were sprayed with 0, 70, 140, 280, 560, 1130, 2260, and 4500 g ai ha^{-1}. To determine if the suspected resistant biotype was cross-resistant to other ALS herbicides, both biotypes were sprayed with 0, 11.7, 23.3, 46.6, 93.3, 187, 373, and 746 g ai ha^{-1} of halosulfuron. Plants were rated for injury at 7, 14, and 28 days after treatment (DAT), and above-ground biomass harvested at 28 DAT. ED_{50} was 41 and 1503 g ai ha^{-1} and the GR_{50} was estimated to be 12.8 and 1853 g ai ha^{-1} for susceptible and resistant biotypes respectively. Both susceptible and resistant biotypes responded similarly to applications of halosulfuron and were controlled at rates greater than 93 g ai ha^{-1}. This study confirms a resistant biotype of *C. esculentus* in Georgia to imazapic. Growers should continue to rotate chemistries for control of yellow nutsedge as the use of imazapic over consecutive years has lead to resistance. Further research is needed to determine the mechanism of resistance and to determine the extent of resistance of *C. esculentus* in peanut production in GA.

EVALUATION OF HERBICIDE PROGRAMS FOR BLACKBERRY PRODUCTION. P Carvalho de Lima*[1], M Machado Noguera[1], L Benedetti[2], NR Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]Federal University of Pelotas, Pelotas, Brazil (54)

ABSTRACT

Blackberry is a high-value crop and is one of the most profitable ventures for small-acreage farmers in some regions of the U.S. Weed management in blackberry is particularly challenging because it is a perennial crop and the majority of registered blackberry herbicides cannot be applied past blooming. This research was conducted in 2018 and 2019 at the Fruit Research Station, Clarksville, AR to assess the response of blackberry to various herbicide treatments. The herbicides were indaziflam (0.07), glufosinate (1.09), oryzalin (4.48), norflurazon (2.8), simazine (2.24), pendimethalin (3.36), *S*-metolachlor (2.14), mesotrione (0.21), flumioxazin (0.191), terbacil (1.68), diuron (1.68 and 2.24), oxyfluorfen (1.12) and a premix of *S*-metolachlor and sulfentrazone (2.07). All herbicide units are in kg ha^{-1}. In total, 24 treatments consisting of various combinations and sequences of these herbicides were sprayed before bud break, early summer, and/or fall. The treatments were arranged in a randomized complete block design with four replications. Plots were 1.8 m wide and 3.7 m long. Weed control (%) was scored in 2019 at 4 wk after treatment before bud break (4 WAT-BB) and 4 wk after early summer application (4 WAT-ES). Yield per plot was converted to yield of 480 plants ha^{-1}. Thirty fruits were counted and weighed. Data were analyzed in SAS 9.4 using PROC GLIMMIX and means were separated using Tukey's HSD at a=0.05. The lowest weed control was obtained from plots treated with *S*-metolachlor + flumioxazin before bud break (59%), and it differed significantly from the top five treatments (98 – 93%). In 2018, simazine + *S*-metolachlor + glufosinate before bud break followed by glufosinate + norflurazon in the fall, and treatment with diuron + glufosinate before bud break followed by oryzalin in early summer resulted in the least weed control at 4 WAT-BB, 48 and 58% respectively. Terbacil + glufosinate applied before budbreak followed by oryzalin in early summer resulted in the highest yield in 2018 and the second highest yield in 2019 (5,074 and 2,553 kg ha^{-1}, respectively). Application of simazine + *S*-metolachlor + glufosinate before bud break followed by glufosinate + norflurazon in the fall resulted in the highest yield in 2019 (3599 kg ha^{-1}). Applying oxyfluorfen + glufosinate before bud break followed by oryzalin in early summer resulted in the lowest yield in both years. The herbicide treatments did not affect the size of fruits.

EVALUATION OF IMPACTZ FOR WEED CONTROL IN CORN. RR Hale*[1], T Bararpour[1], S Ludwig[2], MW Ebelhar[1]; [1]Delta Research and Extension Center, Stoneville, MS, [2]Nichino, Arp, TX (55)

ABSTRACT

Weed control in corn (*Zea mays*) is a necessary component to maximize yield potential. As the evolution of herbicide-resistant weeds continue to rise, herbicide options become limited in controlling troublesome weeds like barnyardgrass (*Echinochloa crus-galli*), broadleaf signalgrass (*Urochloa platyphylla*), entireleaf morningglory (*Ipomoea hederacea*), hemp sesbania (*Sesbania herbacea*), and Palmer amaranth (*Amaranthus palmeri*). A field study was conducted in 2019 at the Delta Research and Extension Center, in Stoneville, MS, to evaluate ImpactZ (topramezone + atrazine) for weed control in corn. Corn (Pioneer P1563YHR) was planted on April 23, 2019 and emerged on April 30. The experiment was arranged as a randomized complete block design with six treatments and four replications. All herbicide rates are in kg ai ha-1. Treatments for the study were as follows: 1) ImpactZ at 0.3 + AAtrex (atrazine) at 2.24 + Roundup PowerMax (glyphosate) at 1.26 (kg ae ha-1) + MSO (methylated seed oil) at 0.25% (v/v) + AMS (ammonium sulfate) at 2.5% (v/v); 2) ImpactZ at 0.3 + Roundup PowerMax at 1.26 + Zidua (pyroxasulfone) at 0.12 + MSO at 0.25% (v/v) + AMS at 2.5% (v/v); 3) ImpactZ at 0.3 + Roundup PowerMax at 1.26 + Dual II Magnum (*S*-metolachlor) at 1.4 + MSO at 0.25% (v/v) + AMS at 2.5% (v/v); 4) Halex GT (glyphosate + *S*-metolachlor) at 2.22 + NIS (non-ionic surfactant) at 0.25% (v/v) + AMS at 2.5% (v/v); 5) Halex GT at 2.22 + AAtrex at 1.68 + COC (crop oil concentrate) at 1% (v/v); and 6) nontreated check. All herbicide applications were made at the V3-V4 corn growth stage.At one-week after treatment (WAT), corn injury was 5 and 4% for treatment 1 and 3, respectively. Barnyardgrass and broadleaf signalgrass control was 90 and 86, 94 and 95, 95 and 94, 96 and 94, 96 and 97% for treatment 1 through 5 at 10 weeks after emergence (WAE), respectively. Treatment 1 through 5 provided 90 to 100% control of entireleaf morningglory and hemp sesbania at 10 WAE. Palmer amaranth control was 98 to 100% for all treatments at 10 WAE, except treatment 4 (85%). Corn yield was 11,801; 10,250; 11,691; 11,894; and 12,115 kg ha-1. Weed interference reduced corn yield by 62% (nontreated check). Based on these results, ImpactZ will give corn producers another option for non-selective weed control in corn.

EVALUATION OF PEANUT TOLERANCE TO FLUMIOXAZIN WITH VARIOUS PLANTING DEPTHS AND SEEDING RATES UNDER EXCESSIVE SIMULATED RAINFALL. KJ Price*, S Li, FB Browne, RD Langemeier; Auburn University, Auburn, AL (56)

ABSTRACT

Flumioxazin is a vital preemergence herbicide in peanuts for residual weed control throughout the southeast. In 2017, Alabama peanut producers who utilized flumioxazin observed injury and stunting following excessive rainfall events. Further evaluation was needed to determine if the injury was caused by the excessive rainfall in combination with flumioxazin, what planting conditions could mitigate this injury, and if one preemergent program caused more injury than others in these conditions. Therefore, two studies were implemented to evaluate peanut seed vigor when planted in a combination of: two different planting times (May and June), two different seeding rates (101 and 151 kg/ha^{-1}), two planting depths (3.8 and 7.6 cm) and different tank mixes with flumioxazin. In 2019, field studies were conducted in Henry and Baldwin counties in AL. The first study evaluated peanuts planted in early May and June, at two different planting depths and treated with flumioxazin 107 + *S*-metolachlor 1,466 g ai ha^{-1} or no herbicide treatment. The second study was planted with two different seeding rates the first week of June and was treated with flumioxazin 107 g ai ha^{-1}, flumioxazin 107 + *S*-metolachlor 1,466 g ai ha^{-1}, *S*-metolachlor 1,466 + diclosulam 26 g ai ha^{-1}, or non-treated check. Treatments were applied the day of planting with Teejet TTI110025 nozzles calibrated at 187 L ha^{-1} output with a hand held boom. Peanut seeding rates and planting depths were planted in strips and herbicide treatments were applied randomly in each of the 4 replications. All treatments were irrigated with 3.8 cm of water immediately after planting and herbicide application to simulate a heavy rainfall event. Peanut growth parameters including stand count, plant heights and widths were collected 3 and 7 weeks after planting as well as yield of each plot at harvest. There were no significant stand reductions observed in either one of the trials. In Henry County, peanut plant heights were significantly reduced by 15% and 22% for flumioxazin + *S*-metolachlor for peanuts planted at 7.8 am and 3.8 cm depth, respectively at 3 weeks after planting (WAP). At 7 WAP, peanut plant heights were significantly reduced by 7% for treatments sprayed with flumioxazin +*S*-metolachlor regardless of seeding depth or planting timing over both locations. A 12% plant height reduction was observed for treatments sprayed with flumioxazin + *S*-metolachlor regardless of the seeding rate at 7 WAP in Henry County. Width reductions of 11-13% were only observed for flumioxazin + *S*-metolachlor planted at 7.8 am and 3.8 cm depth, respectively over both planting timings at 3 WAP in Henry County. *S*-metolachlor + diclosulam did not cause any stand, width or height reductions suggesting flumioxazin is causing the early season stunting. While stunting was observed, given a full growing season, there were no significant yield losses observed. Peanut producers may see stunting in peanuts directly after planting and herbicide application followed by an excessive rainfall event especially when peanuts are planted shallow and/or are treated with flumioxazin + *S*-metolachlor, however, this data suggests peanuts will recover.

EVALUATION OF RESIDUAL HERBICIDES FOR BROAD SPECTRUM WEED CONTROL IN MISSISSIPPI PEANUT. T Bararpour*, J Gore, RR Hale, DR Cook; Delta Research and Extension Center, Stoneville, MS (57)

ABSTRACT

Weed control is one of the most limiting factors facing peanut (*Arachis hypogaea*) producers in Mississippi. A field study was conducted in 2019 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate residual herbicides for broad spectrum weed control in Mississippi Peanut. Peanut (Georgia-D6G) was planted at a seeding rate of 8 seeds ft^{-1} on May 09, 2019 and emerged on May 25. Plot size was 13 ft wide by 20 ft long. The plot area contained Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), broadleaf signalgrass (*Urochloa platyphylla*), barnyardgrass (*Echinochloa crus-galli*), and hemp sesbania (*Sesbania herbacea*). The study was designed as a randomized complete block with 16 treatments and four replications. Treatments were as follows: 1) Prowl (pendimethalin) at 2 pt/A; 2) Valor (flumioxazin) at 2 oz/A; 3) Valor at 3 oz/A; 4) Dual Magnum (*S*-metolachlor) at 1.5 pt/A; 5) Dual Magnum at 2 pt/A; 6) Warrant (acetochlor) at 2 qt/A; 7) Zidua SC (pyroxasulfone) at 2.5 fl oz/A; 8) Zidua SC at 3 fl oz/A; 9) Strongarm (diclosulam) at 0.3 oz/A; 10) Strongarm at 0.45 oz/A; 11) Valor at 3 oz/A + Dual Magnum at 1.5 pt/A; 12) Zidua SC at 2.5 fl oz/A + Dual Magnum at 1.5 pt/A; 13) Warrant at 2 qt/A + Dual Magnum at 1.5 pt/A; 14) Strongarm at 0.45 oz/A + Dual Magnum at 1.5 pt/A; 15) Valor at 3 oz/A + Zidua SC at 2.5 fl oz/A; and 16) nontreated check. All treatments were applied preemergence (PRE). There was no peanut injury from any herbicide application from 1 to 10 weeks after emergence (WAE). Barnyardgrass control was 70 and 48, 84 and 66, 83 and 64, 88 and 66, 89 and 71, 78 and 48, 80 and 60, 75 and 55, 78 and 68, 84 and 73, 89 and 84, 90 and 74, 84 and 65, 86 and 80, 91 and 85% from treatment 1 through 15 at 3- and 6-WAE, respectively. Treatment 1 through 15 provided 64 and 48, 80 and 63, 78 and 64, 84 and 65, 86 and 66, 71 and 40, 75 and 50, 71 and 54, 74 and 65, 80 and 71, 85 and 84, 88 and 71, 83 and 64, 85 and 78, 90 and 81% broadleaf signalgrass control at 3- and 6-WAE, respectively. Hemp sesbania control was 64 and 31, 91 and 83, 90 and 91, 79 and 54, 80 and 55, 64 and 23, 66 and 18, 70 and 25, 81 and 64, 90 and 84, 98 and 91, 84 and 68, 79 and 63, 95 and 89, 100 and 94% from treatment 1 through 15 at 3- and 6-WAE, respectively. Pitted morningglory control was 64 and 45, 79 and 61, 78 and 68, 59 and 44, 56 and 41, 59 and 29, 65 and 38, 66 and 24, 75 and 58, 78 and 63, 76 and 76, 68 and 38, 61 and 45, 85 and 73, 83 and 65% from treatment 1 through 15 at 3- and 6-WAE, respectively. Treatment 1 through 15 provided 76 and 60, 93 and 88, 90 and 83, 86 and 74, 85 and 70, 80 and 43, 79 and 65, 76 and 51, 85 and 75, 93 and 80, 93 and 88, 85 and 69, 84 and 69, 94 and 90, 90 and 84% prickly sida control at 3- and 6-WAE, respectively. Palmer amaranth was a difficult weed to control. Treatment 1 through 15 provided 59 and 39, 81 and 58, 80 and 68, 78 and 66, 78 and 61, 55 and 31, 59 and 35, 65 and 39, 59 and 38, 60 and 24, 83 and 76, 79 and 55, 75 and 48, 73 and 31, 89 and 78% control of Palmer amaranth at 3- and 6-WAE, respectively. Based on this study, treatments 11 (Valor + Dual Magnum) and 15 (Valor + Zidua SC) were the best applications in terms of longer residual activity and broad spectrum weed control.

EVALUATION OF SOYBEAN GRAIN AND SEED QUALITY FOLLOWING HARVEST AID APPLICATION AND DELAYED HARVEST CONDITIONS. AB Scholtes*[1], RL Adams[1], TW Allen[2], JT Irby[1], JA Bond[2]; [1]Mississippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS (58)

ABSTRACT

Soybean growers in the mid-southern U.S. face many challenges throughout the growing season. One example is a decrease in seed and/or grain quality due to delayed harvest that may develop following adverse weather conditions. During these events, the environment becomes conducive for moisture to enter the pod or for pathogens to spread, both of which may contribute to decreased quality of seed and/or grain. The objective of this research was to evaluate seed and grain quality as it relates to delayed harvest conditions for soybean after a harvest aid is applied to facilitate a more efficient harvest. Experiments were conducted during 2019 at the R.R. Foil Plant Science Research Center near Starkville, MS and the Delta Research and Extension Center near Stoneville, MS. Soybean was treated with the following harvest aids: paraquat applied at 280 g ai ha^{-1}, sodium chlorate applied at 3360 g ai ha^{-1}, or a tank mix of paraquat plus sodium chlorate. Harvest aids were applied at the R7 growth stage. Each treatment combination was harvested on time as well as 2, 4, and 6 weeks later in order to simulate delayed harvest conditions. An untreated check was included with each harvest aid and harvest delay combination. Data collection consisted of visual ratings for lodging and desiccation, shattering losses due to harvest (seeds/m^2), seed and grain quality and yield. Preliminary results indicate that soybean yield was found to be impacted by harvest delay, rather than harvest aid treatment. Preliminary results also suggest that harvest delay is linked to a decrease in seed quality as observed through germination tests, as well as a decrease in grain quality as observed through total damage scores determined by an official USDA designated grain inspection facility. Further research should be conducted in order to fully determine the influence of management practices such as harvest aid application on soybean seed and grain quality following delayed harvest conditions when adverse weather conditions occur.

EVALUATION OF WEED CONTROL WITH MULTIPLE COVER CROP TERMINATION TIMINGS. A Ross*[1], T Barber[2], TR Butts[2], RC Doherty[3], ZT Hill[3], LM Collie[4]; [1]University of Arkansas, Lonoke, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas System Division of Agriculture, Monticello, AR, [4]University of Arkansas, Beebe, AR (59)

ABSTRACT

Cover crops have become increasingly popular in the mid-south, primarily for erosion control as well as an economical benefit to soil health and weed suppression. With the increased interest in the utilization of cover crops, a common concern is when to terminate the cover crop to achieve optimum weed suppression throughout the growing season. This study was conducted in 2018 and 2019 at the Lon Mann Cotton Research Station in Marianna, AR to determine weed suppression in soybean, based on cover crop termination timings at four weeks before planting (WBP) and every following week leading up to planting. A common cover crop blend including cereal rye, Austrian winter pea, vetch, clover and radish was planted and compared to straight cereal rye. Cover crops were planted in November each year. A conventional tillage treatment was added for comparison, as well as an untreated treatment, where no herbicide was applied to terminate the cover crop. The test was designed as a randomized complete block with five cover termination timings: 4 WBP, 3 WBP, 2 WBP, 1 WBP, and at planting (AP). Dicamba was applied at 0.5 lb. ae/a with Glyphosate at 1.72 lb. ae/a for each termination timing. A POST herbicide application consisting of Dicamba applied at 0.5 lb. ae/a with a pre-mix of fomesafen + S-metolachlor at 1.53 lb./a and with glyphosate at 1.13 lb. ae/a was made 14 days following crop emergence. Soybean were planted May 9th and 8th in 2018 and 2019 respectfully. A visual weed control assessment was taken two weeks after soybean emergence. The untreated treatments of both the cover crop blend and cereal rye were allowed to terminate and mature naturally. The 2 and 1 WBP, and AP termination timings provided 91-98% control of Palmer amaranth which was not significantly different from the conventional tillage treatments The 4 and 3 WBP termination timings only provided 75% control or less of Palmar Amaranth due to the lack of biomass at time of application. Other weed species such as tall morning, barnyard grass, and goose grass had similar results among the termination timings as Palmar Amaranth. Two weeks after the blanket POST application, another visual weed control assessment was taken. At this time, there was a significant difference between 4 WBP and all other treatments with only 80% control in the cover crop blend and 75% control in the cereal rye. All other treatments achieved 95% control or better following the POST application. The plots that received no chemical termination (untreated) resulted in significantly lower soybean yield with no significant differences among all other treatments.

FALL VERSUS SPRING APPLICATIONS FOR BROADLEAF WEED CONTROL IN WINTER WHEAT. KW Bamber*[1], ML Flessner[1], M VanGessel[2]; [1]Virginia Tech, Blacksburg, VA, [2]University of Delaware, Georgetown, DE (60)

ABSTRACT

Many herbicides labeled in winter wheat (*Triticum aestivum*, L.) can be sprayed from 2-leaf stage (Zadoks' stage 12) through the end of stem elongation (Zadoks' stage 39). Broadleaf winter annual weeds are most actively growing in fall prior to winter wheat dormancy and in spring once dormancy breaks. Therefore, it is possible to apply herbicides to winter wheat in either fall or spring, but it is uncertain which timing provides optimal weed control and/or better yield protection. Three trials were established in the mid-Atlantic region, 2 in Virginia and 1 in Delaware, in fall 2018 to investigate the influence of application timing of six different herbicides/herbicide tank mixes on winter broadleaf weed control and winter wheat grain yield. Treatments included pyrasulfotole at 34 g ai ha^{-1} + bromoxynil at 191 g ai ha^{-1}, halauxifen at 5.5 g ae ha^{-1} + florasulam at 5.2 g ai ha^{-1}, pyroxsulam at 18.2 g ai ha^{-1}, thifensulfuron at 17.5 g ai ha^{-1} + tribenuron at 8.8 g ai ha^{-1} with either 2,4-D ester at 267 g ae ha^{-1} or metribuzin at 158 g ai ha^{-1}, and halauxifen at 5 g ae ha^{-1}. All herbicides were applied in fall (October 18 – November 19, 2018) and in late winter (February 19 – March 20, 2019) with label-recommended adjuvants. All trials were arranged in a randomized complete block design and included a nontreated check. Plots were visually assessed for percent weed control and crop injury 4 weeks after spring application (WAB) as well as for grain yield at harvest. Weed control data were not pooled across site-year because different weed species were observed at each site. Fall applications controlled Persian speedwell (*Veronica persica*, Poiret), mouse-ear chickweed (*Cerastium fontanum* subspecies *vulgare*, (Hartmann) Greuter & Burdet), jagged chickweed (*Holosteum umbellatum*, L.), field pansy (*Viola bicolor*, Pursh), and knawel (*Scleranthus annuus*, L.) better than spring applications (73-88% vs. 56-71%). Spring applications controlled cutleaf evening primrose (*Oenothera laciniate*, Hill) better than fall applications (78% vs. 67%). Both application timings were equally effective (74-90%) at controlling henbit (*Lamium amplexicaule*, L.), shepherd's purse (*Capsella bursa-pastoris*, (L.) Medicus), mouse-ear cress (*Arabidopsis thaliana*, (L.) Heynhold), and corn speedwell (*Veronica arvensis*, L.). Fall-applied thifensulfuron + tribenuron + metribuzin consistently controlled all weeds well (87-100%), whereas most other treatments provided less than 60% control for at least one weed. Spring applications caused more wheat stunting than fall applications in Delaware 4 WAB, ranging 0-16%. No crop injury was observed in Virginia. Neither individual treatment nor application timing affected grain yield at any site. Despite generally better weed control from fall applications, our data suggest that no yield loss will result from waiting until spring to apply the herbicides in these trials.

FIBER QUALITY AND VALUE AS IMPACTED BY SUB-LETHAL RATES OF 2,4-D. SA Byrd*[1], M Manuchehri[1], PA Dotray[2], W Keeling[3], G Morgan[4]; [1]Oklahoma State University, Stillwater, OK, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Texas A&M AgriLife Research, Lubbock, TX, [4]Cotton Incorporated, Cary, NC (61)

ABSTRACT

The impact of sub-lethal rates of 2,4-D on cotton growth, development, and yield has been extensively documented; however, the impact on cotton fiber quality appears to be unexplored. To determine the impact on these post-harvest parameters, a study was conducted in 2013, 2014, and 2015 at the Texas Tech New Deal Research Farm in Lubbock, TX. Five sub-lethal rates of 2,4-D were applied at the nine leaf and first bloom growth stages, with a non-treated control (NTC) also included. The rates represented different fractions of the full rate of 2.22 kg. ae ha-1 of 2,4-D choline plus glyphosate, included 0.0008, 0.008, 0.08, 0.8, and 8% of the full rate. After harvest, lint yield was determined through ginning, fiber quality was determined through USDA classing. The value of fiber per pound was determined using the 2015 upland cotton loan schedule. Compared to the NTC, both micronaire and uniformity were reduced in 2013 at the 8% rate, and in 2015 at the 8 and 0.8% rates. Length was reduced by the 8% rate compared to the NTC in 2013. The 8% rate reduced fiber strength in all three years of the study compared to the NTC. Similar to specific fiber quality categories, both loan value and gross return of cotton per hectare (lint yield X loan value) were reduced due to the 0.8 and 8% rates in 2013 and 2015. Due to cooler seasonal conditions in 2014, the fiber quality and loan value of fiber was not affected by 2,4-D, but the yield loss still resulted in a reduction in gross return at the 0.08, 0.8, and 8% rates. The results of this study provide evidence that the loss in fiber value and, as a result, gross profit, are greatest in years where conditions favorable for high quality fiber production are present.

GENOTYPING ARKANSAS WEEDY RICE ACCESSIONS FOR THE HIS1 (HPPD INHIBITOR SENSITIVE 1) GENE. FG Torralva*, C Brabham, JK Norsworthy; University of Arkansas, Fayetteville, AR (62)

ABSTRACT

Weedy rice is one of the most problematic weeds of rice fields in the midsouthern United States. To control weedy rice, farmers have relied on the Clearfield™ technology, which involves a point mutation in the acetolactate synthase (ALS) gene that provides resistance to imidazolinone (IMI) herbicides. However, the extensive use of this technology has selected for IMI-resistant weedy rice accessions. Recent research has shown benzobicyclon, a 4-hydroxyphenlpyruvate dioxygenase (HPPD)-inhibiting herbicide, may be effective for controlling weedy rice in non-traited cultivated rice. Research has also shown significant differences exist among weedy rice accessions susceptibility to benzobicyclon. Benzobicyclon tolerance is conferred by the presence of a functional HIS1 (HPPD Inhibitor Sensitive 1) gene. In this study, we genotyped randomly selected weedy rice accessions for the presence of a functional HIS1 gene. Furthermore, HIS1 and the ALS gene are located on the same rice chromosome and we were interested in determining if resistance to IMI herbicides and benzobicyclon tolerance in weedy rice accessions is tightly linked. Thus, weedy rice accessions were genotyped using a Kompetitive Allele Specific PCR for the HIS1 gene and the Clearfield-resistant mutation at position 653. Preliminary results have shown that out of 730 weedy rice plants screened, more than 40% had the ALS-653 point mutation whereas nearly 35% of the total plants possessed the HIS1 trait. Samples genotyped as heterozygote in the screened plants have been in the 10% range in both genes. The results obtained in this research shall be incorporated into the rice production systems to successfully combat weedy rice populations.

GLYPHOSATE PREPLANT DAMAGES CUCURBITS AND FRUITING VEGETABLES. AS Culpepper*, J Vance; University of Georgia, Tifton, GA (63)

ABSTRACT

Vegetable growers rely heavily on glyphosate to assist in preparing a weed-free planting environment for over 35 different fresh market vegetable crops grown in Georgia. Glyphosate labels suggest the herbicide provides no residual soil activity thereby eliminating plant back or rotational concerns. Although glyphosate is marginally effective in controlling nutsedge (the most problematic weed for vegetable growers), labels do suggest a glyphosate use rate of 2.2 lb ae/A with sequential applications can be effective. An experiment was conducted to determine the impact of a single glyphosate application at 0, 2.2, or 4.4 lb ae/A made 3 days prior to transplanting fresh market bell pepper, cantaloupe, cucumber, eggplant, summer yellow squash, tomato, and seedless watermelon. Rainfall or irrigation did not occur between application and transplanting; after vegetables were planted, drip irrigation was used to provide water and fertilizer. Each crop was grown following standard production practices with each treatment replicated four times. Soils were over 90% sand with less than 0.65% organic matter, standard for the region. *Visual Injury:* At 21 d after treatment, glyphosate at 2.2 or 4.4 lb injured bell pepper (53 or 79%), cantaloupe (43 or 69%), cucumber (69 or 91%), eggplant (51 or 72%), squash (55 or 89%), tomato (55 or 89%), and watermelon (49 or 79%), respectively. *Plant Biomass:* At 43 d after treatment, glyphosate at 2.2 or 4.4 lb reduced plant biomass of bell pepper (80 or 96%), cantaloupe (59 or 78%), cucumber (77 or 97%), eggplant (58 or 92%), squash (61 or 87%), tomato (80 or 97%), and watermelon (32 or 73%), respectively. *Crop Stand:* Glyphosate did not influence cantaloupe, eggplant or pepper stand. Stand loss was observed for squash, tomato, and watermelon but only with glyphosate at the 4.4 lb rate while both glyphosate rates reduced stand in cucumber.

HORSENETTLE (SOLANUM CAROLINENSE) AND CANADA THISTLE (CIRSIUM ARVENSE) CONTROL WITH A NOVEL HERBICIDE IN PASTURES AND HAYFIELDS. WC Greene*; Virginia Tech, Blacksburg, VA (64)

ABSTRACT

Horsenettle (*Solanum carolinense*) and Canada thistle (*Cirsium arvense*) are two of the most troublesome weed species in pastures and hayfields. Both plants are perennial species with extensive root growth which allows them to be highly competitive in these forage systems. Field studies were conducted in 2018 in Meadowview, Glade Spring, and Blacksburg, Virginia with the objective of determining the level of control of horsenettle and Canada thistle with various common pasture and hayfield herbicides. Herbicide treatments consisted of: (1) florpyrauxifen-benzyl + 2,4-D, (2) aminopyralid + 2,4-D, (3) dicamba + 2,4-D, (4) 2,4-D, (5) 2,4-D + triclopyr, (6) metsulfuron, and (7) triclopyr + fluroxypyr, and a nontreated control. Treatments were applied in April for the Meadowview and Glade Spring locations, and in July for the Blacksburg location. Following herbicide application, visible control of horsenettle, Canada thistle, broadleaf plantain, as well as white clover was assessed on a 0 (no control) to 100 (complete control) scale every 30 days for a total of 3 evaluation timings. All data were subjected to ANOVA and means separation using Fisher's Protected LSD (a=0.05). There were no treatment by location interactions, therefore data were pooled across locations. Canada thistle control 30 days after treatment (DAT) was greater than 78% for all herbicides other than 2,4-D, 2,4-D + triclopyr, and metsulfuron which provided 67 to 69% control, respectively. Horsenettle control was greatest with aminopyralid + 2,4-D (88%), and triclopyr + fluroxypyr (86%) 30DAT. Broadleaf plantain control was greater than 85% for all herbicide treatments except triclopyr + fluroxypyr (75%) 30DAT. All herbicides resulted in greater than 82% white clover control except florpyrauxifen-benzyl + 2,4-D (14%) and 2,4-D (13%). Canada thistle control was greatest 60 DAT with florpyrauxifen-benzyl + 2,4-D (83%) and aminopyralid + 2,4-D (89%). All herbicide treatments provided greater than 95% horsenettle control 60 DAT except for florpyrauxifen-benzyl + 2,4-D (66%), 2,4-D (69%), and metsulfuron (30%). Broadleaf plantain control 60 DAT was greater than or equal to 85% for all treatments with the exception of triclopyr + fluroxypry (75%). All herbicide treatments provided greater than 90% control of white clover except for florpyrauxifen-benzyl (5%) and 2,4-D (18%) 60 DAT. Aminopyralid + 2,4-D (89%) resulted in the most Canada thistle control 90 DAT. Horsenettle control was equal to or greather than 90% with aminopyralid + 2,4-D (93%), dicamba + 2,4-D (91%), and 2,4-D + triclopyr (90%). All herbicide treatments provided equal to or greater than 83% broadleaf plantain control, with the exception of triclopyr + fluroxypyr (68%), with florpyrauxifen-benzyl + 2,4-D providing the most control (98%). All treatments resulted in greater than 94% of white clover 90 DAT, except for florpyrauxifen-benzyl + 2,4-D (0%) and 2,4-D (14%). This research suggests that Canada thistle, horsenettle and broadleaf plantain can be controlled with various herbicides. However, if the goal is to effectively manage broadleaf weeds while maintaining safety to white clover, then florpyrauxifen-benyl + 2,4-D exhibits the greatest level of both control and safety.

IMPACT OF DICAMBA+VARIOUS POSTEMERGENCE HERBICIDE TANK-MIXES ON PALMER AMARANTH (AMARANTHUS PALMERI) CONTROL AND COTTON INJURY. BJ Norris*, DM Dodds, JP McNeal, LX Franca, JJ Williams, SD Hall, WJ Rutland; Mississippi State University, Mississippi State, MS (65)

ABSTRACT

Proliferation of glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) throughout the Southeast United States, necessitates continued evaluation of cost-effective control methods. New technologies have been developed to combat glyphosate-resistant Palmer amaranth. The Xtendi® system allows for postemergence application of dicamba to cotton varieties containing XtendFlex® technology. Experiments were conducted in 2019 to evaluate Palmer amaranth control and cotton injury in Mississippi. Experiments were conducted at Hood Farms in Dundee, MS. The following POST herbicide programs were evaluated in conjunction with fluometuron at 1.1 kg ai/ha PRE to evaluate Palmer control and cotton injury; 1) dicamba 0.56 kg ai/ha + glufosinate 0.66 kg ai/ha + intact 0.5% v/v; 2) dicamba 0.56 kg ai/ha + acetochlor 1.3 kg ai/ha; 3) dicamba 0.56 kg ai/ha + clethodim 0.1 kg ai/ha + NI surfactant 0.25% v/v + intact 0.55 v/v; 4) glyphosate 1.3 kg ai/ha + dicamba 0.56 kg ai/ha + intact 0.5% v/v; 5) glyphosate 1.3 kg ai/ha + dicamba 0.56 kg ai/ha + glufosinate 0.66 kg ai/ha + intact 0.5% v/v; 6) glyphosate 1.3 kg ai/ha + dicamba 0.56 kg ai/ha + acetocholor 1.3 kg ai/ha + intact 0.5% v/v; 7) glyphosate 1.3 kg ai/ha + dicamba 0.66 kg ai/ha + clethodim 0.1 kg ai/ha + NI surfactant 0.25% v/v + intact 0.5% v/v; 8) glyphosate 1.6 kg ai/ha + dicamba 0.55 kg ai/ha; 9) glyphosate 1.6 kg ai/ha + dicamba 0.55 kg ai/ha + glufosinate 0.66 kg ai/ha + intact 0.5% v/v; 10) glyphosate 1.6 kg ai/ha + dicamba 0.55 kg ai/ha + clethodim 0.1 kg ai/ha + NI surfactant 0.25% v/v + intact 0.5% v/v; 11) glyphosate 1.9 kg ai/ha + dicamba 0.73 kg ai/ha; 12) glyphosate 1.9 kg ai/ha + dicamba 0.73 kg ai/ha + glufosinate 0.66 kg ai/ha; 13) glyphosate 1.9 kg ai/ha + dicamba 0.73 kg ai/ha + acetochlor 1.3 kg ai/ha; 14) glyphosate 1.9 kg ai/ha + dicamba 0.73 kg ai/ha + clethodim 0.1 kg ai/ha + NI surfactant 0.25% v/v. The POST applications were made to 4 to 5 node cotton and Palmer amaranth was around 10cm in height. All applications were made with a CO2-powered backpack sprayer equipped with Turbo Teejet induction spray tips and an application pressure of 324 kPa. Visual evaluations of Palmer amaranth control was taken at 14 and 21 DAA. Crop injury was visually evaluated 3, 7, 14 and 21 DAA. Data were subjected to analysis of variance and means were separated using Fischers Protected LSD at α=0.05. No POST herbicide application resulted in significant crop injury. The application of fluometuron PRE, along with a POST application of: glyphosate + dicamba + acetochlor + intact provided 90% palmer amaranth control up to 21 DAA. All the other treatments provided similar control up to 14 DAA and decreased control was observed at 21 DAA. Palmer amaranth can be effectively controlled through a planned PRE/POST weed management program, containing multiple modes of action. Residual herbicides are recommended as part of weed control programs to promote herbicide resistance management.

IMPACT OF REDUCED RATES OF MESOTRIONE ON SOYBEAN GROWTH AND YIELD.

D Miller*[1], DO Stephenson[2]; [1]LSU AgCenter, St Joseph, LA, [2]LSU Ag Center, Alexandria, LA (66)

ABSTRACT

Crops grown in close proximity along with similar equipment being utilized in multiple in-season applications come with many potential challenges involving off-target movement of herbicides or sprayer contamination. These added concerns justify research identifying possible deleterious effects on crops such as soybean. Therefore, a field study was conducted in 2019 at the Northeast Research Station near St. Joseph, La with the objective to evaluate potential negative impacts of reduced rates of mesotrione on soybean growth and yield. A four replication factorial arrangement of treatments was used and included herbicide application timing (Factor A: unifoliate; 2 trifoliate; or 4 trifoliate) and herbicide treatment (Factor B: no herbicide or mesotrione @ 1x (0.156 lb ai/A), 1/8x, or 1/16x). Treatments were applied at designated timings following planting of AG46x6 soybean on 6/10. Parameter measurements included visual crop injury 7, 14, 28, and 42 d after application (DAT), crop height 14 and 28 DAT as well as prior to harvest, and yield. At 7 DAT, within each herbicide rate, crop injury was greater at the unifoliate application for the 1x rate in comparison with the other timings which resulted in equivalent injury (81 vs 51 and 45%) but not the 1/8x herbicide rate (45 vs 36 and 38%). For the 1/16x rate, injury was greater for the unifoliate application compared with the 4 trifoliate timing (43 vs 26%) but not the 2 trifoliate timing (43 vs 37%). Within each application timing, unifoliate application injury was greatest with the 1x rate (81%) while the 1/8 x rate resulted in equivalent injury to the 1/16x rate (45 and 43%). At the 2 trifoliate application, again injury was greatest with the 1x rate (56%) while the 1/8x and 1/16x herbicide rates resulted in equivalent injury of 36 and 33 %, respectively. At the 4 trifoliate application, the 1x rate resulted in 45% crop injury, which was equal to the 38% observed with the 1/8x rate and greater than the 26% with the 1/16x rate. Injury with the 1/8 and 1/16 x rates was equal. At 14 DAT, averaged across application timings, the 1x herbicide rate resulted in 64% crop injury which was greater than the 1/8 and 1/16x rates which resulted in equivalent injury of 43 and 38%, respectively. At 28 DAT, averaged across application timings, the 1x herbicide rate resulted in 69% crop injury which was greater than the 1/8 and 1/16x rates which resulted in equivalent injury of 20 and 18%, respectively. Averaged across herbicide rates, crop injury at the unifoliate application was 31%, which was equal to the 26% for the 2 trifoliate timing and greater than the 23% observed with the 4 trifoliate timing. At 42 DAT, averaged across application timings, a stepwise decrease in crop injury was observed as herbicide rate decreased from 1x to 1/16x (61 vs 15 vs 6%). At 14 DAT, within each application timing, at the unifoliate timing height was significantly reduced only at the 1x (23%) and 1/16x (18%) rates when compared with no herbicide. At the 2 trifoliate timing, all rates reduced height in comparison with no herbicide. Height reduction was equivalent at the 1x (40%) and 1/8x (27%) rates and at the 1/8x (27%) and 1/16x (20%) rates with the 1x rate greater than the 1/16x rate (40 vs 20%). At the 4 trifoliate timing, again all rates reduced height when compared with no herbicide. Greatest reduction was observed with the 1x rate (37%) while the 1/8x and 1/16x rates resulted in equivalent height reductions of 16 and 13%, respectively. At 28 DAT, averaged across application timings, all rates resulted in significant height reduction in comparison with no herbicide. Greatest reduction was observed with the 1x rate (50%) while the 1/8x and 1/16x rates resulted in equivalent height reductions of 17 and 10%, respectively. Prior to harvest, averaged across application timings, soybean height was significantly reduced in comparison with no herbicide at only the 1x (29%) and 1/8x (8%) rates. Averaged across application timings, soybean yield was significantly reduced in comparison with no herbicide at only the 1x (48%) and 1/8x (13%) rates.

IMPACT OF REDUCED RATS OF ISOXAFLUTOLE ON SOYBEAN GROWTH AND YIELD. DO Stephenson[1], D Miller*[2]; [1]LSU Ag Center, Alexandria, LA, [2]LSU AgCenter, St Joseph, LA (67)

ABSTRACT

Crops grown in close proximity along with similar equipment being utilized in multiple in-season applications come with many potential challenges involving off-target movement of herbicides or sprayer contamination. These added concerns justify research identifying possible deleterious effects on crops such as soybean. Therefore, a field study was conducted in 2019 at the Northeast Research Station near St. Joseph, La with the objective to evaluate potential negative impacts of reduced rates of isoxaflutole on soybean growth and yield. A four-replication factorial arrangement of treatments was used and included herbicide application timing (Factor A: unifoliate or 4 trifoliate) and herbicide treatment (Factor B: no herbicide or isoxaflutole @ 1x (0.094 lb ai/A), 1/8x, or 1/16x). Treatments were applied at designated timings following planting of AG46x6 soybean on 6/10. Parameter measurements included visual crop injury 7, 14, and 28 d after application (DAT) (chlorosis, necrosis, and height reduction), crop height 14, 28, and 42 DAT as well as prior to harvest, and yield. At 7 DAT, within each herbicide rate, crop injury was greater at the unifoliate application for the 1x rate (79 vs 51%) but not the 1/8x (38 vs 23%) and 1/16x (38 vs 11%) herbicide rates. Within each application timing, unifoliate application injury was greatest with the 1x rate (79%) while the 1/8 x rate resulted in greater injury than the 1/16x rate (23 vs 11%). At the 4 trifoliate application, again injury was greatest with the 1x rate (51%) while the 1/8x and 1/16x herbicide rates resulted in equivalent injury of 38%. At 14 DAT, within each herbicide rate, crop injury was greater at the unifoliate stage compared with the 4 trifoliate stage for the 1x rate (89 v 74%) but opposite for the 1/16 x rate (41 vs 11%) while injury was similar at the 1/8x rate (39 and 41%). Within each application timing, unifoliate application injury was greatest with the 1x rate (89%) while the 1/8 x rate resulted in greater injury than the 1/16x rate (39 vs 11%). At the 4 trifoliate application, again injury was greatest with the 1x rate (74%) while the 1/8x and 1/16x herbicide rates resulted in equivalent injury of 41%. At 28 DAT, averaged across herbicide rates, crop injury was greater at the unifoliate application (33 vs 26%). Averaged across application timings, a significant stepwise reduction in injury was observed as herbicide rate decreased from 1x to 1/16 x (79 vs 27 vs 13%). At 14 DAT, within each application timing, soybean height was reduced following application to unifoliate soybean only at the 1x rate in comparison with no herbicide applied (25%) and was also significantly reduced by the 1x rate in comparison with the 1/8 x (21%) and 1/16x (25%) rates. At the 4 trifoliate application, all herbicide rates resulted in significant height reduction in comparison with no herbicide applied (13 to 26%). At 28 DAT, averaged across application timing, soybean height was reduced only at the 1x rate (43%) in comparison with no herbicide. At 42 DAT, averaged across application timings, soybean height was reduced 46 and 12% following herbicide application at only the 1 and 1/8 x rates, respectively, in comparison with no herbicide applied. Prior to harvest, within each herbicide rate, soybean height was equivalent between growth stages for all rates with the exception of the 1x rate where height was 21% lower following application at the unifoliate stage. Within each application timing, soybean height following application at the unifoliate and 4 trifoliate growth stages in comparison with no herbicide applied was reduced only at the 1x herbicide rate (48% and 31%, respectively) Within each herbicide rate, soybean yield was equivalent between growth stages with the exception of the 1x rate where yield was reduced 87% following application at the unifoliate stage. Within each application timing, significant soybean yield reduction at the unifoliate application was observed for only the 1x (96%) and 1/8x (27%) rates when compared with no herbicide. Yield reduction was greatest with the 1x rate. At the 4 trifoliate application, yield was reduced at only the 1x (55%) and 1/16x (27%) rates compared with no herbicide. Yield reduction was greatest for the 1x rate.

INADEQUATE CONTROL OF ITALIAN RYEGRASS [LOLIUM PERENNE L. SSP. MULTIFLORUM (LAM.) HUSNOT] WITH PARAQUAT IN LA SUGARCANE. AJ Orgeron*; LSU AgCenter, Baton Rouge, LA (68)

ABSTRACT

Options for chemically controlling Italian ryegrass [*Lolium perenne* L. ssp. *Multiflorum* (Lam.) Husnot] POST in sugarcane (*Saccharum* spp.) is limited to paraquat in Louisiana sugarcane production. Beginning in 2015, sugarcane producers from multiple regions of the state have reported poor control of Italian ryegrass with paraquat in isolated instances. Research was conducted in 2017 at the LSU AgCenter's Sugar Research Station to evaluate Italian ryegrass control with paraquat. On February 20, 2017, paraquat was applied at three rates (840, 1120, and 1680 g ha^{-1}) and two spray volumes (140 and 187 L ha^{-1}) to 20-30 cm tall Italian ryegrass. Visual control estimates were recorded 35 days after application. Regardless of spray volume, the 840 g ha^{-1} paraquat treatment (recommended rate) provided 22% Italian ryegrass control, whereas, the 1680 g ha^{-1} paraquat treatment controlled 52% of Italian ryegrass. These results show poor control of Italian ryegrass with paraquat, even when applied at 2X the recommended rate.

LONG-CHAIN FATTY ACID INHIBITING HERBICIDES IN LOUISIANA RICE PRODUCTION. LC Webster*, EP Webster, BM McKnight, SY Rustom, DC Walker, WB Greer; LSU AgCenter, Baton Rouge, LA (69)

ABSTRACT

Long-Chain Fatty Acid Inhibiting Herbicides in Louisiana Rice Production Webster, L.C., Webster, E.P., McKnight, B.M., Rustom, S.Y., Walker, D.C, Greer, W.B. Over the past three decades, barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.] has been confirmed throughout the Mid-South to be resistant to several herbicides with differing sites of action. Beginning in 1989, barnyardgrass resistant biotypes were discovered to be resistant to propanil and since then barnyardgrass biotypes have been found to be resistant to quinclorac, imazamox, imazethapyr, penoxsulam, and bispyribac. In addition to barnyardgrass, red rice (*Oryza sativa* L.) has been found to be resistant to imazethapyr and imazamox in the Clearfield rice production system. In order to combat herbicide resistance, growers are exploring non-labelled herbicides such as very-long-chain fatty acid inhibiting herbicides, also known as group 15 herbicides. A study was conducted in 2019 at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate the crop safety and potential weed control of group 15 herbicides in Louisiana rice production. Plot size was 3-m by 11.3-m with 16-19.5 cm drill-seeded rows of 'CL-111' at 78.4 kg ha^{-1}. The study was a randomized complete block with a two-factor factorial arrangement of treatments with three replications. Factor A consisted of acetochlor at 1,050 g ai ha^{-1}, dimethenamid at 940 g ai ha^{-1}, S-metolachlor at 1064 g ai ha^{-1}, pyroxasulfone at 119 g ai ha^{-1}, and pethoxamid at 661 g ai ha^{-1}. Factor B consisted of herbicides applied preemergence (PRE), delayed preemergence (DPRE) and early postemergence (EPOST). All DPRE and EPOST applications were applied with a crop oil concentrate at 1% v v^{-1}. All herbicide applications were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 93.5 L ha^{-1}. Visual evaluations for the study were recorded at 14 and 28 days after (DA) each timing for crop injury in addition to barnyardgrass and red rice control. Crop injury was observed at 55 and 32% when treated with acetochlor at 14 and 28 DA PRE, respectively. All other herbicides resulted in crop injury of 87 to 97% at 14 DA PRE and 75 to 95% at 28 DA PRE. Rice treated with all herbicides evaluated exceeded 41% and 36% injury at 14 and 28 DA DPRE, respectively. Crop injury of 20 and 21% was observed at 14 DA EPOST when treated with acetochlor or pethoxamid, respectively. At 28 DA EPOST, crop injury was 5 and 10% when treated with pethoxamid or acetochlor, respectively. Rice treated with all other herbicides resulted in 37 to 60% and 23 to 57% crop injury at 14 and 28 DA EPOST, respectively. These results indicate crop injury is reduced as the rice becomes more developed before application; however, a reduction in control of barnyardgrass and red rice was observed at the DPRE and EPOST timings compared with the herbicides applied PRE.

MANAGEMENT OF RYEGRASS IN WHEAT IN NE TEXAS. CA Jones*; Texas A&M University, Commerce, TX (70)

ABSTRACT

A study was initiated at Fairlie, TX on a Wilson silt loam. Plots were planted with AGS 2055, at 101 kg/ha on November 26, 8-row research drill, 15 cm spacing by 6 m long. A local feral ryegrass was overseeded at a rate of 28 kg/ha. The experimental design was a randomized complete block,with 6 reps. Data analysis using ANOVA and means were separated using Student –Newman-Keuls MRT. Applications were made using a CO2 Backpack sprayer. Treatments consisted of: Pyroxasulfone (DPRE), Pyroxasulfone and Metribuzin (EPOST), Pyroxasulfone and Pinoxaden (EPOST), Pyroxasulfone and Metribuzin and Pinoxaden (EPOST), Pyroxasulfone + Carfentrazone (PRE), Pyroxasulfone + Carfentrazone (DPRE), Pyroxasulfone + Carfentrazone (EPOST), Pyroxasulfone + Carfentrazone and Metribuzin (EPOST), Pyroxasulfone + Carfentrazone and Metribuzin fb Pinoxaden (EPOST fb MPOST), Mesosulfuron-Methyl (MPOST), Flufenacet + Metribuzin fb Mesosulfuron-Methyl (PRE fb MPOST), Pyroxasulfone fb Mesosulfuron-Methyl (PRE fb MPOST), Pinoxaden and Pyroxasulfone (dry)(EPOST), and a non-treated check. Pyroxasulfone was applied at 116g a.i/ha, Metribuzin was applied at 105g a.i/ha, Pinoxaden was applied at 60g a.i/ha, Pyroxasulfone + Carfentrazone was applied at 114g a.i/ha + 8 g a.i/ha, Mesosulfuron-Methyl was applied at 15 g a.i/ha, Flufenacet + Metribuzin was applied at 305g a.i/ha + 76 g a.i/ha, and Pyroxasulfone (dry) was applied at 89g a.i/ha. Rates did not change between treatments. All treatments except Osprey Xtra WG controlled annual ryegrass more effectively than the non-treated check. POST treatments were less effective than PRE treatments and resulted in reduced yields. Zidua SC DPRE, Anthem Flex 4 SE PRE, Anthem Flex 4SE DPRE, and Zidua SC fb Osprey Xtra WG, numerically, resulted in the largest yields. All of these treatments were PRE or DPRE treatments. Zidua SC + Axial XL EPOST, Anthem Flex 4 SE EPOST, Axial XL + Zidua 85 WG, and Osprey Xtra WG did not provide adequate control of annual ryegrass. There was no difference in final ryegrass control when Zidua SC was applied as DPRE or was mixed with Metribuzin 75% and applied as an EPOST treatment. However, there was a noticeable decrease in yield when changing from DPRE application to EPOST application. EPOST treatment of Zidua SC + Axial XL was less effective than similarly timed treatments of Zidua SC + Metribuzin and Zidua SC + Metribuzin + Axial XL. There was no difference in final ryegrass control or yield between Anthem Flex 4 SE applied as a PRE or DPRE. However, the EPOST treatment of Anthem Flex 4 SE was considerably less effective at controlling annual ryegrass and resulted in reduced yield.

MANAGING PALMER AMARANTH WITH SEQUENTIAL APPLICATIONS OF GLUFOSINATE WITH 2,4-D OR DICAMBA. GK Ogden*[1], PA Dotray[2], U Torres[3], J Everitt[4]; [1]Affiliation Not Specified, Stillwater, OK, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Texas Tech University, Lubbock, TX, [4]Bayer CropScience, Shallowater, TX (71)

ABSTRACT

Dicamba and 2,4-D tolerant cotton systems that utilize XtendiMax and Enlist One or Enlist Duo, respectively, provide new opportunities to manage glyphosate-resistant populations of Palmer amaranth (*Amaranthus palmeri*). Adding glufosinate into these auxin-based systems may not only improve management of troublesome weeds, but aid against rapid development of herbicide resistance to Group 4 modes of action. Two trials were conducted near Lubbock, Texas in 2018 and 2019 to assess the use of glufosinate in 2,4-D choline and dicamba herbicide systems. The trials were conducted in a non-crop environment and locations had dense populations of Palmer amaranth. One trial consisted of sequential applications of glufosinate (Liberty® 280 SL) and dicamba (XtendiMax® with VaporGrip Technology®). Palmer amaranth at the initial application was <10 cm, 10 to 20 cm, and >30 cm in size. In a second trial, sequential applications of glufosinate (Liberty® 280 SL), 2,4-D choline (Enlist One® with Colex-D® technology) or 2,4-D choline + glyphosate (Enlist Duo® with Colex-D ® technology) were used. In this second trial, Palmer amaranth at the initial application was 7 to 15 cm and 25 to 30 cm in size. Sequential applications were made 10 to 11 days after the initial application in both trials. Applications were made using a CO_2-pressurized backpack sprayer at a volume of 140 L ha^{-1}. Dicamba and 2,4-D treatments were sprayed with Turbo TeeJet Induction 11002 nozzles while all glufosinate treatments were sprayed with Turbo TeeJet 11002 nozzles and ammonium sulfate at 2.86 kg ai ha^{-1} was added to the tank. Treatments were applied at the following rates: dicamba 0.56 kg ae ha^{-1}, 2,4-D choline 0.80 kg ae ha^{-1}, 2,4-D choline + glyphosate 1.62 kg ae ha^{-1}, and glufosinate 0.88 kg ai ha^{-1} for all initial applications and those that followed an auxin application, or 0.59 g ai ha^{-1} following an initial application of glufosinate. When evaluated 21 days after sequential application, all treatments in the dicamba trial controlled <10 cm Palmer amaranth at least 86%. Glufosinate followed by (fb) dicamba controlled Palmer amaranth as good or better than dicamba fb dicamba regardless of weed size at the initial application. Palmer amaranth was controlled 89% or better 11 days after sequential applications of 2,4-D choline + glyphosate fb 2,4-D choline + glyphosate or glufosinate. Two applications of glufosinate or treatments with 2,4-D choline alone in the initial application were less effective at controlling Palmer amaranth when compared to 2,4-D choline + glyphosate fb 2,4-D choline + glyphosate or glufosinate. In each trial, replacing an application of an auxin herbicide with glufosinate resulted in similar weed control when compared to two applications of the auxin herbicide. The use of glufosinate adds an alternative mode of action in an auxin-based system and should help sustain these new auxin-technologies from rapid development of herbicide resistance.

MIXTURES OF ELEVORE AND QUELEX PLUS 2,4-D OR DICAMBA FOR BURNDOWN WEED CONTROL. SA Hoffman*[1], CW Cahoon[1], J Hurry[1], S Li[2], GD Collins[1], R Vann[1], AC York[3], ZR Taylor[4], FB Browne[2]; [1]NC State University, Raleigh, NC, [2]Auburn University, Auburn, AL, [3]NC State University, Liberty, NC, [4]NC State University, Sanford, NC (72)

ABSTRACT

Adoption of no-till and reduce-till systems as well as widespread herbicide resistance have put greater emphasis on controlling weeds preplant. In response to glyphosate- and ALS-resistant horseweed, cotton producers have turned to Group 4, synthetic auxin, herbicides to control this troublesome weed preplant. In 2017, halauxifen-methyl (Elevore) a new Group 4 herbicide, received a label for preplant burndown applications in cotton for the control of annual broadleaf weeds including herbicide-resistant horseweed. Previous research determined Elevore controlled horseweed well. However, previous research in NC reported the herbicide did not effectively control many commonly found winter weeds including cutleaf evening-primrose, curly dock, chickweed, cudweed, or field pansy. To overcome these shortfalls, it was proposed that tank mixtures of Elevore with low rates of 2,4-D or dicamba would achieve broader preplant weed control. Therefore, this research was conducted to evaluate the efficacy of Elevore and Quelex (halauxifen + florasulam) mixed with 2,4-D and dicamba for control of cutleaf evening-primrose. Experiments were established at private farms near Pine Level and Lumber Bridge, NC and consisted of RCBD with four replications. Herbicide treatments included Elevore (1 fl oz/A), Quelex (0.75 oz wt/A), 2,4-D low rate (LR) (6 fl oz/A), 2,4-D high rate (HR) (12 fl oz/A), dicamba (4 fl oz/A), Elevore + 2,4-D LR, Elevore + 2,4-D HR, Elevore +dicamba, Quelex + 2,4-D LR, Quelex + 2,4-D HR, and Quelex + dicamba. All herbicide treatments included crop oil concentrate at 1% V/V. Herbicides were applied when cutleaf evening-primrose averaged 4.5 and 6 inches in diameter at Pine Level and Lumber Bridge, respectively. Data collected included visual estimates of weed control at 14, 28, and 42 days after treatment (DAT) and weed density 42 DAT. Analysis of variance was completed using PROC GLIMMIX (SAS 9.4) and treatment means were separated using Fisher's Protected LSD at $p<0.05$ when appropriate. Cutleaf evening-primrose was denser, however individual plants were smaller, at Pine Level compared to Lumber Bridge. Similar to previous results, Elevore alone did not control cutleaf evening-primrose. Similarly, control of cutleaf evening-primrose by Quelex was inadequate. The low and high rate of 2,4-D controlled cutleaf evening-primrose 96% or greater 42 DAT whereas dicamba controlled the weed 45%. Elevore plus 2,4-D (94 to 100%) controlled cutleaf evening-primrose similar to 2,4-D alone (96 to 98%). Interestingly, Quelex seemed to antagonize cutleaf evening-primrose control by 2,4-D. At Pine Level, Quelex + 2,4-D LR was 21% less effective than 2,4-D LR alone. Additionally, at Lumber Bridge, where cutleaf evening-primrose was larger in diameter, the effect was more exaggerated. Quelex + 2,4-D LR (67%) and Quelex + 2,4-D HR (72%) were 26 and 29% less effective than 2,4-D LR (96%) and 2,4-D HR (98%), respectively. In general, cutleaf evening-primrose density 42 DAT was similar to visual estimates of control. Cutleaf evening-primrose density averaged 18 and 5 plants per m-2 at Pine Level and Lumber Bridge, respectively. At Pine Level, compared to the nontreated check, all treatments, except Elevore, reduced cutleaf evening-primrose density 61 to 94%. At Lumber Bridge, like visual ratings, cutleaf evening-primrose density was greater in plots treated with Quelex + 2,4-D (2 plants per m-2) compared to 2,4-D alone (0 plants per m-2). In conclusion, as previously reported, 2,4-D controlled cutleaf evening-primrose well. Adding 2,4-D to Elevore greatly improved cutleaf evening-primrose control compared to Elevore alone. However, Quelex seemed to antagonize cutleaf evening-primrose activity by 2,4-D. Therefore, in fields where herbicide-resistant horseweed and cutleaf evening-primrose are problematic, Elevore + 2,4-D would be recommended for preplant burndown whereas Quelex + 2,4-D may not be suitable.

NEW USES FOR BICYCLOPYRONE IN SOUTHERN CROPS. GD Vail*[1], E Rawls[2], H McLean[3], V Mascarenhas[4]; [1]Syngenta Crop Protection, Greensboro, NC, [2]Syngenta Crop Protection, Vero Beach, FL, [3]Syngenta Crop Protection, Perry, GA, [4]Syngenta Crop Protection, Nashville, NC (73)

ABSTRACT

New Uses for Bicyclopyrone in Southern Crops: E.K. Rawls*[1], G.D. Vail[2], Tom Beckett[2], Pete Eure[2], Cheryl Dunne[2], Victor Mascharenas[3], Henry Mclean[4], Monti Vandiver[5] , John Gordy[6], Tim Trower[7], [1]Syngenta Crop Protection, Vero Beach, FL, [2]Syngenta Crop Protection, Greensboro, NC, [3]Syngenta Crop Protection, Cary, NC, [4]Syngenta Crop Protection, Perry, GA, [5]Syngenta Crop Protection, Lubbock, TX, [6]Syngenta Crop Protection, Pearland, TX, [7]Syngenta Crop Protection, Baraboo, WI ABSTRACT Bicyclopyrone is an HPPD inhibiting (Group 27) herbicide. It is one of the active ingredients used in Acuron herbicide. Acuron was registered in 2015 for use in field, seed, sweet, and popcorn. Bicyclopyrone has systemic activity and provides pre-emergence and post-emergence weed control. As an HPPD inhibitor, bicyclopyrone, is an excellent choice for controlling ALS and triazine resistant weed biotypes. University and Syngenta studies evaluated the crop safety and weed efficacy of preemergence and postemergence bicyclopyrone applications in various minor crops grown in the southern region of the U.S.Research has shown that preemergence and/or postemergence applications of 37.5 to 50 g ai/ha exhibit acceptable crop tolerance and weed control in many of the minor crops tested. Bicyclopyrone will offer an additional active ingredient for use in minor crop-integrated weed management systems. Syngenta is pursuing use labels for watermelon, strawberry, sweet potato, broccoli, banana, papaya, lemongrass, rosemary, garlic, and onions grown on muck soils.

NOZZLE TYPE AND ARRANGEMENT EFFECT ON SPRAY COVERAGE. LG Smith*; University of Arkansas, Newport, AR (74)

ABSTRACT

Arkansas row crop producers face many challenges throughout the growing season. One of which includes maintaining necessary spray coverage to achieve optimum levels of weed control. The objective of this research was to evaluate how nozzle arrangement (direction of emitted spray) and droplet size impacted spray coverage. Field experiments were conducted in a dry-seeded rice crop at the University of Arkansas at Pine Bluff Small Farm Outreach Center near Lonoke, Arkansas, and in an irrigated soybean crop at the Rohwer Research Station located near Rohwer, Arkansas. Rice and soybean were seeded in 19- and 97-cm row widths, respectively. Applications were made at 94 L ha^{-1} spray volume with a Bowman MudMaster (Bowman Manufacturing Co., Inc., Newport, AR 72112). Treatments consisted of four nozzle types [AIXR and TTI (TeeJet Technologies, Wheaton, IL 60187), 3D and ULD (Pentair Hypro, New Brighton, MN 55112)], three nozzle arrangements along the boom for the directional 3D and TTI nozzles (all forward, all backward, and alternating), and a nontreated control. This provided a total of nine treatments. Nozzle orifice sizes, spray pressures, and sprayer speeds were selected for each treatment to maintain the correct 94 L ha^{-1} spray volume while creating similar droplet size classifications between comparable nozzles. The AIXR and 3D nozzles produced a Coarse spray, while the ULD and TTI nozzles produced an Ultra Coarse spray. Data collection consisted of three water sensitive paper spray cards (Syngenta, Greensboro, NC 27419) per plot: a horizontal card at the top of canopy (top), a vertical card facing towards the direction of the sprayer (front), and a vertical card facing away from the direction of the sprayer (back). The spray cards were placed 15-cm from the soil surface on collection platforms near the center of each plot. Water sensitive cards were analyzed for spray coverage using DepositScan (USDA-ARS Application Technology Research Unit, Wooster, OH 44691). Coverage data were then subjected to ANOVA using SAS v9.4 (SAS Institute, Cary, NC 27513). No difference was observed in coverage between sites; therefore, sites were pooled. Initial results showed that greater spray coverage was achieved with the AIXR and 3D nozzles compared to the ULD and TTI nozzles. This is due to the AIXR and 3D nozzles emitting smaller droplet sizes and therefore, a greater number of droplets in the fixed spray volume were available to impact the spray card compared to the ULD and TTI nozzles. Additionally, the alternating nozzle arrangement for the directional 3D and TTI nozzles provided overall more uniform spray coverage on the top, front, and back of the collection surfaces than the other nozzle arrangements and was similar to that of the straight-down spray emission of the AIXR and ULD nozzles. Overall, this research highlights differences in spray coverage were achieved based on the nozzle selection and arrangement. Applicators may achieve better weed control through enhanced and more uniform spray coverage by implementing the alternating nozzle arrangement when using directional nozzles such as the 3D and TTI nozzles.

NOZZLE TYPE EFFECT ON COVERAGE, CANOPY PENETRATION, AND WEED CONTROL USING ENLIST ONE AND LIBERTY IN ENLIST E3 SOYBEAN. AN McCormick*[1], TW Dillon[2], BM Davis[2], TR Butts[2], LM Collie[3]; [1]University of Arkansas System Division of Agriculture, Newport, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Beebe, AR (75)

ABSTRACT

Chemical applicators have many variables to account for when applying herbicides. Some of these variables include spray coverage, canopy penetration, and herbicide selection. It is important for applicators to know and understand how nozzle selection impacts these variables, especially for the particular herbicide being used. The objective of this research was to evaluate how droplet size and nozzle type impact spray coverage and canopy penetration. Field experiments were conducted during the summer of 2019 at the University of Arkansas System Division of Agriculture Rohwer Research Station near Rohwer, AR and the Newport Extension Center near Newport, AR in soybean planted in 97-cm row widths and drilled in 19-cm row widths, respectively. Applications were made using 140 L ha^{-1} and 94 L ha^{-1} at the Newport and Rohwer sites, respectively, with a Bowman MudMaster (Bowman Manufacturing Co., Inc., Newport, AR 72112). Treatments consisted of four nozzle types [AIXR, AITTJ60, TTI, and TTI60 (TeeJet Technologies, Wheaton, IL 60187)], three chemical treatments [2,4-D choline (Enlist One), glufosinate (Liberty), and 2,4-D choline (Enlist One) + glufosinate (Liberty) tank-mixture], and a nontreated control. This provided a total of 13 treatments. The nozzle types were selected to allow comparisons between single-fan (AIXR and TTI) and dual-fan (AITTJ60 and TTI60) nozzles. The emitted droplet size was similar between the AIXR and AITTJ60 (Very Coarse) nozzles and between the TTI and TTI60 (Ultra Coarse) nozzles. Data collected consisted of three water sensitive paper spray cards located at two locations within the canopy for a total of six spray cards per plot. At the top of the canopy, cards were oriented as follows: one horizontal card (top), a vertical card facing towards the direction of the sprayer (front), and a vertical card facing away from the direction of the sprayer (back). These same three card directions were placed within the soybean canopy, 15-cm from the soil surface. Water sensitive cards were analyzed for spray coverage using DepositScan (USDA-ARS Application Technology Research Unit, Wooster, OH 44691). Data were then subjected to ANOVA using SAS v9.4 (SAS Institute, Cary, NC 27513) and means were separated using Fisher's Protected Least Significant Difference Test at a=0.05. Due to the greater spray volume used, greater coverage on the top canopy cards was achieved at the Newport site compared to the Rohwer site. However, greater coverage on the within canopy cards was achieved at Rohwer compared to Newport most likely due to wide rows (97-cm) compared to drilled rows (19-cm) allowing easier droplet penetration into the canopy even with a reduced total spray volume. At both locations, greater coverage was achieved depending on the herbicide treatment in the order of glufosinate > 2,4-D choline + glufosinate > 2,4-D choline due to changes in droplet size. Nozzle type did not influence coverage to a large extent. This research indicates the tested dual fan nozzles (AITTJ60 and TTI60) did not provide greater coverage than their single fan counterparts (AIXR and TTI). Instead, factors such as droplet size and agronomic characteristics (row width) played a greater role in spray coverage.

EVALUATION OF WEED CONTROL PROGRAMS IN FURROW IRRIGATED RICE. LM Collie*[1], T Barber[2], TR Butts[2], A Ross[3], RC Doherty[4], ZT Hill[4]; [1]University of Arkansas, Beebe, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Lonoke, AR, [4]University of Arkansas System Division of Agriculture, Monticello, AR (76)

ABSTRACT

Furrow-irrigated rice has gained popularity over the last two years in Arkansas. With the widespread increase in furrow-irrigated rice acres, weed control programs and their effectiveness in this system have come under question. The purpose of this research was to determine the most effective herbicide program for season-long weed control in furrow-irrigated rice. Experiments were conducted in 2019 at Marianna, Arkansas on a Calloway silt loam soil in a randomized complete block design. Individual plots were 3.7 meters wide and 9 meters in length. Rice cultivar XP745 CL was planted at 28 kg ha^{-1}. Several herbicide programs were evaluated, all of which contained clomazone 461g ai ha^{-1} PRE alone and in combination with other herbicide modes of action, followed by two POST applications of various herbicide combinations. All herbicide applications were made with a spray volume of 112 L ha^{-1} and visual ratings for weed control were taken at 28 days after planting (DAP) and 14 days after the final late post application (LPOST). Palmer amaranth control was highest 28 DAP when saflufenacil (Sharpen) 144g ai ha^{-1} was applied with clomazone PRE. Palmer amaranth control POST was only achieved 14 days after LPOST with multiple applications or combinations of florpyrauxifen-benzyl applied at 15 to 30g ai ha^{-1} or with a tankmix combination of propanil 3.46 kg ai ha^{-1} plus triclopyr 217 g ai ha^{-1}. Results indicate, two applications of one of the previous two herbicide mixtures will be needed for season-long Palmer amaranth control in furrow-irrigated rice. Barnyardgrass (*Echinochloa crus-galli L.)* control was similar to management in a flooded rice environment, however, residuals become more important in a furrow-irrigated rice system. Applications of imazethapyr early POST followed by either cyhalofop, fenoxaprop or bispyribac LPOST provided the highest control of barnyardgrass by 14 days LPOST. If POST applications were not made timely then barnyardgrass control was significantly reduced. Goosegrass has proven to be difficult to control in furrow-irrigated rice fields. Goosegrass *(Eleusine indica* L.) control was highest (87%) when cyhalofop was applied in a program LPOST. The weed spectrum appeared to shift more towards broadleaves and difficult to control grasses in the furrow-irrigated rice system. Producers should budget at least one extra herbicide application in furrow-irrigated rice production for difficult to control weeds and increased weed germination late season in absence of the flood. Additionally, multiple residual herbicide applications should be overlapped to prevent continuous flushes of grass weed species.

PEANUT VARIETY RESPONSE TO BRAKE® (FLURIDONE). EP Prostko*; University of Georgia, Tifton, GA (77)

ABSTRACT

Brake® (fluridone) is an herbicide under evaluation for potential preemergence (PRE) use in peanut. Brake has a unique mode of action (inhibitor of phytoene desaturase in carotenoid biosynthesis - WSSA MOA #12) that is not currently being utilized in row crop weed control systems. Limited research has been conducted on the tolerance of newer peanut varieties to Brake. Therefore, the objective of this study was to evaluate the response of several peanut varieties to various rates of Brake 1.2SL applied PRE. A small-plot, replicated field trial was conducted in 2019 at the UGA Ponder Research Farm near Ty Ty, Georgia. The soil type was a Fuquay sand with 92% sand, 6% silt, 2% clay, 0.62% organic matter, and 6.0 pH. Twin-row peanut planting occurred on May 1. Treatments were arranged in a randomized complete block design with a 3 (variety) X 4 (rate) factorial arrangement with 4 replications. Peanut varieties included GA-06G, GA-18RU, and GA-16HO. Brake 1.2SL rates included 0, 16, 32, and 64 oz/A. All treatments were applied 1 day after planting (DAP) using a CO_2-powered, backpack sprayer calibrated to deliver 15 GPA (38 PSI, 3.5 MPH, 11002AIXR nozzles). At 2 DAP, the plot area was irrigated with 0.6" of water and supplemental irrigation was applied throughout the growing season. The plot area was maintained weed-free using a combination of hand-weeding and labeled herbicides. Data collected included peanut stand, visual estimates of peanut injury, and yield. All data were subjected to ANOVA and means separated using Fisher's Protected LSD Test (P=0.10). Brake 1.2SL caused significant peanut injury (bleaching, stunting, and stand loss), especially at the higher rates of 32 oz/A and 64 oz/A. For peanut yield, there was no interaction between variety and rate. When averaged over rate, variety effects on yield were not significant. When averaged over variety, Brake applied at 32 oz/A and 64 oz/A caused significant yield reductions (19.2% and 54.8%, respectively). Previous research suggested that the potential Brake 1.2SL use rate in peanut would be 16 oz/A. Although this rate did not significantly reduce yield in this trial, a 2X margin of safety was not observed.

PRACTICAL ASPECTS OF DICAMBA EXTRACTION FROM PUF SAMPLING MEDIA. J Williams*, T Mueller; University of Tennessee, Knoxville, TN (78)

ABSTRACT

The three cornerstones for good trace analysis of pesticides are accuracy, precision and sensitivity. A variety of tools and methods are used to optimize the ability of researchers to find biologically relevant concentrations of components of interest in various matrixes. The recent deployment of dicamba tolerant crops and the resultant off target movement issues has necessitated the use of air samplers to collect dicamba samples under field and lab conditions. This report details our method validation and optimization to allow the use of PolyUrethane Foam (PUF) as a sampling media to collect dicamba and then later extract from the PUF and analyze using LC chromatography procedures. When PUF extracts were fortified and then run through concentration steps, there appeared to be some dicamba movement and thus cross contamination of untreated, control samples. This cross contamination is well-known to many labs that have conducted dicamba research. Care should be taken to account for both the apparent low recovery of dicamba from actual PUF samples, which would understate true concentrations; and for cross carryover to some samples, which may overstate the true concentration (a false positive).

PREPLANT CONTROL OF KOCHIA IN ENLIST™ COTTON IN THE TEXAS HIGH PLAINS. U Torres*[1], PA Dotray[2], KR Russell[1], M Lovelace[3]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Corteva Agriscience, Lubbock, TX (79)

ABSTRACT

Kochia (*Bassia scoparia L.*) is an introduced annual weed from central and eastern Europe commonly found throughout the western and northern United States. Kochia is well-adapted in the arid to semi-arid region of the Texas High Plains, making it a troublesome weed to control if not properly managed early in the growing season. There also are reports that some areas may contain herbicide-resistant populations, which adds to the complexity of control. In this study, preplant control of kochia in an Enlist™ cotton (*Gossypium hirsutum L.*) system was evaluated. The study was conducted in 2018 and 2019 at the Texas A&M AgriLife Research and Extension Center in Lubbock, TX. Eight treatments (Valor SX® at 0.072 kg. ai/ha plus 2,4-D Amine at 1.1 kg. ai/ha; LeadOff® at 0.035 kg. ai/ha plus 2,4-D Amine; Starane® Ultra at 0.16 kg. ai/ha plus 2,4-D Amine; Valor SX® plus Roundup PowerMAX® at 1.6 kg. ae/ha; LeadOff® plus Roundup PowerMAX®; Starane® Ultra plus Roundup PowerMAX®; FeXapan™ at 0.56 kg. ae/ha plus Roundup PowerMAX®; and LeadOff® plus Afforia® and Roundup PowerMAX®) were applied with a CO_2 pressurized backpack sprayer 45, 30, and 15 days before planting. Kochia was controlled at least 93% at planting by several preplant treatments including LeadOff® plus 2,4-D, Starane® Ultra plus Roundup PowerMax®, Starane® Ultra plus 2,4-D, and FeXapan™ plus Roundup PowerMax® when applied 45 DBP. When applied 30 DBP, LeadOff® plus 2,4-D, LeadOff® plus PowerMax®, Starane® Ultra plus 2,4-D, Starane® Ultra plus Roundup PowerMax®, and FeXapan™ plus Roundup PowerMax® controlled kochia at least 96% at planting. When applied 15 DBP, only FeXapan™ plus Roundup PowerMax® controlled kochia by greater than 90%. FeXapan™ plus Roundup PowerMax® injured Enlist™ cotton in both years. No other treatment caused visible cotton injury. The FeXapan™ treatment was included for efficacy comparisons only and can only be used when planting XtendFlex™ cotton varieties in west Texas. Cotton lint yield ranged from 325 to 574 pounds per acre in 2018 and 496 to 833 pounds per acre in 2019. Yield from the non-treated preplant control plots averaged 250 and 277 pounds per acre in 2018 and 2019, respectively. The blanket at-plant application of Cotoran® in 2019, in-season applications of Enlist Duo®, tillage, and diuron postemergence-directed in 2018 were used to control weeds in-season. Furrow irrigation was also used, which may have masked yield differences that may have occurred because of the differences in kochia control observed by the treatments and preplant application timings.

PRICKLY SIDA AND GRASS SPECIES CONTROL IN XTEND AND ENLIST SOYBEAN SYSTEMS. ZT Hill*[1], T Barber[2], RC Doherty[1], LM Collie[3], A Ross[4]; [1]University of Arkansas System Division of Agriculture, Monticello, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Beebe, AR, [4]University of Arkansas, Lonoke, AR (80)

ABSTRACT

With the continued spread and further development of herbicide resistance observed in Palmer amaranth (*Amaranthus palmeri* S.) the need for new herbicide technologies is required. In recent years, the utilization of the synthetic auxin technologies Enlist and Xtend have been shown to provide effective control of herbicide-resistant Palmer amaranth in soybean in Arkansas. Two experiments were conducted at Tillar, AR on a silt loam soil in 2019, to determine the most effective programs for controlling prickly sida (*Sida spinosa* L.) and barnyardgrass (*Echinochloa crus-galli* (L.) P. Beauv.) in an Enlist and Xtend herbicide system. Both experiments were conducted as a randomized complete block design with four replications, and plot sizes of 3.9 meters (m) by 9.1 m. In the Enlist experiment, Trivence (chlorimuron, flumioxazin, and metribuzin) was applied preemergence (PRE) in all treatments followed by (fb) multiple combinations of postemergence (POST) herbicides. In the Xtend experiment, multiple PRE herbicides were applied fb Roundup Powermax (glyphosate) plus Xtendimax (dicamba) applied early POST or late POST in most systems; as well as one system that contained Scout (glufosinate) applied late POST. Herbicide efficacy was evaluated in both experiments at various times throughout the 2019 growing season. In the Enlist experiment, most of the herbicide systems provided greater than 85% control of prickly sida and barnyardgrass 21 days after the POST (DAPOST) application. The Enlist system containing Enlist (2,4-D), Liberty (glufosinate), and Everprex (*S*-metolachlor) applied POST provided the greatest control of prickly sida and barnyardgrass at the same timing, with 98- and 96% control, respectively. By 29 DAPOST, most of the systems provided greater control of both species than previously observed, with most treatments providing = 90% control. In the Xtend experiment, the herbicide systems containing a residual herbicide applied PRE provided greater control of both species at 10 days after the early POST (DAEPOST) application than the POST-only system, which provided 82% control of prickly sida and 68% control of barnyardgrass. By 13 DAPOST application, the control of both species increased to 99% in the systems that contained both a PRE and POST application; whereas, control from the POST-only system remained ineffective. Based on these data, the use of Enlist and Xtend technologies can be effective in controlling prickly sida and barnyardgrass, which can be problematic weeds in Arkansas soybean. Regardless of the technology, these data suggests that the use of both residual and POST herbicides will be necessary for adequate control of these weed species, in addition to reducing the spread of herbicide-resistant weeds.

RESISTANCE TO ACETOLACTATE SYNTHASE INHIBITORS IS DUE TO A TRP 574 TO LEU AMINO ACID SUBSTITUTION IN THE ALS GENE OF REDROOT PIGWEED AND TALL WATERHEMP FROM MISSISSIPPI. V Nandula*[1], D Giacomini[2], J Ray[1]; [1]USDA-ARS, Stoneville, MS, [2]University of Illinois, Urbana, IL (81)

ABSTRACT

Several *Amaranthus* spp. around the world have developed resistance (and cross resistance) to various herbicide modes of action. Populations of *A. retroflexus* (RRPW-R) and *A. tuberculatus* (TW-R) in Mississippi have been suspected to be resistant to one or more acetolactate synthase (ALS) inhibiting herbicides. Whole plant dose-response experiments with multiple ALS inhibitors, ALS enzyme assays with pyrithiobac, and molecular sequence analysis of ALS gene constructs were conducted to confirm and characterize the resistance profile and nature of mechanism in the RRPW-R and TW-R populations. Two susceptible populations, RRPW-S and TW-S were included for comparison with RRPW-R and TW-R, correspondingly. The R/S values of the RRPW-R population were >283, >448, and >120 for pyrithiobac, imazaquin, and trifloxysulfuron, respectively. The R/S values of the TW-R population for pyrithiobac, imazaquin, and trifloxysulfuron were >10, >448, and >240, respectively. I_{50} values of RRPW-S and RRPW-R populations for pyrithiobac were 0.062 and 208.33 µM, indicating that the ALS enzyme of the RRPW-R population is 3360-fold more resistant to pyrithiobac than the RRPW-S population under our experimental conditions. The TW-R population was 1214-fold resistant to pyrithiobac compared to the TW-S population, with the I_{50} values for pyrithiobac of TW-R and TW-S populations being 87.4 and 0.072 µM, correspondingly. Sequencing of the *ALS* gene identified a point mutation at position 574 of the *ALS* gene leading to substitution of tryptophan (W) residue with a leucine (L) residue in both RRPW-R and TW-R populations. Thus, the RRPW-R and TW-R populations are resistant to several ALS-inhibiting herbicides belonging to different chemical classes due to an altered target site, i.e., ALS. Resistance in *Amaranthus* spp. to commonly used ALS-inhibiting herbicides severely limits postemergence management options for growers.

SCREENING OF SELECTED SOYBEAN GERMPLASM FOR TOLERANCE TO DICAMBA. V Nandula*, R Smith, J Ray; USDA-ARS, Stoneville, MS (82)

ABSTRACT

Drift from dicamba applications to dicamba-resistant soybean and cotton has caused extensive injury and damage to non-dicamba resistant broadleaf crops and other dicotyledonous flora across the agricultural landscape. During 2018 in a USDA Stoneville breeding nursery, multiple non-dicamba-resistant soybean breeding lines with unique pedigrees exhibited reduced injury (tolerance?) from dicamba that had drifted from applications made to dicamba-resistant soybean fields. The level of tolerance to dicamba in these lines was measured in a 2019 field study to identify potential sources of natural tolerance to dicamba. If sufficient tolerance exists, these traits could be bred into public non-dicamba-resistant soybean cultivars. Five conventional dicamba-sensitive lines and two commercial dicamba-resistant varieties, were compared for responses to dicamba (Xtendimax® formulation) treatments at 1/100 x,1/50 x, 1/25 x, 1/10 x, 1/4 x, and 1x rates. The 1x rate corresponds to the highest single application rate of dicamba at 0.56 kg ai ha^{-1}. In addition, 2,4-D (Enlist One™) at 1.06 kg ae ha^{-1} was also included as a treatment. All herbicide applications were made at the V2 to V3 stages of soybean development. As the rate of dicamba increased, plant injury increased in the five conventional lines in a step-wise fashion. Similarly, soybean plant height decreased with increasing rate of dicamba in the five sensitive lines. Interestingly, the extent of plant injury and height reduction (compared to no herbicide control) from 2,4-D were greater in the commercial dicamba-resistant varieties compared to the five conventional lines. Similarly, soybean yield was lower in the commercial dicamba-resistant varieties compared to two conventional lines (yield not recorded in other three lines). This finding may be a cause for concern since 2,4-D is expected to be commercially applied to thousands of acres planted with 2,4-D-resistant soybean in 2020, thereby, increasing the risk of injury and yield reduction to extensive acreage of dicamba-resistant soybean. Dicamba at the 1x rate killed all plants from four conventional lines and no yield was obtained from corresponding plots.

SESAME RESPONSE TO ETHALFLURALIN APPLIED PREPLANT. WJ Grichar*[1], PA Dotray[2]; [1]Texas A&M AgriLife Research, Yoakum, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX (83)

ABSTRACT

Field studies were conducted in south-central Texas near Yoakum and in the Texas High Plains near Lubbock during the 2019 growing season to determine sesame (*Sesamum indicum* L.) tolerance to ethalfluralin alone (0.63, 0.84, and 1.05 kg ha^{-1}) applied 30, 15, or 0 (at plant) day prior to planting (Study 1) or ethalfluralin (at the above mentioned rates) in combination with *S*-metolachlor (1.17 and 1.56 kg ha^{-1}) applied preplant incorporated (PPI) prior to planting (Study 2). In Study 2, in the High Plains, herbicides were incorporated 2 times in opposite directions with a rolling cultivator while in south Texas, herbicides were incorporated either with gang mixing wheels or just the planting action of the Monosem planter. Study 1. This study was conducted only at the High Plains location. Sesame stands were not reduced with ethalfluralin at 0.63, 0.84, and 1.05 kg ha^{-1} applied 30, 15, or 0 days prior to planting when evaluated 16 days after planting (DAP). Sesame injury (16 DAP) with ethalfluralin at 0.63 and 0.84 kg ha^{-1} was apparent when applied 15 (25 to 47%) or 0 (18 to 38%) day prior to planting but not 30 d prior to planting. However, when ethalfluralin was applied at 1.05 kg ha^{-1}, sesame injury (20 to 40%) was noted at all application timings. When evaluated 72 DAP, sesame injury (5 to 12%) greater than the untreated check was still visible with ethalfluralin at 0.63 and 0.84 kg ha^{-1} applied at 0 day (8%) and ethalfluralin at 1.05 kg ha^{-1} applied 15 (10%) and 0 (13%) day prior to planting. Ethalfluralin at 0.63 and 0.84 kg ha^{-1} applied 0 day prior to planting were the only herbicide treatments which resulted in lower yields than the untreated check. Study 2. This study was conducted at both locations. At the High Plains location, when evaluated 9 DAP, sesame stands were not reduced from the untreated check with any herbicide treatment. Injury evaluations recorded 30 DAP, showed 50% or greater injury with ethalfluralin plus *S*-metolachlor applied at 0.63 + 1.56 kg ha^{-1}, 0.84 + 1.17 kg ha^{-1}, 1.05 + 1.17 kg ha^{-1}, and 1.05 + 1.56 kg ha^{-1}. When evaluated 71 DAP, all herbicide treatments resulted in sesame injury (5 to 12%) that was greater the untreated check. With the exception of ethalfluralin + *S*-metolachlor at 1.05 + 1.56 kg ha^{-1}, sesame yields with all other herbicide treatments were not reduced from the untreated check. At the south Texas location, sesame stands were reduced from the untreated check with all ethalfluralin + *S*-metolachlor treatments regardless of rate when incorporated either with mixing wheels (48 to 86%) or just the planting action of the Monosem planter (86 to 99%). Sesame yields were reduced from the untreated check with all herbicides using both incorporation methods with the exception of ethalfluralin at 1.05 kg ha^{-1} plus *S*-metolachlor at 1.17 kg ha^{-1} incorporated using mixing wheels. The use of ethalfluralin as a preplant incorporated herbicide treatment in sesame can result in serious stand issues and sesame injury at emergence which may last throughout the growing season. Method of incorporation may not be a factor in the amount of sesame injury although stand reduction was greatest in south Texas compared with the rolling cultivator used in the High Plains. Since sesame has a great ability to compensate for poor stands and injury, in many instances this stand reduction/injury did not always result in a reduction in yield when compared to the untreated check.

SICKLEPOD EXTRACT PREPARATION, ANALYSIS, AND ITS ANTI-HERBIVORE APPLICATIONS. Z Yue*, T Tseng, D Lang; Mississippi State University, Mississippi State, MS (84)

ABSTRACT

Sicklepod (*Senna obtusifolia*) is one of the top-ten trouble weeds in the southern US. It belongs to the Leguminosae, and its seeds are famous for high anthraquinone derivative contents and often used in herbal medicine to treat constipation. During the past three years, water-based sicklepod extract had been prepared as a deer repellent. Its deer repelling effects only second to Liquid Fence (LF), and better than Hinder and Flight Control Plus (FCP). However, the extract viscosity limited its anthraquinone derivative concentration up to 169 ppm. To increase anthraquinone derivative concentration further to get a better performance as both deer repellent and insecticide, the methanol based extract was prepared from sicklepod fruit meal. After all methanol evaporated, 1% nonionic surfactant was used to emulsify the dried methanol extract. For HPLC analysis, one mL of the emulsion was first freeze dried, then dissolved in one mL methanol to load on the HPLC tray. The results showed that it contained orantio-obtusin (150 ppm), emodin (22 ppm), chrysophanol (19 ppm) physcion (9 ppm), aloe-emodin (7 ppm), and rhein (5 ppm). The total anthraquinone derivatives was determined to be 212 ppm. Field deer browsing test showed the sicklepod extract had same deer browsing rate as LF. Lab soybean looper feeding test showed the extract had same feeding rate as bifen as before. The reformulated sicklepod extract had higher anthraquinone derivative concentration and lower viscosity. Tentative tests showed it had the same deer repelling effect as LF and same antifeedant effect to soybean looper as bifen.

TANK MIX PARTNERS WITH ISOXAFLUTOLE INCREASE SOIL RESIDUAL ACTIVITY ACROSS THE COTTON BELT. DC Foster*[1], PA Dotray[2], SA Byrd[3], AS Culpepper[4], DM Dodds[5], SD Hall[5], BJ Norris[5], RL Noland[6], SA Nolte[7], M House[8], JK Norsworthy[9], RB Farr[9], LE Steckel[10], C Thompson[11]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Texas A&M University AgriLife Extension, Lubbock, TX, [4]University of Georgia, Tifton, GA, [5]Mississippi State University, Mississippi State, MS, [6]Texas A&M Agrilife Extension, San Angelo, TX, [7]Texas A&M AgriLife Extension, College Station, TX, [8]Texas A&M University, College Station, TX, [9]University of Arkansas, Fayetteville, AR, [10]University of Tennessee, Jackson, TN, [11]BASF, Abernathy, TX (85)

ABSTRACT

The increase in number of herbicide resistant weeds threatens Texas cotton (*Gossypium hirsutum L.*) production, forcing producers to use multiple modes of action to manage weeds. Recent cotton germplasm available on the market includes tolerance to auxinic herbicides; however, this technology has become controversial due to off-target herbicide movement. *P*-hydroxyphenylpyruvate dioxygenase (HPPD) inhibitors are a relatively new class of herbicide chemistry although first available for use in the 1980's. While current varieties do not tolerate HPPD inhibitors, BASF Corporation has developed HPPD-tolerant cotton that will allow growers to use isoxaflutole in future weed management programs. Utilizing multiple modes of action that include the use of soil residual herbicides will increase weed management options and help steward old and new technologies in the battle to minimize the development and spread of herbicide resistant weeds. In 2019, a research project was developed with collaboration from a number of universities and BASF Corporation to examine weed control following isoxaflutole applied alone and with a number of different tank mix partners. Treatments included isoxaflutole at 0.11 kg ai/ha applied alone and tank mixed with half and full rates of the following cotton herbicides: fluometuron at 0.56 and 1.12 kg ai/ha, prometryn at 0.67 and 1.35 kg ai/ha, diuron at 0.56 and 1.12 kg ai/ha, fluridone at 0.08 and 0.17 kg ai/ha, fomesafen at 0.14 and 0.28 kg ai/ha, pendimethalin at 0.56 and 1.12 kg ai/ha, *S*-metolachlor at 0.7 and 1.4 kg ai/ha, acetochlor at 0.63 and 1.26 kg ai/ha, and pyrithiobac at 0.029 and 0.058 kg ai/ha. There were nine total locations of this study conducted in Arkansas, Georgia, Mississippi, Oklahoma, Tennessee, and Texas. Several weed species were examined but the target weed was Palmer amaranth (*Amaranthus palmeri S. Watson*). In Texas (Halfway), Georgia, Mississippi, and Tennessee, all full rate tank-mix partners improved Palmer amaranth control when compared to using isoxaflutole alone. Isoxaflutole + fluridone controlled Palmer amaranth 80% and 100% 56 day after planting (DAP) in Arkansas and College Station, respectively. In Texas, isoxaflutole tank-mixed with full rates of fluridone, fluometuron, acetochlor, or s-metolachlor at Halfway or tank-mixed with full rates of fluridone, acetochlor, diuron or s-metolachlor at College Station controlled Palmer amaranth >98% and >95%, respectively, 56 DAP. A decline in Palmer amaranth control was most rapid in Tennessee, Mississippi, and Arkansas and early postemergence applications will be needed to extend effective weed control in cotton. Future studies will continue to focus on soil residual control of Palmer amaranth as well as other common weeds found in cotton production.

THE EFFECT OF ENVIRONMENTAL FACTORS ON DICAMBA VOLATILITY. CL Wilhite*, JM Taylor, G Oakley, BJ Varner, SR Reeves, DB Reynolds; Mississippi State University, Mississippi State, MS (86)

ABSTRACT

Off-target movement (OTM) of auxin herbicides have been problematic since their introduction. Environmental factors such as temperature and rainfall have been shown to affect OTM. This study was conducted to determine if a simulated irrigation event following the application of dicamba herbicide would reduce volatility. Two field studies were conducted in Mississippi using low tunnels to assess the effect of a simulated rainfall event on dicamba volatility. Greenhouse soil flats were filled with field soil and watered to field capacity prior to being treated with a 4X rate of dicamba + glyphosate. Soil in each flat was treated with 2.24 kg ae/ha dicamba (XtendiMax + Vaporgrip) + 4.5 kg ae/ha glyphosate (Roundup PowerMax). Immediately following application, a simulated irrigation event of 0, 1.5, 3.2, 6.4, 9.5, and 12.7 mm of rainfall was applied to individual treatments. Two soil flats were then transferred to individual 30.4 x 1.5 meter plots of soybean. A low tunnel tent that measures 6 x 2 meters was then placed over each plot. The soil flats were covered by a low, open ended tunnel covered with plastic for a period of 48 hr. An air sampler, calibrated to pull 3L of air per minute, was connected to a polyurethane foam tube (PUF) and was placed under each low tunnel and ran for the 48 hr incubation period. At 14 DAT, visual injury was reduced by any amount of rainfall from 61 to 366 cm and only by the 12.7 mm amount at the 0 and 31 cm distance, which was adjacent to the treated flat. At 28 DAT, visual injury was reduced by any amount of rainfall from 91 to 366 cm. Injury did not differ regardless of amount of rainfall at the 0 and 31 cm increment and only by the 12.7 mm amount at the 61 cm interval. Dicamba concentrations as measured by air samplers show that any amount of rainfall decreased the dicamba concentration and concentrations did not differ among rainfall amounts. Dicamba concentration in the non-irrigated plot averaged 42 ng/PUF while concentrations in the irrigated treatments ranged from 1 to 5 ng/PUF. Dicamba vapor travel distance was reduced with the introduction of applied irrigation. These are preliminary data and trials will be repeated in 2020.

THE EFFECT OF MULTIPLE EXPOSURES OF AUXIN HERBICIDE ON SOYBEANS. BJ Varner*[1], KW Bradley[2], A Hager[3], KL Gage[4], DB Reynolds[1], JK Norsworthy[5], LE Steckel[6], BG Young[7]; [1]Mississippi State University, Mississippi State, MS, [2]University of Missouri, Columbia, MO, [3]University of Illinois, Urbana, IL, [4]Southern Illinois University Carbondale, Carbondale, IL, [5]University of Arkansas, Fayetteville, AR, [6]University of Tennessee, Jackson, TN, [7]Purdue University, Brookston, IN (87)

ABSTRACT

The Roundup Ready® XTEND cropping system has provided producers with another tool to help combat the ever-growing resistance problems. Soybean damage from off-target herbicide movement is influenced by herbicide, rate, growth stage, and susceptibility (Scholtes et al. 2014). Dicamba at 0.005 lb. ae/A at V3 soybeans growth stage reduced yield by 34% (Anderson et al. 2004). Dicamba at 0.016 lb./A at R1 growth stage reduced mature soybean height by 28% and yield by 36% (Griffin et al. 2013). With the heavy use of dicamba in the XTEND program more acres of soybeans are being affected with sub-lethal rates of dicamba. Often the same field will be affected with multiple exposures in the same year. These exposures can happen from volatilization, particle drift, and tank contamination. This study evaluated Roundup Ready soybeans following multiple exposures of a sub-lethal rate of Dicamba. The study was sprayed with a 2.8g ae/ha (1/200th of labeled rate). Two factors were used for the timing of the application: Factor A (Vegetation exposure) and Factor B (Reproductive exposure). Factor A timing was no vegetation exposure and V3. Factor B timing was no reproductive exposure, R1, R3, R5, R1/R3, R1/R5, R3/R5, and R1/R3/R5. Data showed that multiple exposures resulted in greater yield reductions when the multiple exposures occurred at the R1 and R3 growth stages.

USEFUL WILD PLANTS OF TEXAS....A VALUABLE WEED SCIENCE REFERENCE. JD Byrd*; Mississippi State University, Mississippi State, MS (88)

ABSTRACT

As weed scientists, our occupation is to help manage plants that are out of place. But, how often do we wish we knew more about a particular species? Is it native or introduced? How did it arrive in North America? Was it brought here on purpose and if so, what was the purpose? Useful Wild Plants of Texas, the Southeastern and Southwestern United States, the Southern Plains, and Northern Mexico is an invaluable resource to help find answers to those questions. Four volumes have already been published with the goal of documenting this information on 4000 species of native and naturalized plants. Volume 1 covers covers 267 species in 78 genera *Abronia* to *Arundo*; Volume 2 provides detailed information on 254 species in the 79 genera *Asclepias* to *Canavalia*; Volume 3 covers 129 species in the 23 genera *Canna* to *Celtis*; while Volume 4 covers 175 species in the 66 genera *Cenchrus* to *Convolvulus*. These clothbound editions contain written descriptions of species and common names, color photographs, distribution maps, ethnobotanical uses as food for human or livestock, medicinal value, fiber, fuel, building, dye, based on archeological and historic fact. There is also information on landscape uses, pollinator habitat, cultural habitat, crop potential, plant toxicity, and potential weediness. They can be ordered online at https://www.usefulwildplants.org or contacting Useful Wild Plants, Austin, Texas at 512-928-4441. Weed scientists that have a desire to know more about a plant than simply what kills it, will find these references invaluable.

VASEYGRASS (PASPALUM URVILLEI) CONTROL IN HYBRID BERMUDAGRASS WITH DERIGO. R Strahan*[1], D Sexton[1], EK Twidwell[1], SJ Gauthier[2]; [1]LSU AgCenter, Baton Rouge, LA, [2]Louisiana State University AgCenter, Breaux Bridge, LA (89)

ABSTRACT

Vaseygrass *(Paspalum urvellei*) is a significant weed 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.). Vaseygrass is a bunching perennial grass that rapidly spreads by seed throughout bermudagrass hay fields, where it often outcompetes the crop and significantly reduces hay quality and yields. Bermudagrass infested with vaseygrass often becomes unusable for hay production. A field study was conducted in 2019 in St. Martin Parish, near Breaux, LA in a hybrid bermudagrass (Jiggs cultivar) hay meadow that was heavily infested with vaseygrass. The purpose of the study was to evaluate the effectiveness of foramsulfuron + iodosulfuron + thiencarbazone (Derigo) on vaseygrass and determine the herbicide's safety on hybrid bermudagrass. The experiment was conducted as a randomized complete block with 3 replications. There were 6 total treatments including an unsprayed check. Herbicides evaluated included glyphosate applied at 0.56 and 1.1 kg/ha, foramsulfuron + iodosulfuron + thiencarbazone (Derigo) applied at 210.2 g/ha and 420.3 g/ha and foramsulfuron + iodosulfuron + thiencarbazone at 210.2 g/ha + glyphosate at 0.28 kg/ha. A non-ionic surfactant (0.25% v/v) was included with all herbicide treatments. Plots were 2.8 m^2. Herbicides were applied with a CO_2 backpack sprayer delivering 224.5 L/ha. The study was initiated on May 30, 2019. Vaseygrass height ranged from 15 to 22 cm at the time of application. Visual ratings of percent vaseygrass control (0% = no control and 100% = complete control) and percent bermudagrass injury (0 = no injury and 100% = dead) were collected at approximately 2 week intervals. A single broomsedge (*Andropogon virginicus*) control rating was collected at 80 DAT. Data were subjected to analysis of variance (P=0.05) and means were separated using Fisher's LSD. At 14 DAT, glyphosate applied at 0.56 kg/ha or 1.1 kg/ha provided at least 90% vaseygrass control. However, the herbicide caused unacceptable bermudagrass injury (40%). Derigo applied at 420.3 g/ha was more effective than Derigo applied at 210.2 g/ha (77 vs 63 %). There was no improvement in vaseygrass control when adding glyphosate at 0.28 kg/ha to Derigo at 210.2 g/ha. This tank-mix caused an increase in bermudagrass injury when compared to Derigo applied alone. By 30 DAT, Glyphosate applied alone at the 1.1 kg/ha rate provided the highest level of vaseygrass control (95%) but still caused unacceptable bermudagrass injury (43%). Vaseygrass control was similar for all rates of Derigo, Derigo + glyphosate and glyphosate alone at 0.56 kg/ha (70 to 82%). Derigo at 210.2 g/ha only caused 5% bermudagrass injury. Vaseygrass control was similar for herbicide treatments by 60 DAT with all herbicides providing at least 80% control. Bermudagrass injury was significantly higher for plots treated with glyphosate at the high rate than all other herbicide treatments. However, Derigo treated bermudagrass caused <15% injury. By 80 DAT, plots treated with Derigo alone provided at least 90% vaseygrass control with little injury or stand impact on the bermduagrass. Although Derigo was effective on vaseygrass, the herbicide applied alone released broomsedge (*Andropogon virginicus*) and test plots became infested with this perennial grass. Glyphosate applied at 0.56 and 1.1 kg/ha controlled 93 to 95% of the broomsedge, whereas broomsedge populations in Derigo treated plots were equivalent to the untreated checks. Tank-mixes of Derigo + glyphosate were more effective on broomsedge than the 2 rates of Derigo applied alone (51% vs 5% and 18%).

WEED CONTROL AND CROP TOLERANCE OF POSTEMERGENCE HERBICIDES IN SUNN HEMP. PJ Dittmar*, D Davis; University of Florida, Gainesville, FL (90)

ABSTRACT

Sunn hemp cover crop is used during the summer fallow period for suppression of weed growth, however, poor seed emergence or inclement weather can reduce the crop stand. The study objective was to evaluate weed control and crop tolerance in low population stands of sunn hemp. The treatments included metribuzin at 0.42 kg ha^{-1}, halosulfuron 0.04 kg ha^{-1}, fomesafen at 0.28 kg ha^{-1}, bentazon at 1.12 kg ha^{-1}, oxyfluorfen at 0.14 kg ha^{-1}, and sulfentrazone at 0.08 kg ha^{-1}. All the treatments included nonionic surfactant was included at 0.25% v/v. Treatments were applied with a backpack sprayer with flat fan 8002VS nozzles calibrated to deliver 20 gal/A. Fomesafen caused sunn hemp death and reduced the plant stand. Halosulfuron and sulfentrazone had similar crop injury at 28 d after treatment to nontreated; similar trends were measured for crop weight and height. The reduced sunn hemp stand in fomesafen caused weed counts to be greater than all other treatments. Halosulfuron had the lowest nutsedge population and was similar to only bentazon. At 56 DAT, halosulfuron had the greatest number of broadleaf weeds and this increased the total number of weeds. No differences were measure among treatments for grass except fomesafen, which was higher. If the sunn hemp stand is reduced by poor emergence or weather, then a herbicide application can be important for nutsedge control, however, not for broadleaf or grass weeds. Halosulfuron and bentazon provided the greatest nutsedge control with minimal injury to the sunn hemp crop.

WEED MANAGEMENT PROGRAMS IN MISSISSIPPI CORN. T Bararpour*, RR Hale, JA Bond, MW Ebelhar; Delta Research and Extension Center, Stoneville, MS (91)

ABSTRACT

Weed management programs are an important component of corn (*Zea mays*) production in Mississippi for obtaining high yield. A field study was conducted in 2019 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate: 1) the efficacy of herbicides available to Mississippi producers for controlling weeds in corn, and 2) the possible use of Sencor (metribuzin) in weed control programs and corn tolerance. Corn (Pioneer P1563 YHR) was planted on beds with 40-inch row spacing at a seeding rate of 2.5 seeds ft^{-1} on April 23, 2019 and emerged on April 30. The plot area contained Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), broadleaf signalgrass (*Urochloa platyphylla*), barnyardgrass (*Echinochloa crus-galli*), and hemp sesbania (*Sesbania herbacea*). The study was designed as a randomized complete block with 20 treatments and four replications. Treatments were as follows: 1) AAtrex (atrazine) at 1.5 qt/A + crop oil concentrate (COC) at 1% (v/v) at V2-V3 (May 13) followed by (fb) Liberty (glufosinate) at 29 fl oz/A at V4-V5 (May 31); 2) AAtrex + COC at V2-V3 fb Roundup PowerMax (glyphosate); 3) RPM (Roundup PowerMax) at V2-V3 fb RPM at V4-V5; 4) Liberty at V2-V3 fb Liberty at V4-V5; 5) Halex GT (mesotrione + *S*-metolachlor + glyphosate) at 3.6 pt/A + AAtrex + COC at V3-V4 (May 20); 6) Zidua SC (pyroxasulfone) at 3.3 fl oz/A + Armezon (topramezone) at 0.75 fl oz/A + RPM + COC at V3-V4; 7) Zidua SC + Sencor (metribuzin) at 3 oz/A + Armezon + RPM + COC at V3-V4; 8) Zidua SC + Sencor + Armezon + RPM + COC at V2-V3; 9) Zidua SC + Armezon + RPM + COC at V2-V3; 10) Sencor + Armezon + RPM + COC at V3-V4; 11) Sencor + Armezon + RPM + COC at V2-V3; 12) Dual II Magnum (*S*-metolachlor) at 1.3 pt/A + AAtrex at 1 qt/A PRE fb AAtrex + COC at V3-V4; 13) Capreno (thiencarbazone-methyl + tembotrione) at 3 fl oz/A + RPM + AAtrex + Ammonium sulfate (AMS) at 2.5% (v/v) at V2-V3; 14) Armezon at 0.57 fl oz/A + Status (diflufenzopyr + dicamba) at 3 oz/A + RPM + AAtrex + AMS at V2-V3; 15) Verdict (saflufenacil + dimethenamid) at 10 fl oz/A + Zidua SC + AAtrex at 2 qt/A PRE; 16) Acuron (*S*-metolachlor + atrazine + mesotrione + bicyclopyrone) at 80 fl oz/A PRE; 17) Resicore (acetochlor + mesotrione + clopyralid) at 2.25 qt/A PRE fb Durango DMA (glyphosate) at 32 fl oz/A + AAtrex at 1 qt/A at V2-V3; 18) Halex GT + Sencor at 4 oz/A + COC at V3-V4; 19) Dual II Magnum + Sencor at 4 oz/A PRE fb AAtrex + COC at V3-V4; and 20) nontreated check. RPM rate was 32 fl oz/A except for treatment 2 and 3 (22 fl oz/A). Corn Injury level was 0% for V2-V3 and 4 to 8% for V3-V4 for Sencor (tank-mix combinations) 1 wk after application (WAA), but there was no corn injury by 7 WAA. All treatments provided 95 to 100% control of prickly sida and hemp sesbania. Palmer amaranth and pitted morningglory control were 98 and 85, 94 and 88, 80 and 94, 94 and 89, 100 and 96, 93 and 95, 98 and 95, 99 and 97, 96 and 93, 96 and 96, 84 and 91, 100 and 90, 93 and 93, 96 and 94, 100 and 98, 90 and 94, 99 and 96, 98 and 99, 100 and 98% on July 8 from treatment 1 through 19, respectively. Barnyardgrass and broadleaf signalgrass control were 84 and 91, 92 and 93, 95 and 97, 89 and 92, 95 and 95, 95 and 93, 99 and 93, 98 and 97, 98 and 96, 85 and 86, 81 and 84, 98 and 93, 90 and 92, 92 and 91, 100 and 99, 98 and 96, 90 and 85, 97 and 96, 100 and 98%, respectively. Corn yield was 161, 178, 180, 150, 174, 172, 168, 175, 180, 164, 158, 180, 162, 171, 166, 159, 168, 184, and 177 bu/A for plots that received the application of treatment 1 through 19, respectively. Weed interference reduced corn yield to 95 bu/A (nontreated check). In conclusion, plots that received the tank-mix combinations of Sencor provided comparable corn yield as standard treatments (trt. 5 and 12). Therefore, Sencor could be used in weed management programs in Mississippi corn.

WINTER ANNUAL BROADLEAF CONTROL IN MISSISSIPPI AND OKLAHOMA WHEAT (TRITICUM AESTIVUM). JC Ferguson[1], M Manuchehri[2], ZR Treadway*[1], KL Broster[1], LH Merritt[1], MT Wesley Jr.[1], JS Calhoun[1], JT Childers[3]; [1]Mississippi State University, Mississippi State, MS, [2]Oklahoma State University, Stillwater, OK, [3]Oklahoma State University, Marlow, OK (92)

ABSTRACT

Childers Cutleaf evening primrose (*Oenothera laciniata*) is a major problem weed of wheat in Mississippi and Oklahoma. Due to the significance of broadleaf weed pressure in the growth and yield of wheat in both states, field studies were conducted in Mississippi and Oklahoma to better understand how to control these weeds. Research was conducted over two years in Newton and Brooksville, Mississippi and Lahoma, Oklahoma to understand the best treatment options for winter annual broadleaf weed control. All three locations were drilled with wheat using appropriate variety (Bullet in Mississippi and Iba in Oklahoma) and plant population for the respective area in mid-October 2019. Treatments selected for comparison included dicamba, 2,4-D, MCPA, fluroxypyr + thifensulfuron methyl, chlorsulfuron + metsulfuron-methyl, halauxifen-methyl + florasulam, and multiple combinations of the above herbicides. Weed control was assessed at 7, 14, 28, and 56 days after application (DAA) for all three locations. Results showed that for the 28 DAA control ratings across all three locations, primrose and winter annual broadleaf control ranged from 91.25% to 12.5% of the treated plots. Across all three locations, the three top performing treatments were chlorsulfuron + metsulfuron-methyl plus 2,4-D, halauxifen-methyl + florasulam plus chlorsulfuron + metsulfuron-methyl and chlorsulfuron + metsulfuron-methyl alone with across location ratings of 84.6%, 83.3% and 83% respectively. The three worst performing treatments were dicamba, MCPA ester, and 2,4-D alone with ratings of 42%, 47.5%, and 55% respectively. Yields will be taken in the spring of 2020 to give a more complete answer to the question of best winter annual broadleaf control program in Mississippi and Oklahoma wheat.

MICROSATELLITE MARKERS ASSOCIATED WITH ALLELOPATHY IN WEEDY RICE (ORYZA SATIVA). BC Schumaker*, SD Stallworth, T Tseng, S Shrestha; Mississippi State University, Mississippi State, MS (93)

ABSTRACT

Rice feeds an estimated 520 million people across the globe. The growing population demands an increase in rice production. The most significant yield-limiting factor in rice production is weed competition. Weedy rice is a wild relative of cultivated rice and one of the most common rice weeds, exhibiting competitive characteristics that imply a vast germplasm of possible traits to incorporate into rice breeding programs. One such trait exhibited in some weedy rice biotypes is allelopathy and is defined as the production of chemical compounds from a donor plant that have inhibitory effects on the development of surrounding species. WR is also genetically diverse allowing them to adapt and thrive in various stressful environments and outcompete their neighboring crops party due to this chemical production. Genetic markers have been used to study the genetic diversity among weedy rice biotypes focusing on stressors such as heat tolerance, cold tolerance, and submergence tolerance. The objective of this research is to the genetic controls associated with allelopathic characteristics in weedy rice using simple sequence repeat (SSR) markers. Eleven Allelopathic weedy rice accessions and five rice cultivars (RONDO, PI312777, Rex, PI338046, CL163) were analyzed using 30 SSR markers. Markers were selected for their ability to determine genetic variability. Three clusters were created but allelopathic and non-allelopathic biotypes were not distinct within the clusters. Identifying markers correlated with allelopathic genes in weedy rice can further selective breeding efforts in order to develop more weed suppressive rice varieties.

EFFECTS OF PINOXADEN APPLICATION TIMING ON CRABGRASS (DIGITARIA SPP.) IN BERMUDAGRASS (CYNODON DACTYLON) TURF. JM Peppers*[1], JS McElroy[2]; [1]Virginia Tech, Blacksburg, VA, [2]Auburn University, Auburn, AL (94)

ABSTRACT

Postemergence crabgrass (*Digitaria* spp.) control options are limited in bermudagrass turf. Pinoxaden is an ACCase inhibiting herbicide newly released for crabgrass control in bermudagrass, zoysiagrass and St. Augustinegrass. Early research has indicated that pinoxaden may be effective in controlling grassy weeds at later maturity stages than other postemergence herbicides. This has led to pinoxaden being marketed for grassy weed control at mature growth stages. The purpose of this research was to determine if pinoxaden can effectively control mature crabgrass species. In the summers of 2018 and 2019, field research was conducted to evaluate the efficacy of pinoxaden on different stages of smooth crabgrass growth. Single and sequential applications of pinoxaden (1.56 kg ai ha^{-1}) were made to smooth crabgrass (*Digitaria ischaemum*) at two growth stages. The early growth stage consisted of 1-3 tiller smooth crabgrass and the late growth stage consisted of 4-7 tiller smooth crabgrass. Percent coverage of smooth crabgrass was recorded throughout the trial. In both years, applications made during the 1-3 tiller stage were more effective at limiting smooth crabgrass coverage than applications made at the 4-7 tiller stage. In 2018, single and sequential applications made at the 1-3 tiller stage reduced smooth crabgrass coverage to <40% until mid-August. In 2018, single applications of pinoxaden at the 4-7 tiller stage reduced smooth crabgrass coverage slightly from ~80% to ~70%. Sequential applications to smooth crabgrass in the 4-7 tiller stage in 2018 reduced smooth crabgrass coverage from ~70% to ~63%. In 2019, single and sequential applications made at the 1-3 tiller stage maintained a relatively clean plot (<20% smooth crabgrass coverage) throughout the growing season. In 2019, single and sequential applications at the 4-7 tiller stage reduced smooth crabgrass more than in 2018. In 2019, single applications to 4-7 tiller crabgrass reduced smooth crabgrass from ~95% coverage to ~55%. In 2019, sequential applications at the 4-7 tiller stage reduced smooth crabgrass coverage from ~95% coverage to ~25%. Greenhouse studies were conducted between 2018 and 2019 to confirm a difference between early and late season applications of pinoxaden to crabgrass control. A rate response screen was conducted on large crabgrass (*Digitaria sanguinalis*) using ten rates of pinoxaden ranging from 4 to 2490 g ai ha^{-1}. Two stages of large crabgrass were examined, 6 and 10 weeks after germination (WAG). I_{50} and I_{90} values for visual injury and WR_{50} and WR_{90} values for weight reduction were determined using nonlinear regressions for each application timing. Large crabgrass was more susceptible to pinoxaden when applications were made 6 WAG. The I_{50} and I_{90} visual injury values for large crabgrass treated at 6 WAG were 8.62 and 42.23 g ai ha^{-1} compared to 41.64 and 494.48 g ai ha^{-1} for large crabgrass treated 10 WAG. The WR_{50} and WR_{90} weight reduction values for large crabgrass treated at 6 WAG were 4.92 and 64.03 g ai ha^{-1} compared to 310.41 and >2490 g ai ha^{-1} for large crabgrass treated 10 WAG. From these studies we can determine that early stages of crabgrass species are more susceptible to pinoxaden than later applications in Auburn, Alabama. Because of differences in efficacy between 2018 and 2019, more research is needed to determine how effective pinoxaden applications are when applied to 4-7 tiller crabgrass.

EVALUATION OF CHEMICAL CONTROL OPTIONS FOR SMUTGRASS (*SPOROBOLUS INDICUS*) IN TEXAS. ZS Howard*[1], M Matocha[2], SA Nolte[3]; [1]Texas A&M University, College Station, TX, [2]Texas AgriLife Extension Service, College Station, TX, [3]Texas A&M AgriLife Extension, College Station, TX (95)

ABSTRACT

Smutgrass *(Sporobolus indicus*) is problematic due to its poor palatability to cattle and its difficulty to control once established. The objective of this research was to evaluate potentially effective herbicides for smutgrass control. Research was conducted in 2018 and 2019 in Grimes County, Texas, to evaluate the efficacy of hexazinone at two application timings, nicosulfuron + metsulfuron methyl as single and sequential applications, glyphosate + imazapic as a single application, and quinclorac as a single application. Smutgrass control and crop response was evaluated at 5, 10, and 18 weeks after (WA) B application. At 5 WAB in 2019, hexazinone provided significantly better control from early summer application, differing from poor control in the same 2018 study. Glyphosate + imazapic as well as the split applications of nicosulfuron + metsulfuron methyl provided increased control in 2019 as well at the same rating. By 18 WAB, control with hexazinone significantly diminished, glyphosate + imazapic provided slightly less than satisfactory control, and the split application of nicosulfuron + metsulfuron failed to control smutgrass. Results from herbicides taken in by foliage are similar to that of the same study completed in 2018. The second application timing of hexazinone, an herbicide primarily received into the plant by the roots, resulted in better initial control in 2019 due an activating rainfall that was lacking in 2018.

EVALUATION OF ECHINOCHLOA CRUS-GALLI SENSITIVITY TO FLORPYRAUXIFEN-BENZYL. GL Priess*, JK Norsworthy, C Brabham; University of Arkansas, Fayetteville, AR (96)

ABSTRACT

The commercialization and widespread use of Loyant® (florpyrauxifen-benzyl) on rice in Arkansas was observed in 2018. However, barnyardgrass accessions appeared to have differing sensitivity levels to Loyant. Barnyardgrass seed from fields where plants survived Loyant applied the previous year were sent to the University of Arkansas for accessions to be screened for sensitivity to the herbicide. A dose response greenhouse experiment was designed to evaluate the effectiveness of Loyant on barnyardgrass at 1/16x, 1/8x, 1/4x, 1/2x, 1x, 2x, and 4X the labeled rate of 30 g ae ha^{-1}. The 1/4x rate of Loyant controlled the susceptible standard (100%). Eight out of twelve barnyardgrass accessions were controlled less than 50% when a 2x rate of Loyant was applied. Additionally, three rice cultivars were evaluated for sensitivity to Loyant. Several of the barnyardgrass accessions evaluated were comparable to rice in degree of tolerance to Loyant. Based on comparison to the susceptible standard, some accessions of barnyardgrass in Arkansas display a high level of resistance to Loyant. Future efforts should try to identify the mechanism for resistance and determine if measures can be taken to effectively control this weed in fields where few chemical options remain.

FROM PEST TO PAL: SCREENING WEEDY RICE (ORYZA SATIVA) FOR ABIOTIC STRESS TOLERANCE. SD Stallworth*[1], T Tseng[1], BC Schumaker[1], S Shrestha[2], AP Tucker[1]; [1]Mississippi State University, Mississippi State, MS, [2]Texas A&M University, College Station, TX (97)

ABSTRACT

Rice (*Oryza sativa*) currently feeds more than 3.5 billion people globally, and is planted on more than 148 million hectares of farmed land annually making it the third-highest produced cereal grain. Asia accounts for more than 90% of the global rice production, while in the U.S., Arkansas accounts for more than 48% of rice produced. Rice favors well-irrigated farmland in tropical and subtropical regions, and can be sensitive to fluctuating climate changes. Abiotic stress such as cold, heat, and flash flooding leading to complete submergence can cause yield losses up to 100%. Unfortunately, numerous traits have been lost due to domestication, and current rice-production programs have lead to the evolution of weedy rice, *Oryza sativa*. Weedy rice is a noxious weed of the same genus and species of rice that naturally competes in rice fields. Weedy rice has the ability to remain dormant in the seed bed for up to 10 years escaping crop rotation programs, grow faster and stronger than rice with fewer nutrients, and withstand extreme climates. Due to its phylogenetic similarities to rice and increased competitive ability, weedy rice may house traits that could protect rice production. In a greenhouse screening for cold, heat, and complete submergence, a weedy rice germplasm was surveyed for tolerance based on height and biomass reduction. Lines showing less than 20% reduction in height and biomass were determined to be stress tolerant. The weedy rice population was composed of 54 selected weedy rice lines that were exposed to cold (10°C), heat (38°C), and complete submergence for 21 days. Individual plant heights were collected every 7 days for 28 days, and total plant biomass was collected on day 28. The average height reduction for cold, heat, and submergence was 36%, 26%, and 53%, respectively. The average biomass reduction for cold, heat, and submergence was 49%, 43%, and 24%, respectively.

INTEGRATION OF ISOXAFLUTOLE INTO COTTON HERBICIDE PROGRAMS. RB Farr*, JK Norsworthy, MC Castner, GL Priess, MM Houston; University of Arkansas, Fayetteville, AR (98)

ABSTRACT

The evolution of herbicide resistance by troublesome weeds such as Palmer amaranth (*Amaranthus palmeri* S. Watson) has limited the number of weed control options in cotton. As of current, there are seven sites of action to which Palmer amaranth has developed resistance, prompting the search for more effective herbicide options in cotton (*Gossypium hirsutum* L.). 4-Hydroxyphenylpyruvate dioxygenase herbicides such as isoxaflutole (IFT) have been shown to be effective at controlling small-seeded broadleaf weeds such as Palmer amaranth in corn (*Zea mays* L.) but is currently not available in cotton. The recent development of IFT-resistant cotton by BASF will allow for the integration of a new effective site of action in cotton. To determine the utility of the addition of IFT into cotton weed control programs a study was conducted in the fall of 2019 in Marianna, AR evaluating nine different herbicide programs. The study was conducted as a one-factor, randomized complete block design with the treatments consisting of different programs utilizing different preemergence, early-postemergence, and mid-postemergence programs containing different typical cotton herbicides with and without the addition of IFT. Some treatments also utilized a layby application of flumioxazin and MSMA. Applications were made with a pressurized gas backpack sprayer at 143 L/ha at 4.8 kph. Visual estimates of weed control were taken every 7 days after each application until 35 days after layby and data were analyzed in a fit model using JMP Pro 14.2 and means were separated using Fisher's protected LSD (a = 0.05). The results from this study show that the use of IFT in cotton herbicide programs provided better control of Palmer amaranth as a preemergence or early-postemergence option. The study also found that the use of residual herbicides with each postemergence application and the use of layby applications provided lasting weed control through the end of the season.

LOW TUNNEL EVALUATION OF DICAMBA PREMIXES. G Oakley*[1], AS Culpepper[2], DB Reynolds[1], R Smeda[3], C Sprague[4], R Werle[5]; [1]Mississippi State University, Mississippi State, MS, [2]University of Georgia, Tifton, GA, [3]University of Missouri, Columbia, MO, [4]Michigan State University, East Lansing, MI, [5]University of Wisconsin-Madison, Madison, WV (99)

ABSTRACT

Multiple weed species are resistant to more than one mode of action, a majority of which are post-emergence herbicides. Dicamba tolerant crops allow growers to apply dicamba herbicides over the top of actively growing soybeans. Although dicamba tolerant crops can provide an effective weed management option, risk of dicamba off-site movement to sensitive crops is a concern (Foster et al, 2019). One such method of off-site movement is through volatility, or the physical change of a liquid into a gas. Dicamba is one post-emergence herbicide that, when moved off target, can result in severe damage to sensitive crops, like soybean. With the release of dicamba tolerant crops, many new premixes are beginning to include dicamba as one mode of action.
This study was conducted to compare volatility and herbicide vapor movement of new dicamba premixes and additives. Field studies were conducted in Alabama, Georgia, Michigan, Mississippi, Missouri, and Wisconsin using low tunnels. Greenhouse soil flats filled with field soil were treated with each premix and then placed between two rows of soybean. The soil flats were covered by a low, open ended tunnel covered with plastic for a period of 48 hr. An air sampler, calibrated to pull 3L of air per minute, was connected to a polyurethane foam tube (PUF) and was placed under each low tunnel. Treatments included 2.0 lb ae/A dicamba (XtendiMax + Vaporgrip) + 4.5 lb ae/A glyphosate + 4% v/v MON 51817 + 2% v/v Intact; 6.5 lb ae/A dicamba + glyphosate premix (MON 301621); 6.5 lb ae/A MON 301621 + 2.34 lb ae/A glufosinate (Liberty); 6.0 lb ae/A dicamba + glyphosate premix (MON 119151); 6.0 lb ae/A MON 119151 + 4% v/v MON 51817; 6.0 lb ae/A MON 119151 + 2.34 lb ae/A Liberty; 6.0 lb ae/A MON 119151 + 2.34 lb ae/A Liberty + 4% v/v MON 51817 + 2% v/v Intact; and an untreated check. Visual injury ratings and plant heights were taken in 31-centimeter increments from the plot center, where the treated soil flats were located, out to 762 cm.

At 14 DAT, the combination of Xtendimax + Powermax + MON 51817 + Intact showed less injury than both MON 301621 and MON 301621 + Liberty, regardless of distance. No difference in visual injury was observed between MON 301621 and MON 301621 + Liberty at both 14 and 28 DAT. Visual injury from MON 119151 alone or with Liberty did not differ regardless of distance at both 14 and 28 DAT. The addition of MON 51817 to MON 119151 alone or in combination with Liberty reduced visual injury at both 14 and 28 DAT. The combination of Xtendimax + Powermax + MON 51817 + Intact showed similar visual injury to MON 119151 + MON 51817 and MON 119151 + Liberty + MON 51817 + Intact at both 14 and 28 DAT. No differences in visual injury were observed among treatments at distances beyond 427 cm at either evaluation interval. The addition of MON 51817 to MON 119151 alone or MON 119151 + Liberty + Intact reduced dicamba concentrations to near 50 ng/PUF. MON 119151 + Liberty (253 ng/PUF) and MON 119151 (195 ng/PUF) showed the highest levels of dicamba volatility. There were no differences from the untreated check or Xtendimax + Powermax + MON 51817 + Intact when combining MON 119151 + Liberty + MON 51817 + Intact, or when combining MON 119151 + MON 51817. MON 301621 (106 and 81 ng/PUF) treatments were less volatile than MON 119151 treatments that did not contain MON 51817 (195 and 253 ng/PUF).

MOLECULAR MARKERS ASSOCIATED WITH WEED-SUPPRESSING ABILITIES IN CHROMOSOME SUBSTITUTION (CS) COTTON LINES. GA Fuller*[1], SD Stallworth[2], BC Schumaker[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (100)

ABSTRACT

Cotton (*Gossypium ssp.*) is grown in over 150 countries around the world and traded in over 200 countries. This crop is vital in the global economy, and is commonly used for affordable textiles globally. There are many species of wild *Gossypium*, but only four are cultivated. Upland Cotton (*Gossypium hisurtum*) is the most commonly cultivated species. The *G. hisurtum* genome is very homogenous with little variation observed among duplicated genomes. Using interspecific introgression, chromosome substitution lines (CS) were developed by incorporating chromosome segments from wild *Gossypium* germplasms into anueploid *G. hisurtum* chromosomes. Developed initially for fiber improvement, many beneficial characteristics have been observed in previous screenings of the CS lines, including weed-suppressing, allelopathic abilities. It is expected for more allelopathic CS lines to have a higher genetic diversity value than non-allelopathic CS lines. Seven cotton genetic diversity markers derived from Liu et al. (2000) were used, and PCR products were run in 1% agarose gels. PopGen 32 software was used to analyze electrophoresis gel results. Genetic diversity values were calculated to be 0.0 among and between allelopathic and non-allelopathic groups. No polymorphic primers were identified. [1] [2] Genetic diversity between allelopathic and non-allelopathic groups is expected to emerge as more primers are run. Nei's Unbiased Measures of Genetic Identity and Genetic Distance resulted in high genetic diversity values between UA 48 and T17, BNTN 16-15, B110, BNTN 17-11, and B26lo. CS lines with high genetic diversity values are likely to contain alleles responsible for traits of interest, including weed-suppression. The eventual identification of the gene or genes associated with weed-suppressing characteristics in the CS lines of interest would be especially beneficial for allelopathic breeding programs in the future.

MULTIPLE DICAMBA DRIFT EVENTS AT VARIOUS TIME INTERVALS ON LOUISIANA SOYBEANS. G LaBiche*[1], LM Lazaro[1], DO Stephenson[2], JT Copes[3]; [1]LSU AgCenter, Baton Rouge, LA, [2]LSU Ag Center, Alexandria, LA, [3]LSU AgCenter, St. Joseph, LA (101)

ABSTRACT

Soybean plants (*Glycine max* L. Merr.) and other nontarget plants are sensitive to synthetic auxin herbicides, such as 2,4-D and dicamba (3,6-dichloro-2-methoxybenzoic acid). Dicamba use is becoming more common in row crop production for its effective weed control in dicamba tolerant crops. It is also effective against many herbicide resistant weeds. The concern over the use of this technology is that nontarget plants are susceptible to spray or vapor drift. Dicamba drift has been very problematic to producers over the last several years. Because of this, there has been a lot of research conducted on which soybean growth stage and what drift rate would decrease soybean yield. However, there has been no trials evaluating the time intervals between drift events. Therefore, the objective of this study was to evaluate the effect of simulated dicamba drift events applied at various time intervals and frequencies, number of exposures to drift. Field trials were conducted in Baton Rouge, Alexandria, and St. Joseph, Louisiana in 2019. Simulated drift events of 14.164 g ae/A (1/8X) rate were applied beginning at the V3/V4 growth stage 0, 1, 3, 5, 7, 10, and 14 days apart with a single, double, and triple drift event. Visual injury, on a scale of 0 to 100%, and the heights of ten random plants were recorded at 7, 14, and 28 days after the last application for each treatment. Furthermore, harvest evaluations were made by collecting ten random plants, once the control plots reached maturity, and counting the total number of nodes, pods, seeds, and damaged seeds. An interval timing by exposure number interaction was seen. Overall, the more drift events that occurred closer together increased injury and reduced plant height. Yield reductions were seen for each additional drift exposure event. This research indicates that an increase in drift events and the closer that they are together greatly impacts plant health and yield. Crop safety and limiting off target movement of dicamba products is paramount.

PALMER AMARANTH CONTROL AND ASSOCIATED PHYSIOLOGICAL RESPONSE TO SYNTHETIC AUXINS AND GLUFOSINATE APPLIED SEQUENTIALLY. FB Browne*, S Li, KJ Price, RD Langemeier, A Sanz-Saez; Auburn University, Auburn, AL (102)

ABSTRACT

Insufficient residual herbicide activation can lead to palmer amaranth escapes in row crop production. Glufosinate is effective on small Palmer amaranth. However, aggressive growth and adverse conditions can complicate timely applications and salvage programs are frequently sought. In order to investigate the influence of sequence and timing of synthetic auxin and glufosinate applications on large Palmer amaranth control, field and greenhouse studies were conducted in 2018 and 2019. Field studies were performed in Henry County, AL. Treatments were applied to Palmer amaranth 35 to 60 cm tall. Herbicides tested were 2,4-D, dicamba, glyphosate, glufosinate, and *S*-metolachlor at 1.06 kg, 559 g, 1.54 kg, 594 g, and 1.47 kg ai ha^{-1}. One-time applications evaluated were 2,4-D/dicamba + glyphosate, glufosinate + *S*-metolachlor, and 4-way tank mixtures. Sequential applications included 2,4-D/dicamba + glyphosate followed by (fb) glufosinate + *S*-metolachlor 3 or 7 days after initial treatment (DAIT) in addition to the reverse sequence at 7 day intervals. Visual injury was recorded at 14 and 28 DAIT in addition to height and biomass 35 DAIT. Palmer amaranth control following dicamba programs varied between years. Sequential applications of dicamba + glyphosate fb glufosinate + *S*-metholachlor 7 DAIT resulted in complete mortality in 2018 and 42% biomass reduction in 2019. Palmer amaranth biomass following 2,4-D programs was similar among treatments and did not differ across years. Time intervals between sequential applications at 3 and 7 days did not influence Palmer amaranth control. Greenhouse studies were performed in 2019 on Palmer amaranth 20 to 40 cm tall. In addition to a nontreated control, treatments included a 4-way mix of dicamba + glufosinate + *S*-metolachlor + glyphosate, dicamba + glyphosate fb *S*-metolachlor + glufosinate 7 DAIT, and glufosinate + *S*-metolachlor fb dicamba + glyphosate 7 DAIT applied at 1/3 of rates used in the field study. Photosynthetic accumulation was recorded at 1, 4, 6, 8, 11, 13, and 35 DAIT. Leaf tissue was removed 14 DAIT, weighed, and regrowth was evaluated 21 days later. Compared to the nontreated control, initial applications that included glufosinate reduced photosynthetic accumulation 90 to 96% 1 DAIT whereas treatments of dicamba + glyphosate only reduced photosynthetic accumulation by 22%. Photosynthetic accumulation did not differ for any treatment 14 DAIT, suggesting complete photosynthetic recovery. Vegetative biomass 14 DAIT was reduced for all treatments relative to the nontreated control. However, dicamba + glyphosate fb glufosinate + *S*-metolachlor 7 DAIT was the only treatment to result in reduced regrowth vegetation 35 DAIT by 48%. These data suggest Palmer amaranth infested fields are more likely to be rescued with sequential applications of 2,4-D/dicamba fb glufosinate than when applied alone or in tank mixtures.

THE DILEMMA OF PALMER AMARANTH CONTROL WITH PPO HERBICIDES WHILE MITIGATING PPO-RESISTANCE. EB Scruggs*, ML Flessner; Virginia Tech, Blacksburg, VA (103)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S.) is a troublesome weed for soybean growers due to its aggressive growth and widespread resistance to glyphosate and ALS-inhibiting herbicides. Palmer amaranth (Palmer) control is further limited in some areas by recently confirmed PPO-inhibitor resistance. A field study was initiated with the overarching goal of mitigating PPO-resistance utilizing POST herbicides following PPO herbicides applied PRE to evaluate Palmer control in a PPO-susceptible population. Studies were conducted in South Hill, Virginia in 2018 and Blackstone and Blacksburg, Virginia in 2019. The study utilized randomized complete block design with four replications and a nontreated check. All herbicide rates remained the same throughout the study. Treatments were flumioxazin (89 g ai ha^{-1}), sulfentrazone (280 g ai ha^{-1}), or fomesafen (420 g ai ha^{-1}) applied PRE alone and followed by (fb) either mesotrione (105 g ai ha^{-1}), dicamba (560 g ae ha^{-1}), 2,4-D choline (1060 g ai ha^{-1}), glufosinate (656 g ai ha^{-1}), or fomesafen each tank mixed with glyphosate (1260 g ae ha^{-1}) applied POST. Additionally, glyphosate was applied alone POST with no PRE application. PRE treatments were applied to a weed-free area on May 22 in 2018 and on May 7 and May 15 at the Blackstone and Blacksburg locations, respectively. POST treatments were applied when weeds averaged 10 cm in the nontreated checks. Up to twenty 10 cm tall weeds were flagged prior to POST application to note which weeds were exposed to both the PRE and POST herbicides. All treatments included adjuvants and utilized nozzles as per product labels. Data collected included overall visible control assessed on a 0 (no control) to 100% (complete necrosis) scale and weed counts prior to POST applications. Visible weed control of emerged (flagged) plants was also collected 4 WAP. Counts of surviving flagged plants divided by number of flagged plants were transformed to mortality % at harvest. Data were subjected to ANOVA and subsequent means separation using Fisher's Protected LSD (a=0.05) with the nontreated check excluded from visible control data analysis. At POST application, fomesafen, sulfentrazone, and flumioxazin (1.0, 1.1, and 1.2 plants m^{-2}, respectively) all reduced weed counts compared to the nontreated check (2.1 plants m^{-2}). Fomesafen (74%) resulted in greater visible weed control than flumioxazin (67%) at POST application. The interaction of PRE herbicide by POST herbicide applied was not significant, so POST herbicide control was pooled across PRE. Dicamba + glyphosate (94%), 2,4-D + glyphosate (93%), glufosinate + glyphosate (92%), and fomesafen + glyphosate (87%) resulted in the greatest visible control of emerged plants 4 WAP. Similar results were seen in weed mortality with dicamba + glyphosate (88%), 2,4-D + glyphosate (89%), glufosinate + glyphosate (88%), and fomesafen + glyphosate (88%) resulting in greatest mortality. Glyphosate alone with no PRE resulted in 48% visible control 4 WAP and 63% mortality at harvest. These studies reinforce the effectiveness of dicamba, 2,4-D, and glufosinate on escapes from PPO-containing PRE-herbicides. These studies also reinforce the effectiveness of PPO herbicides applied PRE in Palmer amaranth control, contributing to the dilemma of using PPO herbicides while attempting to mitigate PPO-resistance. Future research should investigate the efficacy of these treatments on PPO-resistant Palmer amaranth populations and other weed species.

DOES PLANTING DATE AFFECT SENSITIVITY OF RICE LOYANT? TH Avent*, JK Norsworthy, JW Beesinger, LB Piveta, ZD Lancaster; University of Arkansas, Fayetteville, AR (104)

ABSTRACT

In 2018, a new synthetic auxin was released by Corteva that provides effective control of several weeds including some grasses in rice (*Oryza sativa* L.). Across the midsouthern U.S. region, significant injury to rice has been observed after applications of florpyrauxifen-benzyl. Currently, researchers are trying to understand what factors enhance the risk for injury and ways to mitigate its occurrence. At the Rice Research and Extension Center near Stuttgart, Arkansas, a field trial was conducted in 2019 to determine if planting date and/or environmental conditions near or at the time of application of florpyrauxifen-benzyl was a factor in the severity of rice injury. The experiment was designed as a randomized complete block design with three factors: planting dates of early April, early May, and late May, florpyrauxifen-benzyl rate of 15, 30, and 60 g ae ha^{-1}, and two cultivars. Both cultivars, Diamond and XP 753, did not differ in injury. However, injury was influenced by the main effects of both planting date and florpyrauxifen-benzyl rate at 10 and 28 days after treatment (DAT), with late May planting generally resulting in the greatest injury across cultivar and rate. A two-way interaction was observed at 20 DAT for planting date and herbicide rate, with rice in the late May planting date having the greatest injury which increased with florpyrauxifen-benzyl rate. At the timing of application for the late May planting, rice was experiencing rapid growth in association with the late planting and warmer temperatures. This is believed to have contributed to the increased injury. In general, injury increased across all three timings as rate increased, but planting date appeared to have a greater impact on the extent of injury than did florpyrauxifen-benzyl rate. Results from this research indicate that growers should consider the increased risk of injury when applying florpyrauxifen-benzyl under warm conditions ideal for rapid growth of rice.

THE IMPORTANCE OF TIMELY APPLICATIONS AND ZERO-TOLERANCE WHEN CONSIDERING PALMER AMARANTH. DJ Mahoney*; NC State University, Clayton, NC (105)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S. Wats.) is a highly competitive weed that can produce short- and long-term problems for farm managers. Research to date has not quantified the growth and development of *A. palmeri* in a manner that allows direct comparisons across cropping systems. Characterizing competition-related parameters would enable better planning of short- and long-term management strategies. Therefore, the objective of this study was to determine the growth and development of male and female *A. palmeri* when competing with corn, cotton, peanut, and soybean. Additionally, total seed production was measured for each cohort of female *A. palmeri* plants in each crop. Two cohorts of *A. palmeri* were allowed to emerge either with the crop (Cohort 1) or three wks after planting (Cohort 2). Height and width measurements were recorded throughout the growing season with fresh biomass and seed production for female plants quantified at harvest. *Amaranthus palmeri* in Cohort 1 reached 10 cm in height approximately 17 to 18 d when it emerged with corn, cotton, peanut, or soybean. Plants in Cohort 2 reached 10 cm in height approximately 3 wk after emergence in cotton, peanut, or soybean while four wks were needed in corn. *Amaranthus palmeri* seed production was greatest in cotton and peanut (approximately 534,00 and 443,000 seed plant^{-1}, respectively), followed by soybean (approximately 173,000 seed plant^{-1}), and finally corn (approximately 51,000 seed plant^{-1}). Seed production from *A. palmeri* in Cohort 2 was still high. Plants competing with cotton and peanut produced greater than 35,000 seed plant^{-1}. Plants produced less seeds when competing with soybean (approximately 3,700 seed plant^{-1}) or corn (approximately 200 seed plant^{-1}). Thus, cotton and peanut were less competitive with *A. palmeri* than soybean or corn. These data illustrate the importance of applying PRE herbicides and adding residual herbicides to POST application for *A. palmeri* management.

DOES NITROGEN FERTILIZER AID RICE RECOVERY FOLLOWING EXPOSURE TO A SUB-LETHAL CONCENTRATION OF PARAQUAT. JD Peeples*, B Lawrence, TL Sanders, HM Edwards, BR Golden, JA Bond; Delta Research and Extension Center, Stoneville, MS (106)

ABSTRACT

Due to Mississippi's diverse cropping mix and production of rice (*Oryza sativa* L.) near corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), and soybean [*Glycine max* (L.) Merr.], off-target paraquat movement to rice has become a major issue in recent years for Mississippi rice producers. Nitrogen (N) fertilizer is applied to rice in greater quantity and frequency than all other nutrients to optimize rice yield. A common N fertilizer management practice is to apply starter N fertilizer as ammonium sulfate (AMS) at 24 kg N ha^{-1} to support rice that encounters early-season stress. Therefore, research was conducted to evaluate (1) whether starter N fertilizer can aid rice recovery from exposure to a sub-lethal concentration of paraquat and (2) rice response to different N fertilizer management strategies following exposure to a sub-lethal concentration of paraquat. Two studies (Starter N Fertilizer Study and Nitrogen Fertilizer Timing Study) were conducted from 2015 to 2018 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate N fertilizer management following exposure to a sub-lethal concentration of paraquat. Treatments in the Starter N Fertilizer Study were arranged as a two-factor factorial within a randomized complete block design and four replications. Factor A was paraquat treatment and consisted of paraquat at 0 and 84 g ai ha^{-1} applied to rice in the two- to three-leaf (EPOST) stage. Factor B was starter N fertilizer timing and consisted of no starter N fertilizer and starter N fertilizer at 24 kg ha^{-1} as AMS (21-00-00) applied to rice in the spiking to one-leaf rice (VEPOST), EPOST, and three- to four-leaf (MPOST) stages. The Nitrogen Fertilizer Timing Study utilized a two-factor factorial treatment arrangement in a randomized complete block design with four replications. Factor A was paraquat treatment and consisted of paraquat at 0 and 84 g ha^{-1} EPOST. Factor B was N fertilizer application timings and consisted of N fertilizer at 168 kg N ha^{-1} as urea (46-00-00) applied in a single application at four-leaf to one-tiller rice (LPOST); in two sequential applications of 112 and 56 kg N ha^{-1} applied LPOST followed by (fb) panicle differentiation (PD); in three sequential application of 84, 42, and 42 kg N ha^{-1} applied LPOST fb 14 d postflood (14 DPF) fb PD; in four sequential applications of 42, 42, 42, and 42 kg N ha^{-1} applied MPOST fb LPOST fb 14 DPF fb PD; and in four sequential applications of 42, 42, 42, and 42 kg N ha^{-1} applied LPOST fb 14 DPF fb PD fb 5% heading (5% HD). In both studies, data collected included visible estimates of rice injury 3, 7, 14, 21, and 28 d after paraquat treatment (DAPT), rice height 14 DAPT, days to 50% heading, rice aboveground biomass, and rough rice yields. All data were subjected to ANOVA and estimates of the least square means were used for mean separation with a = 0.05. In the Starter N Fertilizer Study, rice injury following exposure to a sub-lethal concentration of paraquat ranged from 41 to 55% at all evaluations. Rice dry weight prior to flooding was reduced from 106 to 24 g m^{-2} following exposure to paraquat. Rice height was 16 cm following exposure to paraquat compared with 28 cm with no exposure to paraquat. Averaged across six siteyears and four starter N fertilizer application timings, rice dry weight at maturity was reduced from 1,731 to 1,157 g m^{-2}, rough rice yield was reduced from 8,400 to 5,490 kg ha^{-1}, and total milled rice yield was reduced from 71 to 70% following exposure to paraquat EPOST. Starter N fertilizer treatment had no influence on rice growth, development, or yield following exposure to paraquat. In the Nitrogen Fertilizer Timing Study, rice was injured 45 to 62% 3, 14, and 21 DAPT regardless of N fertilizer timing. For all N fertilizer timings, rice injury 28 DAPT was =60%; however, greatest rice injury (67%) was recorded in plots exposed to paraquat when 100% of N fertilizer was applied in a single LPOST application. Paraquat reduced rice height from 108 to 93 cm, increased d to 50% heading 10 d, reduced dry weight at maturity from 1,800 to 1,000 g m^{-2}, total milled rice yield from 70 to 69 g, and rough rice yield from 7,930 to 4,430 kg ha^{-1}. Rice maturity was 86 to 88 d regardless of N fertilizer timing; however, a timing with 100% of N fertilizer applied LPOST increased d to 50% heading more than when a split application was utilized. Rough rice yield was 6,300 kg ha^{-1} when data were averaged across paraquat treatments and N fertilizer was applied at 42 kg N ha^{-1} in four equal doses at MPOST:LPOST:14 DPF:PD; however, this N fertilizer management

strategy produced rough rice yield comparable to all single, two-, and three-way split applications of N fertilizer. Data from these studies indicate severe rice growth and development issues can occur from rice exposure to a sub-lethal concentration of paraquat. Additionally, rice was unable to overcome early-season exposure to paraquat. In both studies, manipulation of N fertilizer management did not facilitate rice recovery from early-season exposure to paraquat.

DISSIPATION RATE OF S-METHOLACHLOR IN SOIL SPRAYED WITH THE SAME HERBICIDE PRE TO SOYBEAN. J Kouame*[1], R Grewe[1], E Grantz[1], C Willett[1], MC Savin[2], N Burgos[1]; [1]University of Akansas, Fayetteville, AR, [2]University of Arkansas, Fayetteville, AR (107)

ABSTRACT

A field experiment and laboratory incubation study were conducted in summer 2019 at the Shult Agricultural Research and Extension Center, University of Arkansas, Fayetteville to evaluate the effect of prior applications of *S*-metolachlor (*S*-moc) on its dissipation in spiked soil. A randomized complete block experiment was established in the field with 4 replications. Two treatments (a preemergence application of *S*-metolachlor and a nontreated control) were compared. Roundup-Ready soybean was planted in June. Herbicide treatments were applied using a CO_2 pressurized backpack sprayer delivering 187 L ha^{-1} at 276 kPa. Preemergence application of *S*-moc (1344 g ai/ha) was done within 2 days after planting and the whole test was sprinkler-irrigated (12.7 mm) within 24 h after application. Soil samples were collected 22 and 57 d after the preemergence application within 0 to 10.2 cm depth. Soil samples were sieved, spiked with 0.94 ppm of analytical grade *S*-moc on the same day, and incubated in the growth chamber in duplicates at 25°C and 100% relative humidity. The concentration of *S*-moc in spiked soil was analyzed at seven time points (0, 1, 4, 7, 14, 28, 56 d after spiking) using a triple quadrupole GCMS. The data was fitted with the Gustafson and Holden biphasic model and half-life values were determined. The half-life values of spiked *S*-moc in soil samples collected 22 d after PRE application of *S*-moc in the field were shorter compared to those of soil samples collected 57 d after PRE application. However, the $t_{1/2}$ values did not differ from the control. Prior application of *S*-moc in the field did not induce enhanced dissipation of the herbicide in spiked soils.

UNDERSTANDING THE MECHANISM OF RESISTANCE TO S-METOLACHLOR IN PALMER AMARANTH. G Rangani*[1], L Benedetti[2], M Machado Noguera[3], N Roma-Burgos[4]; [1]University of Arkansas, Fayatteville, AR, [2]Federal University of Pelotas, Fayetteville, AR, [3]University of Arkansas, Fayetteville, AR, [4]University of Arkansas, Fayetteville, Fayetteville, AR (108)

ABSTRACT

Glyphosate-resistant Palmer amaranth is one of the extremely difficult weeds in southern US crop production. Recently, resistance of Palmer amaranth to the protoporphyrinogen oxidase (PPO)-inhibitor herbicides has been reported in the mid-southern states starting in Arkansas. Another group of herbicides used to manage Palmer amaranth is very-long-chain fatty acid (VLCFA) inhibitors. This group, which includes *S*-metolachlor, has been used in numerous crops every year for decades. In general screening, six Palmer amaranth populations had survivors with 1,120 g ai/ha (1X) *S*-metolachlor. Dose response assays were conducted to determine the level of tolerance to *S*-metolachlor in these accessions. The effective dose for 50% control (ED_{50}) of the susceptible accession was 58 g ai/ha, whereas the ED50 of the putative resistant accessions ranged from 80 to 809 g ai/ha. To determine the molecular basis of elevated tolerance to *S*-metolachlor, a few candidate genes were analyzed in leaves and roots of survivors (with 0.75X or 1X *S*-metolachlor). The data showed that GST19 was significantly upregulated in leaves in several accessions. The expression of GST8 was constitutively upregulated in roots of nontreated plants and upregulated even more in *S*-metolachlor survivors form the R accessions. The expression of GST1 differed among R accessions. Taken together, higher expression of GST genes, which would lead to higher GST activity in roots and leaves appears to be responsible for resistance to in *S*-metolachlor in *A. palmeri*.

CAN FLORPYRAUXIFEN-BENZYL FOLLOWED BY BENZOBICYCLON SAFELY BE USED ON HYBRID AND MEDIUM-GRAIN RICE? JW Beesinger*[1], JK Norsworthy[1], C Sandoski[2], JA Patterson[1], OW France[1]; [1]University of Arkansas, Fayetteville, AR, [2]Gowan USA, Collierville, TN (109)

ABSTRACT

Loyant (florpyrauxifen-benzyl) is a synthetic auxin (Group 4) herbicide for use as a broad-spectrum herbicide as a pre-flood treatment. Benzobicyclon (Rogue), a Group 27 herbicide, has yet to be labeled in rice in the southern United States, but is used as a post-flood treatment in rice maintained with a continuous flood in other countries. Loyant has been found to control many broadleaf weeds, barnyardgrass (*Echinochloa crus-galli*), and sedges (*Cyperus* ssp.), while Rogue boasts control of weedy rice (*Oryza sativa*) and sprangletops (*Leptochloa* spp.), making the combination of both herbicides an effective means of controlling the four most problematic weeds in Arkansas rice production. Loyant has been found to induce auxin injury on some varieties of rice. Rogue has also been shown to cause phytotoxicity on certain varieties, mainly those with an *indica* background. An experiment was conducted at the Rice Research and Extension Center near Stuttgart, Arkansas in 2019 to test the tolerance of two varieties and three hybrids to Loyant, Rogue, and a combination of both herbicides. Cultivars planted included the hybrids XP753, CLXL745, and Gemini 214CL, the medium grain variety Titan, and the long grain variety Diamond. Herbicide treatments included no Loyant or Loyant applied pre-flood at 30 g ae ha^{-1} and no Rogue or applied at 371 g ai ha^{-1} in a post-flood application. There was no more than 15% injury observed for any application. Findings from the heading date observations lead to the conclusion that Rogue delays maturity of Diamond by approximately 3 days. Grain yields did not differ among treatments. Based on these results, there is an increased risk for injury to rice when Loyant is followed by Rogue, but this risk is variety specific and is possibly dependent upon environmental conditions during or after application.

IMPACT OF WEEDY RICE GROWTH STAGE ON THE EFFICACY OF BENZOBICYCLON. MC Castner*[1], JK Norsworthy[1], C Brabham[1], C Sandoski[2]; [1]University of Arkansas, Fayetteville, AR, [2]Gowen USA, Collierville, TN (110)

ABSTRACT

Weedy rice (*Oryza sativa*) is one of the most problematic weeds to Midsouth rice production due to a lack of chemical control options as well as its adverse influence on grain quality. Not only are chemical control options limited, the effective window for controlling weedy rice is likely a function of size. In order to assess the scope of herbicidal activity of benzobicyclon, experiments were conducted near Stuttgart, Arkansas, and Colt, Arkansas in 2019. A total of 15 weedy rice accessions and 6 known rice cultivars were planted at two separate timings and flooded when the initial rice planting reached 4 to 5 leaves at Colt and 1 to 2 tillers at Stuttgart to determine the efficacy of benzobicyclon at multiple growth stages. Treatments were arranged as a two-factor split-plot with three replications, with the whole-plot factor being size at application (3 to 4 leaves or 1 to 2 tillers at Stuttgart; 1 to 2 or 4 to 5 leaves at Colt) and sub-plot factor being accession. An interaction of accession and application timing was observed for injury at both 14 and 28 days after treatment. Overall, smaller, later planted accessions saw greater injury in comparison to earlier planted accessions. However, highly sensitive weedy rice accessions or cultivated rice varieties were effectively controlled or severely injured at both application timings. Injury from a cross between Purple Marker, a sensitive variety, and RoyJ, a tolerant variety, showed partial tolerance when applications exceeded the 3- to 4-leaf stage. Ultimately, benzobicyclon is most effective when applied to weedy rice prior to the 3-leaf growth stage or when weedy rice plants do not express a functional HIS1 gene.

EVALUATION OF SAFLUFENACIL PLANTBACK INTERVALS IN COTTON. RD Langemeier*, S Li, KJ Price, FB Browne; Auburn University, Auburn, AL (111)

ABSTRACT

Increased adoption of conservation tillage systems has driven the need for effective preplant burndown herbicides. Saflufenacil is an effective tool to control glyphosate and ALS resistant weeds. In cotton saflufenacil has a plantback interval of 42 days at the lowest labeled rate of 25 g ai ha^{-1}, and a maximum cumulative use rate of 50 g ai ha^{-1}. The objective of this trial is to evaluate cotton injury and yield responses to saflufenacil applied at 42, 21, 14, 7, and 0 days before planting (DBP) at 25 and 50 g ai ha^{-1} to determine the optimal plantback interval. Field studies were conducted in Limestone and Macon counties in Alabama in 2019. Stands counts and plant heights were recorded 21 and 49 days after planting in addition to yield at maturity. No significant reductions in stands were observed when saflufenacil was applied 14 DBP or earlier. In Macon county stands were reduced 62% and 94% relative to the non-treated control (NTC) with applications 0 DBP of 25 and 50 g ai ha^{-1} respectively. Heights were reduced at both locations when product was applied 0 DBP, but the effects were not statistically different than the NTC. Yield reductions of 81% relative to the NTC were observed in Macon county when 50 g ai ha^{-1} was applied 0 DBP. No other treatments had statistically significant yield reductions. This data suggests that the saflufenacil plantback interval could be reduced without causing yield loss. Further study is required on the influence of precipitation following herbicide application.

IMPACT OF PREEMERGENCE HERBICIDES ON PALMER AMARANTH (AMARANTHUS PALMERI) EMERGENCE AND COTTON INJURY. SD Hall*, DM Dodds, JP McNeal, LX Franca, JJ Williams, BJ Norris, WJ Rutland; Mississippi State University, Mississippi State, MS (112)

ABSTRACT

An experiment was conducted in 2019 at Hood Farms in Dundee, MS to evaluate the impact of various post applied preemergence herbicides tank mixed with dicamba on the emergence of Palmer amaranth and cotton injury. The location for this experiment contained a natural infestation of glyphosate-resistant Palmer amaranth. Treatments where arranged in a randomized complete block design with four replications. The cultivars used for this study were DP 1646 B2XF and NG 3994 B3XF and were seeded on 3 June 2019. A PRE application of flumeturon at 1.1 kg ai ha^{-1} was made to all plots on 3 June 2019 after planting. POST applications were applied when Palmer amaranth height averaged 10-15 cm. Herbicides used in POST application included: dicamba (0.83 kg ai ha^{-1}), *S*-metolachlor (1.1 kg ai ha^{-1}), acetochlor (1.3 kg ai ha^{-1}), and dimethenamid-*P* (0.45 kg ai ha^{-1}). Treatment combinations consisted of the following: dicamba + *S*-metolachlor, dicamba + acetochlor, and dicamba + dimethenamid-*P*. An untreated check for each variety was also included for comparison purposes. Data collected throughout the growing was visual Palmer amaranth control and visual cotton injury at 7, 14 and 21 days after application. Data were subjected to analysis of variance using the PROC GLIMMIX procedure in SAS v9.4 and. Means were separated using Fisher's Protected LSD with an alpha value of 0.05. No differences in visual Palmer amaranth control following the POST application were observed due to herbicide treatments. No visual cotton injury due to herbicide application was observed due to herbicide treatments. At 7 days after application (when pooled over variety) all treatments provided 62-65% visual Palmer amaranth control. At 14 days after application (when pooled over variety) all treatments provided 55-64% visual Palmer amaranth control. At 21 days after application (when pooled over variety) all treatments provided 48-50% visual Palmer amaranth control. Visual Palmer amaranth control percentages would be considered unacceptable to growers in the Mississippi delta. The lack of a quality control is likely due to the lack of uniformity in Palmer amaranth height with some being greater than 15cm in height at the time of application as well a level of rainfall received after the application which likely aided in the regrowth and emergence of new Palmer amaranth plants.

INFLUENCE OF CULTIVAR ON INJURY TO SOYBEAN BY A LOW-DOSE OF DICAMBA. OW France*, JK Norsworthy, MC Castner, MM Zaccaro; University of Arkansas, Fayetteville, AR (113)

ABSTRACT

The resurgence of dicamba in recent years, while providing an effective option for weed control, has also posed several new threats to non-dicamba soybean farmers in the form of physical drift and volatility. Soybean is extremely sensitive to dicamba, even at very low rates, such as when volatility or physical drift occur. The objective of this study was to determine if commercial soybean cultivars exhibit differential tolerance to low rates of dicamba. A field trial was established at the Arkansas Agricultural Research and Extension Center in Fayetteville, Arkansas in 2019. This trial was set up as a factorial containing four replications with a 1/250X rate of dicamba applied to 15 soybean cultivars at the V3 or R1 growth stages. Averaged across cultivars, injury was lower for applications made at V3 than R1, with 20% and 35% injury at 14 days after the V3 and R1 applications, respectively. Several cultivars exhibited less visible injury following the dicamba applications, with those having greatest tolerance being P47A761 and Eagle Drewsoy, and UA5014C. Relative yield data did not reveal any significant yield loss for any variety. These findings would indicate that breeders could possibly select for enhanced tolerance to low rates of dicamba, which would be beneficial to growers in areas where the herbicide is widely used.

EFFECT OF SUB-LETHAL DICAMBA RATES ON SOYBEAN AS AFFECTED BY VARIETY AND MATURITY GROUP. MA Fajardo Menjivar*; NC State University, Raleigh, NC (114)

ABSTRACT

Production of soybean (*Glycine max*) in USA is one of the main agricultural interest, being the country the leader is production and falling in the second place in terms of exporting this grain. The use of soybeans can mainly be separated into the largest source for animal protein feed and processing for vegetable oil, being soybeans the second source for this and in the country representing the 90 percent of oilseed production. The use of new and better technologies have changed the rules of planting dates and the correlation it has in terms of the crop yield by the end of the season. Different varieties and maturity groups planted early may become an improved technique farmers may use as advantage with better results this past years. Being a root or foliage absorbed systemic herbicide dicamba may be a potential injury factor in soybeans, affecting the growing points of the plant and reducing by this the plant full capacity of developing, affecting yield according to the rate of exposure. The research had for objective to assess the effect in terms of injury and yield in two different maturity groups, each with two different soybean varieties, when exposed at vegetative (V4) or reproductive stages (R2) and with two different planting dates (May or June). The location of the research was the Upper Coastal Plain Research Station. Rates of Dicamba applied were 0.0, 1.08, 4.35, and 17.40 g ae ha-1 to soybeans. Evaluations to the treatments were conducted at 14, 21, 28, 35 and 42 days after treatment (DAT). Results provide evidence that different maturity groups, and different varieties of these, do not have significant effects on yield in soybeans.

EVALUATING PEANUT PLANTING DATE AND TWIN-ROW SPACING FOR SICKLEPOD GROWTH SUPPRESSION. P Kharel*[1], P Devkota[1], B Tillman[2], G MacDonald[3], MJ Mulvaney[1], R Tiwari[1]; [1]University of Florida, Jay, FL, [2]University of Florida, Marianna, FL, [3]University of Florida, Gainesville, FL (115)

ABSTRACT

Adjusting cultural practices contributes to weed suppression and this could aid in improving the effectiveness of the weed control programs. However, in-depth knowledge is required for recommending cultural practices adjustment. A field study was conducted to evaluate the effect of peanut (*Arachis hypogaea L.*) planting timing and row spacing on sicklepod (*Senna obtusifolia (L.) H.S. Irwin & Barneby*) suppression. The research was an RCB split-plot design with planting timing as main plot factor and row spacing as treatment levels. Planting timing included early planting (in late April), mid planting (in mid May), and late planting (in early June). Row spacing included single-row spaced at 91 cm apart and twin rows spaced at 12.7 cm, 17.8 cm, or 22.9 cm apart on 91 cm centers. 2,4-DB was sprayed at 6 wks after each planting to prevent sicklepod from outgrowing peanut. Planting timing by row spacing interaction was not significant for any of the data parameters collected. Planting timing did not affect the peanut height and canopy width at 8 WAP; however, 22.9 cm twin-row spacing had greater canopy width compared to the single row or 12.7 cm twin-row spacing. Conversely, peanut canopy height was greater with the single row or 12.7 cm twin-row spacing compared to 17.8 cm or 22.9 cm twin-row spacing. At 8 WAP, sicklepod height reduction was significantly different with planting timing. Early planting (17.7%) had the least height reduction compared to mid or late planting (= 28.9%). Likewise, row spacing affected sicklepod height reduction. Sicklepod height reduction was greater in the single row (35.5%) compared to 17.8 cm twin-row spacing (18.8%). Row spacing did not affect sicklepod biomass or peanut yield; however, the effect of planting date was significant. Sicklepod biomass in early planting (125.0 g) was similar to mid planting (88.0 g) but was greater compared to late planting (63.7 g). Peanut yield was also greater in early or mid planting (= 6566.9 kg ha^{-1}) compared to late planting (4280.2 kg ha^{-1}). The findings from this research suggest that the mid planting timing has the potential for sicklepod suppression in peanut production.

CRITICAL PERIOD OF ITALIAN RYEGRASS (LOLIUM MULTIFLORUM) CONTROL IN NO-TILL WINTER WHEAT IN NORTH CAROLINA. DJ Contreras*, W Everman; NC State University, Raleigh, NC (116)

ABSTRACT

Winter wheat (*Triticum aestivum*) is often used in double cropping systems, as it can aid reducing soil erosion, weed suppression, and provides growers with an additional source of income. Italian ryegrass (*Lolium multiflorum*) is one of the most troublesome weeds for wheat production throughout Southern US. The inability to control this weed can result in reduced yields, reduced quality, or both. Cultural practices, such as the Critical Period of Weed Control (CPWC) can help reduce yield losses. The CPWC is a period in a crop´s growth cycle during which weeds must be controlled to prevent yield losses. The objective of this study was to determine winter wheat's CPWC for Italian ryegrass that results on or less than 5% total yield loss. On this two-year study, plots were kept weedy or weed free throughout two weekly intervals (Year 1) and three week intervals (Year 2) after crop emergence. Two controls consisting of weedy and weed free all season plots were used for a treatment comparison based on a regression analysis where time of weed removal was related to crop yield. The CPWC to reduce yield losses to 5% or less on Year 1 was found to start around the 7th WAE (6.89, p=0.05) and end at 19th WAE (19.36, p=0.05). On Year 2, the CPWC started on the 11th WAE (11.00, p=0.05) and finished at 23rd WAE (23.16, p=0.05). Factors such as earlier planting dates, warmer weather and precipitation changes can give way to such variations in timing of the CPWC, but its duration was maintained.

FORAGE RADISH (RAPHANUS SATIVUS) CONTROL WITH HERBICIDES IN WINTER WHEAT.

SJ Michael*, ML Flessner, KB Pittman, KW Bamber, MS Reiter; Virginia Tech, Blacksburg, VA (117)

ABSTRACT

Studies have shown that intercropping forage radish (*Raphanus sativus* L.) and winter wheat (*Triticum aestivum* L.) is possible without yield reduction, potentially allowing for improved nitrogen cycling. Typically, forage radish winter-kills, although, some survival into the spring is possible. In such a scenario, selective herbicidal control of forage radish is desirable but herbicide susceptibility is not known. Studies were conducted to evaluate herbicide control options for forage radish that does not winter-kill in wheat. Field research was conducted in Blacksburg and Blackstone, VA. Studies utilized a randomized complete block design with four replications. Forage radish and winter wheat were planted mid-October in Blackstone and early March in Blacksburg at 13.5 kg ha^{-1} and 134.5 kg ha^{-1}, respectively. Fall application of N consisted of 34 kg ha^{-1} and mid-February application consisted of N at 56.0 kg ha^{-1} with fungicide. Herbicide applications were made when fertilizer was applied in mid-February in Blackstone and in Blacksburg on April 30, 2019. Treatments included: thifensulfuron-methyl (0.026 kg ha^{-1}), thifensulfuron-methyl + tribenuron-methyl (0.026 kg ha^{-1}), 2,4-D ester (0.560 kg ha^{-1}), dicamba (0.140 kg ha^{-1}), metribuzin (0.158 kg ha^{-1}), thiencarbazone-methyl + pyrasulfotole + bromoxynil (0.235 kg ha^{-1}), bromoxynil (0.420 kg ha^{-1}), mesosulfuron-methyl (0.015 kg ha^{-1}), prosulfuron (0.014 kg ha^{-1}), pyroxsulam (0.0182 kg ha^{-1}), halauxifen-methyl + florasulam (0.0107 kg ha^{-1}), fluroxypyr (0.125 kg ha^{-1}), and bicyclopyrone + bromoxynil (0.213 kg ha^{-1}) in addition to a nontreated check. Visible control data on a 0 (no control) to 100% (complete necrosis) scale relative to the nontreated check were taken approximately 30 days after application. Visible control data were subjected to ANOVA and subsequent means separation using Fisher's protected $LSD_{(a=0.05)}$. In Blacksburg, forage radish was controlled by 2,4-D ester (100%), halauxifen-methyl + florasulam (100%), mesosulfuron-methyl (100%), prosulfuron (100%), pyroxsulam (100%), thifensulfuron-methyl + tribenuron-methyl (100%), and thiencarbazone-methyl + pyrasulfotole + bromoxynil (97%). Treatments of fluroxypyr (86%), bicyclopyrone + bromoxynil (83%), bromoxynil (79%), thifensulfuron-methyl (54%), metribuzin (29%), and dicamba (0%) all resulted in <87% control with metribuzin and dicamba displaying <30% control. In Blackstone, treatments of halauxifen-methyl (95%), prosulfuron (95%), pyroxsulam (95%), thiencarbazone-methyl + pyrasulfotole + bromoxynil (98%), bicyclopyrone + bromoxynil (98%), bromoxynil (98%), and metribuzin (95%) all resulted in = 95 % control. All other treatments in Blackstone resulted in =80% control. These results show that halauxifen + florasulam, prosulfuron, pyroxsulam, and thiencarbazone-methyl + pyrasulfotole + bromoxynil are effective herbicide options in wheat for control of forage radish that does not winter-kill. Future research should also investigate control of forage radish at different sizes and the impact of fertilizer/herbicide tank mixes on forage radish control.

EXPLORING PUTATIVE HERBICIDE RESISTANCE IN A GOOSEGRASS BIOTYPE FROM HAWAII. BD Pritchard*[1], JJ Vargas[1], J Brosnan[2], J DeFrank[3]; [1]University of Tennessee, Knoxville, TN, [2]Univeristy of Tennessee, Knoxville, TN, [3]University of Hawaii, Honolulu, HI (118)

ABSTRACT

Goosegrass (*Eleusine indica* L. Gaertn) is a summer annual weed of warm-season turfgrass. While goosegrass biotypes have evolved resistance to several herbicidal modes of action, there are few reports of goosegrass resistance to acetolactate synthase (ALS) inhibitors. Plants surviving treatment with foramsulfuron (44 g ha^{-1}) were collected from a bermudagrass (*Cynodon* spp.) bowling green in Ala Moana Beach Park in Honolulu, HI and cultured for seed collection. Foramsulfuron dose-response experiments were conducted at the University of Tennessee (Knoxville, TN) during summer 2019 comparing putative-resistant (PR) goosegrass to a known susceptible (S) biotype. Experiments were repeated in both time and space during 2019. During the first experimental run glasshouse air temperature averaged 25.5°C and plants received an average of 375 µmol m^{-2} s^{-1} of solar radiation. During the second experimental run, glasshouse air temperature averaged 26.1°C and solar radiation averaged 301 µmol m^{-2} s^{-1}.In both experimental runs, goosegrass was surface seeded into 8.9 cm^3 greenhouse pots. Soil was a Sequatchie silt loam amended with calcined clay in a 4:1 soil-to-clay ratio. After establishment, pots were thinned to contain three plants and treated with foramsulfuron at 0, 5.5, 11, 22, 44, 88, 176, 352 g ha^{-1} using an enclosed spray chamber calibrated to deliver 215 L ha^{-1}. Herbicide was applied at a three-tiller growth stage. Treatments were arranged in a randomized complete block design with four replications. Goosegrass control was visually assessed using a 0 (i.e., no control) to 100% (i.e., plant death) scale. Aboveground biomass was harvested at the end of the study, dried in a forced-air oven at 55°C, and weighed. Data were subjected to log-logistic regression analysis to determine the relationship between PR and S goosegrass to increasing doses of foramsulfuron. Few differences in goosegrass control and aboveground biomass were detected between biotypes and those present were inconsistent across experimental runs. We cannot conclude that PR goosegrass is resistant to foramsulfuron based on the data collected in these experiments. Poor control of PR goosegrass in the field may be due to edaphic factors (e.g., soil texture, organic matter, soil moisture, pH, etc.) light conditions at application, plant maturity, or a combination thereof.

MOVEMENT OF TRIFLOXYSULFURON WITHIN THE SOIL PROFILE IN RESPONSE TO CHANGES IN CARRIER VOLUME. AJ Brown*[1], GM Henry[1], NT Basinger[1], J Brosnan[2]; [1]University of Georgia, Athens, GA, [2]Univeristy of Tennessee, Knoxville, TN (120)

ABSTRACT

Greenhouse experiments were conducted in 2019 at the Athens Turfgrass Research and Education Center at the University of Georgia. Dallisgrass (*Paspalum dilatatum* Poir.) plants were transplanted from a common bermudagrass [*Cynodon dactylon* (L.) Pers.] rough (3.8 cm height) at Pine Hills Golf Course in Winder, GA into 15.2-cm pots in the greenhouse. A 10.2-cm golf course cup-cutter centered over each plant was used to remove the aboveground biomass and corresponding rhizomes together as a plug (12.7 cm depth). Plants were transplanted the same day they were harvested on August 8, 2019. Pots received fertilizer (18 N – 9 P_2O_5 – 18 K_2O) at time of transplant at a rate of 49 kg N ha^{-1} and were allowed to grow in the greenhouse for 14 wks. Pots were destructively harvested and 3.8 cm of rhizome tissue with attached above-ground biomass (approx. 5.8 cm in length) were transplanted into 45.7 cm long PVC pipe (5.1 cm in diameter) containing a steamed 2:1 mixture of a Cecil clay loam and a Wakulla sand (bulk density of 1.5g cm^{-3}) on November 14, 2019. Pipes were fertilized with 12 N – 3 P_2O_5 – 12 K_2O at a rate of 49 kg N ha^{-1} at time of transplant and received overhead irrigation at a rate of 3.8 cm of water wk^{-1}. Dallisgrass pipe transplants were allowed to grow for 7 wks prior to trial initiation under day/night temperatures of 29/24°C. Pipes were arranged in a 2 x 4 factorial within a split-plot experimental design with five replications. The main plot factor was irrigation treatment (no irrigation or irrigation 24 hr after treatment) while the subplot factor was trifloxysulfuron treatment (non-treated check, trifloxysulfuron at 28 g ai ha^{-1} and carrier volume (CV) of 407 L ha^{-1}, trifloxysulfuron at 57 g ai ha^{-1} and CV of 814 L ha^{-1}, or trifloxysulfuron at 112 g ai ha^{-1} and CV of 1628 L ha^{-1}). All trifloxysulfuron treatments were applied with the addition of a methylated seed oil at a rate of 0.5% v/v. Treatments were applied using a spray chamber equipped with a single TeeJet 8002E nozzle at 5.1 km hr^{-1}. Pipes scheduled to receive irrigation 24 hr after treatment were returned to the greenhouse. Pipes not scheduled to receive irrigation were allowed to sit for 2 hrs before each pipe was cut lengthwise to yield two soil column halves. Herbicide activity within each column was determined by planting 4 'Champion' perennial ryegrass (*Lolium perenne* L.) seeds at 2.5-cm intervals from the soil surface to a depth of 15.2 cm. Pipes scheduled to receive irrigation were irrigated 24 hr after treatment and cut similarly. They were also planted with perennial ryegrass seed and all columns were placed back in the greenhouse. Perennial ryegrass germination was determined 2 wks after treatment by counting seedling establishment. Surface germination was reduced (seedling counts: 0.6 to 2), regardless of trifloxysulfuron treatment or irrigation practice. This may be attributed to seed exposure and subsequent desiccation. Ryegrass seedling germination at 2.5 and 5.1-cm depths was greater for non-irrigated pipes (seedling counts: 2.7 to 3.5 and 2.9 to 3.4, respectively), regardless of trifloxysulfuron treatment, compared to irrigated pipes (seedling counts: 1.9 to 2.6 and 2.6 to 2.8, respectively). A similar trend was observed at the 7.6-cm depth; however, the non-treated checks were nearly identical. Increases in trifloxysulfuron activity (reduced seedling counts) were observed as carrier volume and rate increased, regardless of irrigation practice. In conclusion, movement of trifloxysulfuron through the soil profile appears to be minimal, regardless of irrigation practice. However, irrigation applied 24 hr after trifloxysulfuron treatment did slightly increase penetration leading to a reduction in ryegrass germination. Furthermore, the increase in trifloxysulfuron activity in the soil profile observed in response to a higher carrier volume is not enough to account for enhanced dallisgrass control with those same treatments.

COMPARISON OF GROUND AND UNMANNED AERIAL SPRAYER INDIVIDUAL PLANT TREATMENT METHODS FOR CONTROL OF SMUTGRASS (SPOROBOLUS INDICUS).

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ABSTRACT

The broad range of variables involved in herbicide applications can make achieving effective weed control very challenging. These include herbicide selection, application timing, weather and many other factors. The impact of these variables has been researched extensively in several weed species, but the technology of application equipment and methodology is evolving rapidly and is not deeply understood. There has been no research published on the impact of aerial equipment and methodology on smutgrass control. The objective of this experiment is to determine efficacy differences between an unmanned aerial sprayer (UAS) and a more conventional method which is a spray gun operated by hand. A pilot study was initiated in April of 2019 at two locations in Grimes and Montgomery County, TX to determine treatments to be used going forward. Spray treatments were applied with a backpack sprayer and applied at 35 ml plant $^{-1}$. This study included 1%, 2% and 5% product rates of glyphosate, hexazinone and glyphosate + imazapic, totaling 9 spray treatments, along with hexazinone in solid tablet form. Visual ratings were conducted every 30 days until July 2019, evaluating performance of the herbicide based on smutgrass control and desirable grass tolerance. It was determined that glyphosate at 0.434 g plant^{-1} (2% product rate) and hexazinone at 0.079 g plant^{-1} (1% product rate) were the highest performing treatments while also considering cost effectiveness. Those results were used to form the treatment protocol for this study. This study was initiated October 31, 2019. This study is being conducted as a completely randomized design with 4 replications of each treatment at two locations in Brazos County and Montgomery County, TX. The three herbicide treatments used in this experiment are glyphosate at 0.434 g plant^{-1} (2%) , hexazinone at 0.079 g plant^{-1} (1%) and glyphosate at 0.217 g plant^{-1} (1%) plus hexazinone at 0.079 g plant^{-1} (1%). All three herbicide treatments were applied using both a CO_2 powered backpack sprayer with a 1.136 L min.$^{-1}$ full cone nozzle and a six-rotor agriculture drone, equipped with a nozzle 2.272 L min^{-1} nozzle. The research hypothesis of this study is that hand applied treatments will perform better than UAS applied treatments. The evaluations for this study evaluate smutgrass control and desirable grass tolerance. Evaluations were conducted 30 days after treatment (DAT) and will be resumed every 30 days in the spring of 2020 after the plants break dormancy. The 30 DAT ratings show there is potential for certain hand treatments to significantly outperform UAS treatments, but more complete conclusions will be drawn after the spring ratings.

GROWTH RESPONSES OF AMARANTHUS PALMERI TO CROP PLANTING ARRANGEMENTS.

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ABSTRACT

Effective and complementary cultural and mechanical practices are needed in row crop agriculture to manage herbicide-resistant (HR) weeds. Practices that prevent or at least reduce the production of new weed seeds surviving herbicide applications or cultivations are especially valuable for sustainable management. The objective of this study was to identify planting arrangements that increase weed suppression of Palmer amaranth (*Amaranthus palmeri* S. Watson) for three major row crops: corn, cotton, and soybean. This study was conducted in Rocky Mount (RM) and Goldsboro (GB), North Carolina during the 2019 summer growing season. Four different crop planting arrangements, including uniform and variable in-row densities, were created to maximize light interception in lower canopy layers to increase crop yield while maintaining weed suppression under weed free and weedy conditions. The study was conducted as a randomized complete block design with three and four replications in RM and GB, respectively, arranged as a split-split-plot with crop as the main plot, weed treatments as the sub-plot and planting arrangement as the sub-sub-plot. In these planting arrangements, Palmer amaranth plants were marked and measurements were taken throughout the season. The results indicated that the overall dry weight of Palmer amaranth was greater in cotton than in soybeans and corn. Within the total dry weight, there were differences in the shoot dry weight and the leaf dry weight of the plants in the different crops. Palmer amaranth did not differ in height across planting arrangements, however there were differences in their width, likely in response to difference in canopy light environment. Lastly, there were no differences in the total leaf number or leaf area of the Palmer amaranth in the different crops suggesting that width differences were due to branch length. These results show that Palmer amaranth plant architecture is highly adaptable to differences in crop canopy characteristics and planting arrangements.

INFLUENCE OF WINTER BRASSICA CARINATA PRODUCTION ON SUMMER ANNUAL WEEDS EMERGENCE. R Tiwari*1, P Devkota1, RG Leon2, MJ Mulvaney1, T Reinhardt[2], P Kharel[1]; [1]University of Florida, Jay, FL, [2]NC State University, Raleigh, NC (124)

ABSTRACT

Carinata (*Brassica carinata*) is an alternative biofuel crop that has recently been introduced to the Southeastern U.S. Sicklepod (*Senna obtusifolia*) and smooth pigweed (*Amaranthus hybridus*) are problematic summer annual weeds in agronomic crop production systems in this region. *S*-metolachlor is a residual herbicide labeled in many crops for preemergence control of small-seeded annual and broadleaf weeds. A field study was conducted to determine the effect of winter carinata production on sicklepod and smooth pigweed emergence. The study was a randomized complete block design arranged as a split-plot with four replications. Cropping history (cotton, peanut, or fallow) was the main plot factor; whereas, winter weed management treatments were the subplots: 1) carinata with *S*-metolachlor, 2) carinata without *S*-metolachlor, and 3) weedy fallow as a control. Sicklepod and smooth pigweed seeds were sown at 2,000 and 25,000 seeds m^{-2}, respectively, before planting carinata in the fall. *S*-metolachlor was applied at 1,420 g ai ha^{-1} after planting carinata. There was no interaction of cropping history and winter weed management for sicklepod and smooth pigweed emergence in the following spring. Likewise, there was no effect of cropping history on sicklepod and smooth pigweed emergence. Sicklepod emergence was higher in carinata with *S*-metolachlor (95 seedlings m^{-2}) or carinata without *S*-metolachlor (93 seedlings m^{-2}) compared to weedy fallow (67 seedlings m^{-2}). Similarly, a significant difference was observed for the smooth pigweed emergence, and emergence was higher in weedy fallow (630 seedlings m^{-2}) compared to carinata with (342 seedlings m^{-2}) or without (296 seedlings m^{-2}) *S*-metolachlor. These results suggest that growing carinata with PRE applied *S*-metolachlor application has the potential for reducing smooth pigweed emergence in subsequent crops, but this practice may not be effective for reducing sicklepod emergence.

INTERSPECIFIC HYBRIDIZATION BETWEEN SORGHUM BICOLOR AND S. HALEPENSE WITH AND WITHOUT SELF-POLLEN COMPETITION. C Sias*[1], D Hathcoat[1], G Hodnett[1], W Rooney[1], BL Young[2], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M University, La Vernia, TX (125)

ABSTRACT

The potential for gene flow between cultivated species and their weedy relatives poses agronomic and environmental concerns, particularly when there are opportunities for the transfer of adaptive or agronomic traits such as herbicide resistance into the weedy forms. One of the most widely cultivated crops in Texas, *Sorghum bicolor*, is a prime example of a crop that has a weedy relative, *S. halepense*, capable of exchanging genetic information. Previous findings have shown that the resulting triploid progenies typically collapse and only few of them develop into mature seed, whereas the tetraploids often turn into fully developed seeds. The objective of this experiment was to determine the impact of pollen competition on the frequency of hybridization between *S. halepense* and *S. bicolor*. A total of 12 different cytoplasmic male sterile *S. bicolor* genotypes and respective male fertile lines were compared side-by-side on the level of hybridization with *S. halepense*, where *S. halepense* served as the pollinator parent. Results showed that pollen competition greatly reduced the rates of hybridization between *S. halepense* and *S. bicolor*. Further, there were differences in the frequency of hybridization among the *S. bicolor* genotypes evaluated. Results are helpful for developing appropriate gene flow mitigation strategies.

NEW TECHNOLOGIES FOR WEEDY RICE CONTROL IN LOUISIANA. WB Greer*, EP Webster, BM McKnight, SY Rustom, LC Webster, DC Walker; LSU AgCenter, Baton Rouge, LA (126)

ABSTRACT

Developing new and improved strategies for weedy rice (*Oryza sativa* L.) control is essential for rice (*O. sativa* L.) growers. The use of herbicide-resistant rice such as imazethapyr or quizalofop-resistant varieties provide growers with the added benefit of controlling weedy rice throughout the growing season. However, with the increase in imazethapyr-resistant weedy rice it is important to find other management options. In these studies, benzobicyclon was evaluated alone and in combination with imazethapyr or quizalofop programs. These two studies were conducted in 2019 at the H. Rouse Caffey Rice Research Station near Crowley, LA, on a Crowley silt loam soil. The plot size was 1.5 x 5.1 m, with 8 drill seeded rows of 'CL-111' in the imazethapyr program or 'PVL-01' in the quizalofop program. The experimental design was a two-factor factorial arrangement of treatments in a randomized complete block design. In study 1, factor A consisted of 1) no imazethapyr. 2) imazethapyr @ 35 g ai ha^{-1} applied at two- to three-leaf (EPOST) fb imazethapyr @ 35 g ai ha^{-1} applied at one- to two-tillers (PREFLOOD). 3) imazethapyr @ 35 g ai ha^{-1} EPOST fb imazethapyr @ 35 g ai ha^{-1} PREFLOOD fb imazamox @ 44 g ai ha^{-1} applied at two- to three-tillers (POSTFLOOD). In study 2, Factor A consisted of 1) no quizalofop. 2) quizalofop @ 119 g ai ha^{-1} EPOST fb quizalofop @ 119 g ai ha^{-1} PREFLOOD. 3) quizalofop @ 119 g ai ha^{-1} EPOST fb quizalofop @ 119 g ai ha^{-1} POSTFLOOD. 4) quizalofop @ 77 g ai ha^{-1} EPOST fb quizalofop @ 77 g ai ha^{-1} PREFLOOD fb quizalofop @ 77 g ai ha^{-1} POSTFLOOD. In both studies, Factor B consisted of benzobicyclon @ 0 g ai ha^{-1} POSTFLOOD or benzobicylon @ 370 g ai ha^{-1} POSTFLOOD. Visual ratings of weedy rice control were taken at 21, 35, and 49 days after the POSTFLOOD application. Low rates of imazethapyr were used to provide partial control of the herbicide to control the weedy rice plants in the trial. No control was observed with the imazethapyr followed by imazethapyr program or the benzobicyclon alone, and weedy rice treated with the imazethapyr program + benzobicyclon applied POSTFLOOD was controlled 24 to 29%. When imazamox was added to the imazethapyr program with or without benzobicyclon, weedy rice control was 94 to 97%. In the quizalofop program, when quizalofop was applied greater than 95% control was observed, regardless of timing. No activity was observed on weedy rice when treated with benzobicyclon. In these studies, benzobicyclon did not improve weedy rice control when compared with the standard programs for these herbicide tolerant rice varieties.

COTTON (GOSSYPIUM HIRSUTUM) DEFOLIATION AS AFFECTED BY DROPLET SIZE AND CARRIER VOLUME. JP McNeal*[1], DM Dodds[1], G Kruger[2], LX Franca[1], JJ Williams[1], BJ Norris[1], SD Hall[1], WJ Rutland[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska - Lincoln, North Platte, NE (127)

ABSTRACT

In 2018 and 2019, a field experiment was conducted to evaluate the effect of carrier volume and spray droplet size on the efficacy of cotton (*Gossypium hirsutum*) defoliation programs. This experiment was conducted at the R.R. Foil Plant Science and Research Center in Starkville, Mississippi and at the Black Belt Branch and Experiment Station in Brooksville, Mississippi. Eight-row (7.7m x 12.1m) plots were planted to DP 1646 B2XF. Initial harvest aid applications were made at 60% open boll, and secondary applications to select plots occurred 12 days later. Applications were made with a Capstan® Pinpoint Pulse-Width Modulation (PWM) sprayer on a high-clearance Bowman Mudmaster at a speed of 14.5 km hour^{-1}. This experiment utilized two carrier volumes: 47 and 187 L ha^{-1}, and three droplet sizes: 200 µm, 500 µm, and 800 µm. Defoliation materials included: thidiazuron (TakeDown® SC) applied at 0.15 kg ha^{-1}, ethephon (BollBuster®) applied at 1.5 kg ha^{-1}, tribufos (Folex® 6EC) applied at 0.37 kg ha^{-1}, and pyraflufen-ethyl (ET®) applied at 0.105 kg ha^{-1}. Defoliation programs included: [1A] thidiazuron + ethephon and [1B] thidiazuron + ethephon + tribufos, [2A] 1A + pyraflufen-ethyl + ethephon, and [2B] 1B + pyraflufen-ethyl + ethephon. Visual ratings were taken at 3, 7, and 10 days after application (DAT) for both A and B applications, and included open bolls, green leaves, defoliation, desiccation, and terminal regrowth and basal regrowth. All ratings were normalized to the non-treated control. The center two rows were mechanically using a spindle picker modified for plot research., and seed cotton samples for each plot (4.5 kg) were sent to the University of Tennessee in Jackson, TN for ginning. Fiber quality was determined by the USA classing office in Memphis, TN. The experimental design was a factorial arrangement of treatments within a randomized complete block and included four replications, each with a non-treated control. Data were analyzed in SAS v. 9.4 using PROC MIXED. Means were separated using Fisher's Protected LSD at an alpha level of 0.05. Results did not vary across year or location, and were therefore pooled across these factors. Green leaves 10 days after application A (DAA) varied due to a program*carrier volume*droplet size interaction ($p = 0.0142$). Thidiazuron + ethephon applied at 187 L ha^{-1} with 800µm spray droplets left 23% green leaves on the plant, with all other treatments leaving = 12%. Defoliation 10 DAA varied due to carrier volume ($p = 0.0077$) and a program*spray droplet size interaction ($p = 0.0056$). A carrier volume of 47 L ha^{-1} resulted in 5% more defoliation than 187 L ha^{-1}. Furthermore when pooled across carrier volume, applications of thidiazuron + ethephon with 800µm spray resulted in only 80% defoliation, with all other treatments > 90%. Green leaves 7 days after application B (DAB) a carrier volume*droplet size interaction ($p = 0.0181$). A carrier volume of 47 L ha^{-1} and 800 µm droplets left 19% green leaves on the plant. Conversely, applications of either carrier volume and 200 µm droplets left = 9 % green leaves. Defoliation 7 days after application B (DAB) varied due to program ($p = 0.0236$), carrier volume ($p = 0.0130$), spray droplet size ($p < 0.0001$), and a carrier volume*droplet size interaction ($p = 0.0181$). Initial defoliation applications that did not contain tribufos resulted in 3% more defoliation than those that did. A carrier volume of 187 L ha^{-1} resulted in 2.5% more defoliation than 47 L ha^{-1}, and spray droplet sizes of 200 µm resulted in 2.5% more defoliation than 500 µm, and 7.5% more than 800 µm. In this study, we observed no impact on open bolls, regrowth, fiber quality, or seedcotton yield. As such, our conclusions reflect the impact of defoliation efficacy only. Therefore, these data indicate that lower carrier volumes have a utility in cotton defoliation programs. We hypothesize this is due to the increased concentration of active ingredient within each spray droplet. Secondary applications, if necessary, will benefit from higher carrier volumes and fine spray droplets due to increased coverage of the remaining plant material.

UNNAMED AERIAL VEHICLE-BASED CHARACTERIZATION OF HERBICIDE DRIFT INJURY IN COTTON. BB Sapkota*, MV Bagavathiannan; Texas A&M university, College Station, TX (128)

ABSTRACT

Off-target movement of herbicides into sensitive crop cultivars is a serious concern in agricultural landscapes. An ability to detect and assess herbicide injury and predict its impact on crop yield can allow for informed decision making by growers regarding contingency plans. This can be accomplished by spectral response evaluation using unmanned aerial system (UAS)-based imagery. In the current study, the spectral response of young cotton plants to tembotrione (Laudis®), 2,4-D, and chlorimuron (Classic®) were recorded with DJI Matrice 600 mounted with a multispectral camera at 7, 14, and 21 days after application (DAA). The spectral response was compared based on two different spectral indices namely Normalized Difference Vegetation Index (NDVI) and Chlorophyll Vegetation Index (CVI). Further, a graphical user interface (GUI) was developed using a deep neural network model trained with several true color imageries acquired with DJI Phantom 4. The GUI was designed to predict the herbicide site of action based on the unique injury patterns detected using true-color imagery. Preliminary results show that NDVI was significantly different for all the herbicides at 14 and 21 DAA while CVI was significantly different at 7 and 21 DAA. NDVI values were the highest for the plants with no drift effect, followed by the plants injured by chlorimuron, tembotrione, and 2,4-D for all observation timings, whereas CVI was the highest for 2,4-D drift, followed by that of chlorimuron, no drift, and tembotrione. The neural network model showed higher performance in identifying the herbicide site of action for all observation timings tested (7, 14, and 21 DAA), although the highest accuracy was achieved for 14 DAA (85 % for 7 DAA; 90 % for 14 DAA; 80 % for 21 DAA). The recorded spectral response and developed GUI will be of great value to farmers for assessing herbicide drift related impacts.

POSTEMERGENCE APPLICATIONS OF LIBERTY AND ENGENIA IN BOLLGARD II XTENDFLEX COTTON. CR White*, J Spradley, BM DeLong, W Keeling; Texas A&M AgriLife Research, Lubbock, TX (129)

ABSTRACT

Postemergence dicamba applications in Bollgard II XtendFlex cotton are widely utilized to control glyphosate-resistant Palmer amaranth in Texas High Plains cotton. It is estimated that approximately 70% of cotton acres in this region were planted to XtendFlex varieties in 2019. Strategies to avoid or delay development of weed resistance to dicamba includes using additional modes of action of both preemergence and postemergence herbicides such as Prowl H2O, Liberty, and Outlook. A study was conducted in 2019 at the Texas A&M AgriLife Research Center in Lubbock, TX on an Acuff loam soil to compare sequential applications of Engenia and Liberty herbicides alone, or in combination with Outlook herbicide for season-long Palmer amaranth control in XtendFlex cotton. The hypothesis is there are no differences between combinations of Engenia, Liberty, and residual herbicides. Pre plant treatments went out on February 11, 2019 and included Prowl H2O at 40 fl oz/A. POST I treatments were applied on June 11, 2019 and compared Liberty (43 fl oz/A) alone, Liberty + Roundup (32 fl oz/A), and Engenia (12.8 fl oz/A) +Roundup, Liberty + Outlook (16 fl oz/A), Liberty + Roundup + Outlook, and Engenia + Roundup + Outlook. POST II treatments compared Liberty fb Liberty, Liberty + Roundup fb Liberty + Roundup, Engenia + Roundup fb Engenia + Roundup, Liberty + Roundup fb Engenia + Roundup, Engenia + Roundup fb Liberty + Roundup, Liberty + Outlook fb Liberty, Engenia + Roundup + Outlook fb Egnenia + Roundup, Liberty fb Egnenia + Roundup + Outlook, Liberty + Outlook fb Engenia + Roundup, Engenia + Roundup fb Liberty + Outlook, and Engenia + Roundup + Outlook fb Liberty. Ammonium Sulfate (21% N) was added to all Liberty treatments at 3.0 lbs./A. All treatments were applied at 15 GPA. Liberty treatments went out using TT 11002 nozzles and Engenia treatments used TTI 11002. The trial was planted on May 5, 2019 and weed control evaluations were performed at 14, 28, and 35 DAT. Adequate rainfall and actively growing weeds resulted in effective Palmer amaranth control (>95%) with Engenia or Liberty alone or tank-mixed with glyphosate. The sequential POST application treatments that included Engenia in either POST I or POST II provided similar Palmer amaranth control which was more effective than Liberty fb Liberty. The addition of Roundup to the Liberty treatments did not improve control compared to Liberty alone in this trial. Due to lack of rainfall later in the growing season, additional Palmer amaranth emergence was limited. However, the addition of Outlook to either POST I or POST II improved control for some treatment combinations and is an important part of weed resistance management.

QUANTIFICATION OF DICAMBA TRANSLOCATION AND ACCUMULATION IN SOYBEAN SEED. MM Zaccaro*[1], JK Norsworthy[1], C Brabham[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (130)

ABSTRACT

The spreading of multiple herbicide-resistant weeds has motivated the release of the dicamba-resistant technology (XtendFlex), which provides an alternative herbicide option. Nevertheless, the use of this technology has resulted in a record number of complaints about off-target movement partly due to the high sensitivity of non-dicamba-resistant soybean (*Glycine max* (L.) Merr.) to the herbicide. Post-reproductive exposure of non-dicamba-resistant soybean to dicamba often leads to pod malformation and subsequent auxin-like injury to the progeny. So far, no publication to date documented the presence of dicamba in seed. The purpose of this experiment was to determine if dicamba could be detected in seed of non-dicamba-resistant soybean exposed to the herbicide at late reproduction, using radiolabeled techniques. Non-dicamba-resistant soybean plants were grown in the greenhouse until the pod-filling growth stage and then treated with 2.8 g ae/ha dicamba (1/200 of the 560 g ae/ha rate plus 0.25% v/v of nonionic surfactant) using a spray chamber calibrated to deliver 187 L/ha. After the application, [^{14}C]dicamba (approximately 6.4 kBq per plant) was applied to the adaxial surface of one trifoliate leaf located at the 4th-uppermost node of each plant. The greatest amount of [^{14}C]dicamba recovered was in seeds and in pods, and these plant parts totaled 80% of the total absorbed dicamba. Moreover, results showed that the total amount of the [^{14}C]dicamba present in the soybean seeds was in the phytotoxic form, except for a single sample, in which a metabolite was detected (probably, 5-hydroxy dicamba). Preventive measures to reduce dicamba exposure to soybean plants should be performed because the seed quality of the progeny may be impacted.

EVALUATING EFFICACY OF DICAMBA AND GLUFOSINATE APPLIED ALONE OR IN COMBINATION. EA Jones*, W Everman, RG Leon, JT Sanders, DJ Contreras, MA Granadino, MA Fajardo; NC State University, Raleigh, NC (131)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) has evolved resistance to seven herbicide groups and multiple herbicide-resistant populations are pervasive throughout the Southeast. The evolution of resistance to dicamba and glufosinate has not been confirmed in Palmer amaranth. Thus, farmers may be begin to apply these herbicides more extensively to control multiple herbicide-resistant Palmer amaranth populations and mitigate the evolution of resistance to either herbicide. Each herbicide inhibits different physiological plant processes which result in plant death. Thus, understanding the interaction between the two herbicide herbicides is critical, as some applications could result in control failures. A field experiment was conducted to determine the control of Palmer amaranth with tank mixes and sequential applications of dicamba and glufosinate. The herbicides were applied to plants 5 and 15 cm in height. Sequential applications were made one week after the initial application. Treated Palmer amaranth plants were assessed weekly for percent weed control and height reduction for 5 weeks. Colby's equation was used to assess if tank mixes of dicamba and glufosinate at both weed sizes resulted in antagonism. Colby's equation indicated no antagonism of tank-mixed dicamba and glufosinate at either weed size. The tank-mixed dicamba and glufosinate application at the 5 cm weed size provided 87% control compared to the application on the 15 cm weed size which achieved 62% control. The sequential applications of dicamba and glufosinate at both weed sizes provided the same control as the dicamba+glufosinate tank mix except for glufosinate followed by glufosinate (15 cm) treatment. The reduction in growth was comparable to the visual efficacy evaluations for each herbicide program (R = 0.62). The results of the experiment provide evidence that tank mixes and sequential applications of both herbicides are efficacious on Palmer amaranth of both sizes tested. Since there is no difference in control between any combinations of sequential applications, both herbicides should be included to reduce selection pressure.

FORMULATION, DOSE, AND ADJUVANT EFFECT ON GLUFOSINATE EFFICACY. M Machado Noguera*[1], P Carvalho de Lima[1], L Earnest[2], N Roma-Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Rohwer, AR (132)

ABSTRACT

Glufosinate remains as an important herbicide option for the management of hard-to-kill weeds. In the scenario of diminishing alternatives as a result of herbicide resistance, preserving glufosinate efficacy is important. One way is by developing improved formulations and improved adjuvants. Considering that, the objective of this work was to evaluate the interaction between glufosinate formulations, glufosinate rates and adjuvants on the control of summer weeds. A study was conducted at the Southeast Research & Extension Center, Rohwer, AR in a trifactorial scheme (2x3x5) in a randomized complete block design with four replications. Factor A was glufosinate formulation (Liberty 280SL and OR-270); factor B was glufosinate rate (0.295, 0.585 and 1.18 kg ha^{-1}); and factor C was adjuvant (AMS, OR-079, OR-009E and OR-295). A non-treated check was included. Adjuvant concentrations were 10 g L^{-1} for AMS and 0.125% v v^{-1} for the others. The plots were sprayed at 187 L ha^{-1}, using a 4-nozzle (DG 80 015 VS) boom attached to a CO2 pressurized backpack sprayer. Overall weed control was evaluated at 14 DAT using a 0 – 100% scale. Palmer amaranth was the dominant species (~2.5 plants m^{-2}) but morningglory, velvetleaf, hemp sesbania, and prickly sida were also present. The three-way interaction was significant. No differences were detected at the 1.17 kg ai ha^{-1} rate, where weed control was generally greater than 90%, regardless of adjuvant. Therefore, adjuvants or formulations do not matter at the high rate. At 0.585 kg ai ha^{-1}, the adjuvant OR-295 had the highest weed control regardless of glufosinate formulation (80 and 86% with Liberty and ORO-270, respectively). OR-270 + OR-295 was not different from OR-270 alone, but OR-270 alone was more effective than Liberty alone (86 and 71%, respectively). The 0.5X dose had poor weed control, but at this rate, OR-270 alone had higher activity than Liberty alone (56% against 27%, respectively). Liberty was most effective when mixed with OR-009E (63%) rather than with AMS. In conclusion, the novel glufosinate formulation OR-270 is a promising alternative to Liberty. Also, the novel adjuvant OR-295 is the best partner for glufosinate when used at 0.125% v v^{-1}.

INTEGRATED MANAGEMENT WITH MECHANICAL TUBER REMOVAL, COVER CROP AND GLYPHOSATE DURING THE SUMMER FALLOW FOR NUTSEDGE CONTROL. RS Randhawa*, PJ Dittmar; University of Florida, Gainesville, FL (133)

ABSTRACT

Nutsedge (*Cyperus* spp.) is the most troublesome weed for vegetable production, partly due to persistent underground tubers. Single control methods provide partial nutsedge control so integrated weed management using mechanical, chemical and cultural methods should be investigated. A field study was conducted to evaluate nutsedge control in bell pepper using a fallow period weed management program including mechanical tuber removal (MTR) using a peanut digger followed by cowpea (*Vigna unguiculata* L.) cover crop (CC) and glyphosate (Gly). The eight treatments were MTR-CC, Gly-CC, MTR-MTR-CC, MTR-MTR-Gly, Gly-Gly-CC, MTR-Gly-CC, Gly-MTR-CC, and non-treated check. Treatments were arranged in a randomized complete block design with four replications. The MTR and GLY applications were 4 weeks apart and CC planting was 2 weeks after the latest MTR or GLY application. Bell pepper (*Capsicum annum* L.) were transplanted 2 weeks after CC termination. Nutsedge populations were counted, using two randomly placed feet squares, at 2-week intervals beginning the initiation of trial through CC termination until the final bell pepper harvest. Weed biomass was measured 1 day before cover crop termination and after the final bell pepper harvest. The non-treated had a higher nutsedge population than all the other treatments at all dates. At CC termination, all treatments except GLY-MTR-CC had fewer than 7 nutsedge plants relative to 25 nutsedge plants in non-treated check. A similar trend was observed for tuber count and nutsedge biomass. All treatments had less than 6 tubers and 2 g of dry weight biomass relative to 42 tubers and 22 g nutsedge dry weight biomass relative to the non-treated check. During the bell pepper crop season, two weeks after transplanting (WAT) the GLY-MTR-CC, MTR-CC and GLY-CC resulted in seven to nine nutsedge plants while MTR-MTR-CC, MTR-MTR-GLY, and GLY-GLY-CC resulted in less than 4 plants relative to 25 plants in non-treated check. MTR-MTR-CC and GLY-GLY-CC provided season-long effective nutsedge control and had significantly lower nutsedge density relative to non-treated check at 6 WAT. However, MTR-MTR-GLY provided the best control with 4 plants compared to 21 for the non-treated areas at 6 WAT. In conclusion, MTR-MTR-GLY provided the greatest nutsedge control but the grower recommendations will consider the yield economic analysis and the cover crop biomass contributions to the soil health. The future research will focus on evaluating the total duration of effective nutsedge control from one season integration of MTR with CC and GLY.

EFFECTS OF MICRONUTRIENTS ON THE REDUCTION OF BERMUDAGRASS BLEACHING INJURY ASSOCIATED WITH TOPRAMEZONE APPLICATION. AP Boyd*, D Han, E Guertal; Auburn University, Auburn, AL (134)

ABSTRACT

Topramezone offers excellent control of hard to control grassy weeds in bermudagrass; however, significant bleaching and necrosis symptoms follow application. Previous research using chelated iron and iron sulfate have shown a reduction of bleaching and necrosis symptoms when applied in combination with topramezone. Research utilizing other micronutrients, which may offer similar results, is lacking. Greenhouse trials were conducted from December of 2018 to April of 2019 (Auburn University Plant Science Research Center) to determine whether various micronutrients may help safen topramezone (Pylex, BASF, Research Triangle Park, NC) use on bermudagrass by reducing bleaching symptoms. Mixtures of topramezone (12.3 g ai ha^{-1}) and MSO (0.5% v v^{-1}) were applied in combination with six different micronutrients at varying rates including sodium borate (0.09; 0.17; 0.34 kg ai ha^{-1}), zinc sulfate (0.69; 1.39; 2.08 kg ai ha^{-1}), manganese sulfate (0.99; 1.98; 2.98 kg ai ha^{-1}), magnesium sulfate (0.62; 1.23; 2.47 kg ai ha^{-1}), copper sulfate (0.39; 0.78; 1.55 kg ai ha^{-1}), and iron sulfate (0.61; 1.22; 2.44 kg ai ha^{-1}). 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 were analyzed using PROC GLM and Fisher's Protected LSD ($P<0.05$) was utilized for means separation. The results were varied over the two runs which can only be attributed to an increase in light intensity from the winter to spring season, since temperature, supplemental lighting, and moisture were regulated. For the winter trial, the treatments of zinc sulfate (0.69; 1.39; 2.08 kg ai ha^{-1}), magnesium sulfate (0.62 kg ai ha^{-1}), copper sulfate (1.55 kg ai ha^{-1}), and iron sulfate (0.61; 1.22; 2.44 kg ai ha^{-1}) were comparable to the non-treated control for the entirety of the trial. During the spring trial, observed levels of bleaching were substantially higher than that of the winter trial. Iron sulfate (2.44 kg ai ha^{-1}) at 7 DAT and iron sulfate (0.61 kg ai ha^{-1}) at 14 DAT were the only treatments which were comparable to the non-treated control on those rating dates. compared to the non-treated control. By 21 DAT, all treatments with the exception of sodium borate (0.34 kg ai ha^{-1}) and magnesium sulfate (0.62; 1.23 kg ai ha^{-1}) were not significantly different than the control. Symptoms of bleaching were transient for all treatments and subsided by 42 DAT during the fall, and 28 DAT during the spring. Although, the treatments of zinc sulfate (0.69; 1.39; 2.08 kg ai ha^{-1}) and copper sulfate (1.55 kg ai ha^{-1}) were statistically similar to other treatments during the winter trial, these treatments offered the most apparent visual reduction of bleaching when compared to all other treatments. Future trials should take into account these micronutrients and they should be evaluated further.

FECUNDITY ESTIMATION OF LATE-SEASON COMMON WATERHEMP (AMARANTHUS RUDIS) ESCAPES IN SOYBEAN USING DRONE IMAGERY. C Hu*, BB Sapkota, MV Bagavathiannan; Texas A&M University, College Station, TX (135)

ABSTRACT

Seed rain from uncontrolled weed escapes present during late-season is one of the largest sources of seedbank replenishment that greatly favors weed species persistence in arable fields. Effective estimation of seed production in late-season weed escapes allows us make informed management decisions to minimize seedbank replenishment. In this research, late-season common waterhemp escapes present in a soybean field was used as a case study to evaluate the feasibility of utilizing drone imagery to estimate weed fecundity. Data were collected at the Texas A&M field research facility in Burleson County, TX. Eleven quadrats with different density gradients of waterhemp were sampled across the field at the time of soybean maturity. Prior to sample collection, high-resolution RGB and multispectral images were collected using drones. The effectiveness of normalized difference vegetation index (NDVI), excess green index (ExG), and canopy height model were evaluated by calculating their correlation with waterhemp biological measurements (biomass and seed production) carried out on the ground. Results showed that NDVI and ExG have very strong correlation (0.89 – 0.97) with waterhemp biomass, and strong correlation (0.66 – 0.81) with seed production. A linear model based on NDVI was established to estimate seed production of each waterhemp seed head in the imagery. Findings indicate that drone imagery is a promising tool for fecundity estimation in late-season waterhemp escapes.

EFFECTS OF SUGARCANE STRAW ON SOIL TEMPERATURE AND WEED EMERGENCE. D Belapart*[1], II Brito[2], EB Castro[3], GD Macedo[4], CA Carbonari[2], ED Velini[2], NR Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]Universidade Estadual Julio de Mesquita Silva, Botucatu, AR, [3]Mississippi State University, Mississippi State, MS, [4]University of Nebraska, Lincoln, NE (136)

ABSTRACT

This work evaluated the effects of different amounts of sugarcane straw on soil temperature and emergence of problem weeds in sugarcane production. Two field studies were conducted during three seasons to evaluate the effect of sugarcane straw volume (0 and 2.5 t ha^{-1}) on soil thermal regimen at 2- and 10-cm depth and the effect of sugarcane straw volume (0, 2.5, 5, 10, 15 and 20 t ha^{-1}) on the emergence of nine weed species (*Bidens pilosa* L*, Urochloa decumbens* (Stapf) R. Webster*, Euphorbia heterophylla* L.*, Ipomoea grandifolia* (Dammer) O'Donell*, Ipomoea hederifolia* L.*, Ipomoea nil* (L.) Roth *, Ipomoea quamoclit* L.*, Merremia aegyptia* (L.) Urb. and *Panicum maximum* Jacq.) at 7, 14, 21, 28, 35 and 42 d after sowing (DAS). The experiments were conducted in a randomized block design with four replicates. The presence of straw reduced the soil thermal range, especially at greater depths. The straw reduced weed emergence; the degree of effect depended on the species and the amount of straw. The effect of straw on weed emergence differed slightly by season. General models were established to describe the relationship between the amount of straw and weed emergence. The amount of straw needed to reduce weed emergence by 50% differed greatly across weed species. The small-seeded species, *B. pilosa* and *P. maximum*, were most sensitive to the presence of straw, whereas species with larger seeds including *I. nil*, *I. hederifolia* and *M. aegyptia*, were less affected. Therefore, seed size and the size of soil seedbank determine weed emergence capacities when sugarcane straw covers the soil.

QUANTIFYING THE DISSIPATION OF CONTACT HERBICIDES FROM PLASTIC MULCHES USING A NOVEL ANIONIC POLAR PESTICIDE COLUMN. KM Eason*, TL Grey, AS Culpepper; University of Georgia, Tifton, GA (137)

ABSTRACT

Plasticulture is a management technique used in vegetable production that includes a combination of raised beds, plastic mulch, and drip irrigation. There are multiple types of plastic mulch that can be used, such as low-density polyethylene mulch (LDPE) and totally impermeable film (TIF). The mulch is used across multiple crops to outweigh input costs, therefore weed suppression is crucial to keeping the integrity of the mulch intact. Nutsedge species (*Cyperus* spp.) are especially troublesome for fruiting vegetables grown on mulch, with the potential to cause significant damage to the bed. To control nutsedge and other weed species from damaging the mulch, producers can apply herbicides on-top of and under the mulch. The main objectives for this study were to 1) evaluate glyphosate and glufosinate for over-the-top use in mulch based cropping systems and 2) validate a novel method and novel liquid chromatography (LC) column for quantifying anionic polar pesticides (i.e. glyphosate and glufosinate). Herbicides were applied using a tractor-boom sprayer (187 L/ha) at the following rates: glyphosate (0.80 kg ae/ha) and glufosinate (0.58 kg ai/ha). Mulch samples (0.1 m^2) were collected using an open-faced square frame and box-cutting knife. Samples were stored in individual plastic bags and frozen upon collection (-20^C) until analysis. Samples were extracted using 100 mL of 10:90 methanol:water solution in 125 mL flasks, shaken for 2 hr, filtered through a 0.2 µm filter, and centrifuged at 12,000 RPM for 5 min. An aliquot was transferred to a 1.5 mL vial for analysis.Herbicide dissipation from the surface of LDPE and TIF mulch was evaluated using ultra-high performance liquid chromatography coupled with a UV-detector and mass spectrometer. The Waters™ Anionic Polar Pesticide (2.1 x 100mm; 5µm packing) column was used with the corresponding method.Concentrations were subjected to ANOVA and non-linear regression analysis to establish half-life information for the given herbicides. Dissipation was described using the exponential decay equation ($y=B_0e^{-B1(x)}$).The exponential decay equation effectively described glyphosate and glufosinate. While there were varying k values, all herbicide concentrations dropped below detectable levels after 18 days after treatment (DAT). DT_{50} for glyphosate and glufosinate were 3.3 and 1.4 d respectively. This data indicates that Georgia producers may be able to use these herbicides over-the-top of mulch beds between crops, however further research is needed before labels can be generated for each herbicide evaluated to ensure no significant damage to varying vegetable crops. The data also indicates that the novel column and method can be used to detect glyphosate and glufosinate concentrations.

BLUEBERRY RESPONSE TO SPRING AND AUTUMN INDAZIFLAM APPLICATIONS OVER TIME. NL Hurdle*[1], TL Grey[2], KS Rucker[3]; [1]University of Georgia, Collierville, TN, [2]University of Georgia, Tifton, GA, [3]Bayer CropScience, Tifton, GA (138)

ABSTRACT

United States blueberry production has increased from 33,727 ha^{-1} to 36,100 ha^{-1} from 2013 to 2018, respectively, with Georgia responsible for 5,400 ha^{-1} averaging 4600 kg ha^{-1} in 2018. Numerous weed species threaten these yields by harboring diseases and insects, competing for nutrients, water, space, and sunlight. Weeds such as southern dewberry (*Rubus trivialis),* Carolina horsenettle *(Solanum carolinense)* and multiple morningglory species *(Ipomoea spp.)* may reduce blueberry yields. In order to prevent yield loss, growers implement control measures that may include PRE and POST applications. Indaziflam is a PRE herbicide belonging to the WSSA group 29 and alkylazine family. This herbicide affects plant growth by preventing cellulose biosynthesis and is registered in citrus crops, grapes, tree nuts, turfgrass, and forage production. Research from 2012 through 2014 in Clinch and Lanier counties in Georgia on highbush and rabbiteye cultivars were subjected to spring and autumn applications of either 36 g ai ha^{-1} of indaziflam tank-mixed with 1129 g ai ha^{-1} of glufosinate, 73 g ai ha^{-1} of indaziflam and 1129 g ai^{-1} of glufosinate, 146 g ai ha^{-1} of indaziflam mixed with 1129 g ai ha^{-1} of glufosinate, or 1129 g ai ha^{-1} of glufosinate. Applications were made in March and September of each year. Data recorded included trunk diameter and was subjected to a PROC GLIMMIX in SAS 9.4. Data reported no differences for any treatment across all years, indicating indaziflam may be safely applied to blueberry bushes in spring and autumn sequential applications.

EVALUATING THE UTILITY OF BENZOBICYCLON FOR WEEDY RICE CONTROL IN PROVISIA RICE. JA Patterson*, JK Norsworthy, JW Beesinger, OW France, LB Piveta; University of Arkansas, Fayetteville, AR (139)

ABSTRACT

Weedy rice (*Oryza sativa*) is particularly challenging to control in Midsouth rice cropping systems due to its highly competitive and resilient nature, similarity to cultivated rice, and resistance to herbicides. Hence, there is a need for a new effective site of action in rice production. Gowan Company is currently pursuing registration of benzobicyclon, a Group 27 herbicide, as a post-flood option in rice. It will be the first 4-hydroxyphenylpyruvate dioxygenase-inhibiting (HPPD) herbicide commercially available in Midsouth rice production. In 2019, two field experiments were conducted at the Rice Research and Extension Center near Stuttgart, AR, and the PineTree Research Station near Colt, AR. The experiments were implemented as randomized complete block designs with four replications. The objective of the experiments was to evaluate benzobicyclon-containing weedy rice control programs, most of which contain Provisia™ herbicide, in Midsouth rice compared to currently used programs. The herbicides used in the experiments included Prowl H20 (pendimethalin), Bolero (thiobencarb), Warrant (acetochlor), Provisia (quizalofop), and Rogue (benzobicyclon). The herbicides were applied in various combinations and timings, except all benzobicyclon applications were made post-flood. At Stuttgart, four weeks after the post-flood application, >90% weedy rice control was observed for all treatments but were not significantly different. At four weeks after the post-flood application, =10% injury was observed from treatments containing quizalofop followed by benzobicyclon. At PineTree, four weeks after the post-flood application, >98% weedy rice control was observed for all programs containing quizalofop followed by a post-flood application of benzobicyclon. At four weeks after the post-flood application, no more than 4% injury was observed from treatments containing quizalofop followed by benzobicyclon. These data suggest that the use of benzobicyclon in Provisia rice systems could be a viable weedy rice control option and may provide some protection against weedy rice evolving resistance to Provisia herbicide.

MELATONIN SAFENS BENTAZON TO SWEETPOTATO IN VITRO. GA Caputo*[1], MA Cutulle[2], PA Wadl[3]; [1]Clemson University, Clemson, SC, [2]Clemson University, Charleston, SC, [3]USDA ARS, Charleston, SC (140)

ABSTRACT

The main limiting factor for growing Sweetpotato (*Ipomoea batatas* L.) is weed competition. Environmental conditions and limited options for post-emergence control of yellow nutsedge (*Cyperus esculentus* L.) is a serious problem in sweetpotato production. Research was conducted to evaluate the plant hormone melatonin on its ability to safen the herbicide bentazon, which is a herbicide that has nutsedge activity. Bioassays using Murashige and Skoog (MS) media supplemented with melatonin and bentazon were conducted to evaluate the effect of bentazon on sweetpotato injury and to determine the interactive response of sweetpotato to bentazon and exogenously applications of melatonin. The sweetpotato cultivar 'Beauregard' appeared inherently more tolerant to bentazon, requiring dosages two-times higher to cause the same injury when compared to the other cultivars. When melatonin was incorporated into the media, sweetpotato showed less herbicide injury and greater plant mass, than plants treated only with bentazon. We found that melatonin reduces the damage caused by bentazon in sweetpotato, nevertheless, more research is necessary to evaluate the mechanism of safety that melatonin.

ACCESSING ROOT SYSTEM ARCHITECTURAL TRAITS ASSOCIATED WITH ALLELOPATHY IN WEEDY RICE (ORYZA SATIVA). BC Schumaker*, SD Stallworth, T Tseng, AP Tucker; Mississippi State University, Mississippi State, MS (141)

ABSTRACT

Barnyardgrass *(E. crus-galli)* and weedy rice (WR) *(Oryza sativa*) are two of the most economically troublesome weeds in southern rice production. With reliance on chemical weed control methods, resistance developing in barnyardgrass has made it very difficult to control. Supplemental strategies are needed to manage the weed. WR rice is a wild type rice that has shown potential to be a gene pool for competitive traits to improve rice varieties. One such trait is a natural ability to release secondary metabolites through its roots that can inhibit the growth of species around it called allelopathy. This allelopathic trait could be incorporated into rice variety's to give them an advantage in the field over troublesome weeds like barnyardgrass. Phenotypic traits from weedy rice can be used to overcome the limited knowledge surrounding the production of these inhibitory chemicals produced by the weed. Ten WR accessions and five rice lines were screened for their potential to reduce barnyardgrass seedling growth and ranked. Seedlings were then propagated in germination bags for four weeks. At the end of the four weeks, the bags were scanned, and images of the roots were collected and uploaded into Image J (Rasband, 2008) for analysis. Root area and length were recorded to compare allelopathic and non-allelopathic WR root structures. Allelopathic WR roots showed longer root trends than non-allelopathic WR and were similar to cultivated rice seedlings. This knowledge will be helpful for marker-assisted breeding associated with allelopathy in WR in efforts to develop barnyardgrass suppressive rice cultivars.

A COMPARISON OF SEASON LONG WEED CONTROL PROGRAMS IN PEANUT (ARACHIS HYPOGEA). KL Broster*[1], JC Ferguson[1], BJ Zurweller[1], TA Baughman[2], B Rushing[1], P Devkota[3], S Li[4]; [1]Mississippi State University, Mississippi State, MS, [2]Oklahoma State University, Ardmore, OK, [3]University of Florida, Jay, FL, [4]Auburn University, Auburn, AL (142)

ABSTRACT

Mississippi is an important producer of peanuts for the United States. In 2019 there were 10,100 hectares planted in Mississippi (USDA NASS, 2019). Weed control in peanuts is crucial to maximize yield, by preventing interference and competition for nutrients, water, and light. Peanuts are a slow growing crop that relies on both pre-emergent (PRE) and post-emergent (POST) herbicides to reduce the effect of weeds. The objective of this study is to determine the most effective herbicide program for weed control in peanut. A field study was conducted at Mississippi State University, Oklahoma State University, University of Florida, and Auburn University using 5 PRE, 2 early POST (cracking), and 2 late POST herbicide programs. The programs were compared to a non-treated and weed free treatment to determine the effect of a season-long herbicide program on weed control and peanut yield. Weed control ratings were collected at 7, 14, 28, 42, and 56 days after late POST. At harvest, yield data was collected to determine most effective combination for season long weed control. Our data shows that although there is a significant difference among locations, there are similar treatments that were better than other treatments. Across all locations the best PRE herbicides were *S*-metolachlor, diclosulam, and flumioxazin, and the best cracking and POST combination is paraquat plus pyroxasulfone followed by 2,4-DB plus imazapic. These studies were spread across the southern region, spanning about 1400 km, with varying soil types and weed competition. The results displayed similar trends in terms of weed control and yield, meaning that the data observed can be used by peanut growers across the region to build a management program to combat their weed problems, and resistance issues.

SEASONAL HERBICIDE EFFICACY ON SMUTGRASS (SPOROBOLUS INDICUS) IN PERENNIAL GRASS PASTURE IN TEXAS. Z Howard*[1], M Matocha[2], SA Nolte[3]; [1]Texas A&M University, College Station, TX, [2]Texas AgriLife Extension Service, College Station, TX, [3]Texas A&M AgriLife Extension, College Station, TX (143)

ABSTRACT

Smutgrass *(Sporobolus indicus*) is problematic due to its poor palatability to cattle and its difficulty to control once established. The objective of this research was conducted in 2019 in Grimes and Austin County, Texas, to evaluate current recommendations for smutgrass control at three seasonal timings. Treatments of hexazinone, nicosulfuron + metsulfuron methyl + crop oil, glyphosate + methylated seed oil, and imazapic + crop oil were each applied in spring (A), summer (B), and fall (C) applications. Smutgrass control and common bermudagrass (*Cynodon dactylon*) injury were evaluated at 1, 2, and 3 months after (MA) application. All treatments 1 MAB application obtained highest level of initial control, while all treatments 1 MAA saw the least control and highest bermudagrass injury. Only A and B applications were rated at 3 MA application due to heavy frost and subsequent dormancy of rated plants in December. By 3 MA both A and B applications treatments of hexazinone obtained the highest level of smutgrass control of any treatments, while bermudagrass injury had fully recovered.

CLONING AND CHARACTERIZATION OF PPO2 (ΔG210) MUTATION IN RICE. P Carvalho de Lima*[1], G Rangani[1], S Zhao[2], AC Langaro[3], V Srivastava[1], NR Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Fayeteville, AR, [3]Federal Rural University of Rio de Janeiro, Seropedica, Brazil (145)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) has evolved resistance to eight herbicide modes of action, including protoporphyrinogen IX oxidase (PPO) inhibitors. The majority of PPO-inhibitor-resistant *A. palmeri* plants harbor the *ppo2* ?G210 mutation. This research aimed to evaluate the level of resistance conferred by the mutant *A. palmeri ppo2* ?G210 on rice. We generated a transgenic 'Nipponbare' rice line overexpressing the *A. palmeri ppo2* ?G210 gene by particle bombardment. The presence of the transgene in the T0 line was confirmed by PCR. Seeds (T1) were harvested and seedlings were treated at V3 stage with 0.78 kg ha^{-1} fomesafen (2x if field dose) to select resistant T1 plants. About 68% of T1 plants had higher tolerance when compared to wild type plants; 86% had the transgene. T1 plants containing the construct, showing low injury, were grown to produce T2 seeds. An agar-based dose-response assay was also conducted in Petri dishes containing half-strength Murashige and Skoog medium spiked with various concentrations of technical grade fomesafen (0, 5, 10, 20, 40, 60, 80 and 100 µM). Each treatment had two replicates. The presence of the transgene in surviving seedlings was verified using PCR. In agar, fomesafen severely inhibited the root growth of all WT seedlings, even at the lowest concentration, but not the root growth of T2 seedlings. The phenotypic response of T2 plants to doses higher than 20 µM differed between individuals. With exception of one plant, good root growth was correlated with the presence of the *ppo2* transgene. The stability of transgene inheritance and phenotypic expression of resistance across multiple generations will be evaluated in further generations (T2 and T3 survivors). This trait could be a tool for weed management in some sensitive crops.

EVALUATING ST. AUGUSTINEGRASS (STENOTAPHRUM SECUNDATUM) SOD GROW-IN FOLLOWING PREEMERGENCE HERBICIDE APPLICATION USING MULTISPECTRAL IMAGING.

AL Wilber*[1], JD McCurdy[1], M Richard[1], JM Czarnecki[1], DG Sullivan[2]; [1]Mississippi State University, Mississippi State, MS, [2]TurfScout, LLC, Greensboro, NC (146)

ABSTRACT

St. Augustinegrass (*Stenotaphrum secundatum*) sod is widely produced in the southeastern and gulf-coastal United States. Producers apply preemergence herbicides to prevent annual weed emergence. Those herbicides may negatively affect sod grow-in and harvest characteristics. Our objective is to evaluate the effects of commonly used preemergence herbicides upon St. Augustinegrass grow-in using two multispectral imaging sensors in comparison to traditional visual evaluation. Field research was conducted as a randomized complete block design at Mississippi State University during summer 2019. Within each experimental unit (2.32 m^2), ten plugs (232 cm^2 apiece) of 'MS-B-2-3-98' St. Augustinegrass were planted on 12 June. Herbicide treatments were applied on 13 June with a CO_2 pressurized back-pack sprayer in a water carrier volume of 374 L ha^{-1}. Treatments included a non-treated check, prodiamine (0.60 kg ai ha^{-1}), pendimethalin (1.66 kg ha^{-1}), oxadiazon (2.24 kg ha^{-1}), *S*-metolachlor (2.78 kg ha^{-1}), atrazine (2.24 kg ha^{-1}), atrazine + *S*-metolachlor (2.24 + 1.74 kg ha^{-1}), and dithiopyr (0.42 kg ha^{-1}), as well as the treated-check, indaziflam (0.033 kg ha^{-1}). Percent visual cover and spectral reflectance (?=670, 730, and 780 nm) were observed weekly using a Holland Scientific RapidSCAN CS-45 Handheld Crop Sensor. Spectral reflectance (?=475, 560, 668, 717, and 840 nm) using a MicaSense RedEdge-MX sensor mounted on a UAV was observed weekly to biweekly, weather dependent. Spectral reflectance data was evaluated using vegetative indices: Ratio Vegetation Index (RVI), Normalized Difference Vegetation Index (NDVI), and Chlorophyll Index—Red Edge (CI-RE). Data were regressed in order to determine treatment effects upon grow-in. Percentage visual cover data were log transformed and fit to a sigmoidal, variable slope regression model to determine time to 50% cover (GraphPad Prism 8.0.0, GraphPad Software, San Diego, CA). Study-long data were correlated and regressed using PROC CORR and REG (SAS 9.4 SAS Institute Inc., Cary, NC). Sensitivity equivalents (SEq) values were calculated by dividing slope by root mean square error. Prodiamine, pendimethalin, *S*-metolachlor, atrazine + *S*-metolachlor, dithiopyr and indaziflam increased estimated time to reach 50% cover compared to the nontreated. When compared over the length of the study, there were strong correlations between indices and percent visual cover, coefficient of determination (r^2) values between 0.8586 and 0.9001. Pearson's correlation coefficients showed similar correlation values for the same index regardless of sensor platform: 0.9488 and 0.9440 for UAV and handheld RVI, respectively; 0.9266 and 0.9389 for UAV and handheld NDVI, respectively; 0.9319 and 0.9480 for UAV and handheld CI-RE, respectively. SEq values were consistently low for all indices, but used a relative comparison, UAV RVI showed highest sensitivity to visual cover, 0.098, and UAV NDVI showed lowest sensitivity to visual cover, 0.080. Although correlations between indices and percent visual cover were high, it is still unknown which device and index is best at detecting differences between treatments over time. Different indices are suited for different growth stages, so the best index for sparse vegetation/new planting may not be the most ideal for full canopy cover. Other green organisms, such as algae and weeds, may artificially increase multispectral band values that a visual evaluation would not account for. Ongoing research seeks to create a workflow for other small plot researchers, with aerial imagery and ArcGIS Pro, to acquire vegetation indices on a large scale in a time efficient manner.

BEST MANAGEMENT PRACTICE FOR CLEANING DICAMBA FROM CONTAMINATED SPRAYERS. SR Reeves*, ZA Carpenter, BJ Varner, G Oakley, DB Reynolds; Mississippi State University, Mississippi State, MS (147)

ABSTRACT

With dicamba tolerant soybeans (*Glycine max*) being introduced commercially, the application of dicamba herbicides have been an effective tool to combat weedy species. Non-dicamba tolerant soybeans, however, are susceptible to injury when exposed to trace amounts of dicamba. Proper tank cleanout protocols are imperative to prevent damage to non-tolerant crops from contaminated sprayers. The study objectives were to use various tank cleaners with different rinse volumes and use sequences to see what methodology is best for dicamba residue removal. Experiments were conducted in Starkville and Brooksville, Mississippi in 2016, 2017, and 2018 to evaluate sprayer cleanout. A small-scale sprayer was used to replicate a large commercial sprayer cleanout procedure. The system was first contaminated with dicamba at a rate of 590 kg ae/ha, then a three-rinse tank cleanout was performed at 10% of the tank's volume with a cleaner being added to the second rinse. For each rinse, the solution was recirculated through the sprayer system for fifteen minutes and samples were collected. After the third rinse was completed, the sprayer was filled with 867g ae ha^{-1} rate of glyphosate and a sample was collected for analysis. The samples were analyzed using a liquid chromatograph-mass spectrometer (LC-MS/MS) to determine dicamba herbicide concentrations to evaluate cleaner effectiveness. All samples were applied over non-dicamba tolerant soybeans at the R1 growth stage. Plant height and visual injury data were taken 14 and 28 DAT. Data collected at 28 DAT showed that visual injury and height reductions were unaffected regarding different tank cleaners when averaged over all rinse volumes. The plots were harvested at maturity to determine yield. The yield data collectively showed that yields did not differ among cleaners averaged over sequence. Yield data also showed that increased rinse volumes were not different than the standard rinse regarding yield reductions. The (LC-MS/MS) analysis showed that the samples among the various rinse volumes had differences regarding dicamba concentration. The addition of a tank cleaner did not increase removal of dicamba from the spray tank when using a three-rinse cleanout procedure over that of water alone.

MODELING EMERGENCE OF ANNUAL BLUEGRASS (POA ANNUA) IN HYBRID BERMUDAGRASS (C. DACTYLON X C. TRANSVAALENSIS). DR Taylor*[1], J Brosnan[2], M Prorock[1], TC Mueller[1], LE Steckel[3], B Horvath[1]; [1]University of Tennessee, Knoxville, TN, [2]Univeristy of Tennessee, Knoxville, TN, [3]University of Tennessee, Jackson, TN (148)

ABSTRACT

Annual bluegrass (*Poa annua* L.) is a problematic weed that is widely distributed throughout warm and cool-season turfgrass. While annual bluegrass has been shown to germinate across a wide range of air temperatures (10 to 39 C), information pertaining to effects of environmental factors on annual bluegrass emergence is lacking. Field research was initiated in 2019 at the East Tennessee AgReseach & Education Center- Plant Sciences Unit (Knoxville, TN) to understand environmental factors associated with annual bluegrass emergence under both turf- and bare soil conditions. Plots (1 m^2) were established in a hybrid bermudagrass (*C. dactylon* x *C. transvaalensis* Burt-Davy, cv. 'Tifway') fairway (1.5 cm height of cut) with a known history of annual bluegrass infestation. Bare soil plots of the same size were established in the same field by physically removing dormant biomass prior to the experiment and maintained by applying glyphosate (1120 g ha^{-1}) thereafter. Plots were arranged in a randomized complete block design with four replications. Emerged annual bluegrass (ABG) inside a 1000 cm^2 area of each plot was counted on a weekly basis from 1 January through 31 May, biweekly from 1 June through 31 July, and weekly from 1 August to 31 December 2019. After counting, ABG was removed with tweezers and discarded. Sensors in each plot captured soil moisture, soil temperature (5 cm depth), air temperature, and daily light integral data on 15-minute intervals and were summed hourly. Air temperature data were expressed as cooling degree days accumulated after 21 June 2019 (i.e., the summer solstice) using a 21 C base temperature (CDD_{21C}) prior to analysis in R (v. 3.5.1). Regressive partitioning techniques were used to generate a decision tree highlighting a 98% likelihood of ABG emergence >10% when soil temperatures were < 25 C. Non-linear equations using CDD_{21C} also fit both early (< 20% cumulative emergence) and season-long ABG emergence data well ($R^2 > 0.98$). Research will be repeated during 2020 to validate and further refine these models for predicting ABG emergence.

ITALIAN RYEGRASS (LOLIUM PERENNE SSP. MULTIFLORUM) TIMING OF REMOVAL EFFECTS ON CORN IN MISSISSIPPI. MT Wesley Jr.[1], ZR Treadway*[1], JC Ferguson[1], DB Reynolds[1], JA Bond[2], EJ Larson[1]; [1]Mississippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS (149)

ABSTRACT

A field study was conducted to determine the effects of Italian ryegrass (Lolium perenne ssp. multiflorum) removal timing on corn (Zea mays L.) productivity in Mississippi. The study was conducted at the Coastal Plain Branch Experiment Station in Newton, MS and included seven different timings: 70, 54, 39, 29, and 7 days before planting (DBP), at planting, and 7 days after planting (DAP). Treatment timings were the events where Italian ryegrass was sprayed at different dates relative to corn planting. The study also included an untreated check and a weed-free check. The earliest treatment was sprayed January 8, 2019. The latest treatment was sprayed March 26, 2019. S-metolachlor + atrazine + mesotrione + bicylopyrone (Acuron) at 1,952 g ai ha^{-1} and paraquat (Gramoxone SL 2.0) at 2,270 g ai ha^{-1} were used in this study. All treatments were applied using a four-nozzle boom sprayer at 4.3 km ha^{-1}, a carrier volume of 140 L ha^{-1}, and a pressure of 276 kPa. Plots measured 3 by 15 m, and DeKalb 70-27 hybrid seed corn was planted in 76 cm spaced rows at 69,200 seeds ha^{-1} March 19, 2019. Corn development was assessed throughout the growing season by obtaining plant height measurements. Corn was harvested August 15, 2019, and yields were recorded and analyzed. Yield was lower following the 54 and 39 DBP applications than in the weed-free check. Yield following the applications made 7 DBP, at planting, and 7 DAP was lower than yield following the 29 DBP application. From 29 DBP to the application at planting, a 2,279 kg ha^{-1} yield loss occurred (79 kg ha^{-1} loss per day). These data highlight the effects of Italian ryegrass removal timing on corn productivity in Mississippi.

GROWTH RESPONSE OF SOUTHERN LANDSCAPE ORNAMENTALS TO LOW RATES OF 2,4-D, DICAMBA, AND GLYPHOSATE PARTICLE DRIFT. RD Langemeier*, S Li, KJ Price, FB Browne; Auburn University, Auburn, AL (150)

ABSTRACT

Growing use of synthetic auxin herbicides in row crops has increased the potential for off-target herbicide movement onto sensitive ornamental shrubs in nurseries and residential landscaping. Alabama's nursery and greenhouse industry contributes over $500 million to the state's economy. Due the high value of these crops', herbicide damage can impose significant costs to both commercial growers and homeowners. The objective of this study was to evaluate the sensitivity of three commonly grown southern landscape ornamentals to simulated drift of 2,4-D, dicamba, and glyphosate. The trial consisted of two locations with 6 replications at each location in Lee and Mobile counties. Crape myrtle *(Lagerstroemia indica x fauriei* var. *Natchez)*, Japanese holly *(Ilex crenata var. Compacta)*, and azalea *(Rhododendron x* var. *Fashion)* were planted into pots in May, 2019 and sprayed in August, 2019. There were 6 replications of each species at each location. Herbicides were applied at 20%, 10% and 1% of field use rates for each product to simulate off target drift on ornamentals. Field use rates were 1065, 560, and 1540 g ai ha^{-1} for 2,4-D, dicamba, and glyphosate respectively. Growth indices ((height x width x width)/3) were recorded at immediately prior to spraying and 56 days after treatment (DAT). Visual ratings were recorded at 14, 28, and 56 DAT. At 28 DAT the 20% rate of 2,4-D caused the most severe injury to Japanese holly at 13.8%. Azalea at 28 DAT exhibited the most severe damage for the 20% rate of dicamba, 10.0% and 13.3% for Lee county and Mobile counties respectively. Injury ratings 28 DAT for crape myrtle injury was the highest when treated with the 20% rate of 2,4-D at 8.3%. From 28 to 56 DAT injury ratings generally decreased more for 2,4-D relative to dicamba for azalea and Japanese holly, but this did not hold true for crape myrtle. For all three species glyphosate injury ratings generally dropped from 14 to 28 DAT, but increased or stayed the same from 28 to 56 DAT due to abnormal regrowth. Significant reductions in growth index, up to 20%, were recorded only for Japanese holly. Observation of abnormal regrowth from all herbicides suggests only partial recovery is possible without pruning of damaged areas. Due to the importance of aesthetics in the ornamental industry, even minimal injury can reduce marketability.

ROW SPACING AND PLANTING DATE EFFECT ON THE CRITICAL PERIOD OF GRASS WEED CONTROL IN GRAIN SORGHUM (SORGHUM BICOLOR) IN NORTH CAROLINA. DJ Contreras*, W Everman; NC State University, Raleigh, NC (151)

ABSTRACT

Grain sorghum (*Sorghum bicolor*), which is mainly used for animal feed, is the 4th most planted crop in the US. Its production is focused in the Midwest, where precipitation is limiting for high yielding corn and soybean production. North Carolina growers can benefit from grain sorghum production, especially in dry and hot areas, due to a constant demand for animal feed. Weed management is a concern for grain sorghum growers due the limited number of herbicide options available. Grass weed species have been able to thrive under conditions were most herbicide control programs are focused on broadleaf weeds because of lack of selective annual graminicides. Cultural control practices such specialized crop varieties with herbicide tolerance, row width variations, planting date and Critical Period of Weed Control (CPWC) are some of the tools available for weed management. The objective of this study was to determine the CPWC for grass species in grain sorghum using a crop variety with Inzen™ Sorghum Trait technology, two different row width arrangements (15 and 36 in.) and two planting dates (Mid-May and Mid-June). Plots were kept weedy or weed free through 2, 3, 5, and 7 weeks after crop emergence (WAE). Two controls consisting of weedy and weed free all season plots were used for a treatment comparison based on a regression analysis where time of weed removal was related to crop yield. An acceptable yield loss of 5% was given to limit the CPWC. Grain sorghum planted in Mid-May had a CPWC that lasted from 2.5 to 7.6 WAE for 15” row spacing and from 2.2 to 7.8 WAE for 36” row spacing (p=0.05). Grain sorghum planted in Mid-June had a CPWC from 3.4 to 6.7 WAE for 15” row spacing and 2.9 to 6.3 WAE for 36” row spacing (p=0.05).

DOES A RICE SEED TREATMENT SAFEN AGAINST DIFFERING RATES AND FORMULATIONS OF ACETOCHLOR? TH Avent*, JK Norsworthy, C Brabham, LB Piveta, MC Castner; University of Arkansas, Fayetteville, AR (152)

ABSTRACT

There are no labeled applications for very-long chain fatty acid inhibitors in rice (*Oryza sativa* L.) in the United States; however, chloroacetamides are widely used in Asian rice production systems. Specifically, pretilachlor is used for transplanted and water-seeded rice as a preemergence herbicide. In Asia, pretilachlor is used in combination with fenclorim, an herbicide safener for rice developed by Ciba Geigy, to effectively reduce injury to the rice crop and still maintain broad spectrum weed control. In June of 2019, field trials were conducted in Fayetteville, AR to evaluate the safening effects of fenclorim when applied as a rice seed treatment when acetochlor was applied. The experiment was setup as a split plot randomized complete block design with split-plot factors being fenclorim seed treatment at 0, 0.25, and 2.5 g kg-seed^{-1}. Warrant® (microencapsulated, ME) and Harness® (emulsified concentrate, EC) were the two chosen formulations of acetochlor applied delayed preemergence at 315, 630, and 1260 g ai ha^{-1}. Non-herbicide treated plots also included fenclorim seed treatments at each rate. As rate of acetochlor increased, injury to rice increased. Higher rates of fenclorim also decreased injury to rice caused by acetochlor applications. Decreasing rates of acetochlor at the highest rate of fenclorim resulted in comparable stand to that of the nontreated acetochlor plots. Furthermore, applications of ME acetochlor rather than EC resulted in less rice injury and increased stand. When combining a fenclorim treatment rate of 2.5 g kg-seed^{-1} and ME acetochlor of 1260 g ai ha^{-1}, rice injury was only 9% rather than 56% injury at the same acetochlor rate, no fenclorim, and EC formulation. The results of this experiment lead to the conclusion that commercial safety for rice to delayed preemergence applications of ME acetochlor is obtainable when combined with a fenclorim seed treatment.

EFFECT OF HERBICIDES AT VARIOUS GROWTH STAGES AND FIRST FEMALE INFLORESCENCE ON PALMER AMARANTH FECUNDITY AND SEED VIABILITY. EB Scruggs*, ML Flessner; Virginia Tech, Blacksburg, VA (153)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S.) is a troublesome weed due to its aggressive growth, prolific seed production, and resistance to many herbicides. Effective control at a size greater than 10cm is difficult. Two field studies were initiated with the overarching goal of mitigating PPO resistance by determining the effects of herbicides applied at different timings on Palmer amaranth control, fecundity, and seed viability: (1) to compare POST herbicidal effects in a non-crop system across various Palmer heights with and without fomesafen and (2) to determine the effects of herbicide application at first female inflorescence on seed production and viability. The field studies were located in South Hill, VA for study 1 in 2018 and in Blackstone and Blacksburg, VA for both studies in 2019. Both studies were randomized complete block designs with four replications although study 2 was split by soybean variety and respective treatments. Treatments in study one consisted of the following alone and in combinations with fomesafen: mesotrione, dicamba, 2,4-D choline, glufosinate, glyphosate, and fomesafen (alone only). Herbicide treatments were standard labeled field rates. Emerged weeds were counted and flagged according to size (5 to 10, 10 to 20, and 20 to 30cm tall) prior to application. Study two consisted of Enlist and Xtend soybeans with the following treatments: glyphosate, 2,4-D (Enlist), 2,4-D + glyphosate (Enlist), glufosinate (Enlist), glufosinate + glyphosate (Enlist), 2,4-D + glufosinate (Enlist), 2,4-D + glufosinate + glyphosate (Enlist), dicamba (Xtend), dicamba + glyphosate (Xtend), dicamba + glufosinate (Xtend), and dicamba + glufosinate + glyphosate (Xtend). Prior to treatment application, up to 10 female plants were flagged per plot and treatment applications were made at first female inflorescence. Data collected for both studies included visible control assessed on a 0 (no control) to 100 (complete necrosis) scale 4 weeks after treatment (WAT), and end of season counts of surviving flagged weeds (used to calculate mortality % data). All data were subjected to ANOVA and subsequent means separation using Fisher's Protected LSD (a=0.05). In study one, there was no treatment by size interaction. Overall, control decreased as size increased. Visible control 4 WAT was best from glufosinate (83%), dicamba + fomesafen (81%), 2,4-D + fomesafen (90%), and glufosinate + fomesafen (84%). All treatments resulted in greater control (=58%) 4 WAT than mesotrione (32%) or glyphosate (30%) applied alone. End of season mortality % data were similar to visible control data 4 WAT with dicamba (79%), glufosinate (86%), mesotrione + fomesafen (81%), dicamba + fomesafen (77%), 2,4-D + fomesafen (88%), and glufosinate + fomesafen (82%) performing best. In study two, 2,4-D + glyphosate + glufosinate (94%), 2,4-D + glufosinate (95%), glufosinate + glyphosate (88%), and glufosinate alone (86%) performed best in Enlist soybeans, 4 WAT. 2,4-D applied alone resulted in 62% control and glyphosate alone resulted in 16% control. Similar results were seen in the Xtend treatments, with dicamba + glufosinate + glyphosate (94%), dicamba + glufosinate (93%), and dicamba + glyphosate (87%) performing best. Dicamba alone resulted in 72% control and glyphosate alone resulted in 9% control. These studies reinforce the importance of targeting small (<10cm) weeds as well as the effectiveness of auxin herbicides and glufosinate combined with fomesafen on PPO-susceptible Palmer amaranth. Future research will examine fecundity and viability of seed set from survivors of these treatments to better inform herbicide resistance mitigation management strategies.

EFFICACY AND ECONOMICS OF PALMER AMARANTH MANAGEMENT IN COTTON. BM DeLong*[1], JD Everitt[2], W Keeling[1], PA Dotray[3]; [1]Texas A&M AgriLife Research, Lubbock, TX, [2]Bayer CropScience, Shallowater, TX, [3]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX (154)

ABSTRACT

Increasing populations of glyphosate-resistant Palmer amaranth *(Amaranthus palmeri)* have increased weed management costs for Texas High Plains cotton producers. The introduction of Bollgard II XtendFlex (dicamba-tolerant) varieties and registration of dicamba formulations for postemergence use in cotton, combined with residual herbicides, can effectively control Palmer amaranth. It is estimated that 60-70% of the region's cotton acreage was planted in Bollgard II XtendFlex varieties in 2019. To maintain this technology, proper use of residual herbicides is essential. Field studies were conducted in 2018 and 2019 at Lubbock to evaluate Palmer amaranth control and economics of weed management for XtendFlex, LibertyLink, Roundup Ready, and conventional cotton systems for irrigated and dryland production. Trifluralin was used as a preplant incorporated (PPI) treatment in all cotton production systems. Caparol was applied preemergence (PRE) in all systems. The XtendFlex system included a tank mix of XtendiMax + Roundup PowerMax applied early postemergence (EPOST) and XtendiMax + Roundup PowerMax + Warrant applied mid postemergence (MPOST). LibertyLink systems included Liberty EPOST and Liberty + Warrant MPOST. Applications were made using a CO_2-pressurized backpack sprayer at a volume of 15 gallons per acre. Dicamba treatments were sprayed with Turbo TeeJet Induction 11002 nozzles and non-dicamba treatments were applied with Turbo TeeJet 11002 nozzles. In 2019 the Liberty Link system required tillage and hand-hoeing to control escaped weeds. Roundup Ready systems included Roundup PowerMax EPOST and Roundup PowerMax + Warrant MPOST and used hand-hoeing and tillage to control glyphosate-resistant Palmer amaranth. The conventional system utilized tillage and hand hoeing for in-season weed control and Warrant MPOST. Consistent season-long Palmer amaranth control was achieved with the XtendFlex system in both irrigated and dryland production with 99-100% control in 2018. In irrigated production, greatest lint yields were achieved with XtendFlex and Roundup Ready systems. In 2018, greatest gross revenues above weed management costs were achieved with the XtendFlex and Roundup Ready systems in irrigated production. All systems produced similar yields in dryland cotton production and gross revenue above weed management costs were similar across dryland production systems in 2018. Total weed management costs were similar across all systems, with greater seed/technology and herbicide costs in XtendFlex and Liberty Link systems, compared to higher tillage and hand hoeing costs in Roundup Ready and conventional systems in 2018 and 2019. The most consistent season-long Palmer amaranth control was achieved with the XtendFlex and conventional systems in both irrigated and dryland production in 2019. In 2019, the XtendFlex and conventional systems resulted in similar returns and were the only systems to produce positive gross revenues above weed management costs.

EVIDENCE OF ANTAGONISM: CUTLEAF GROUNDCHERRY (PHYSALIS ANGULATA L.) CONTROL BY GLYPHOSATE + 2,4-D. JD Joyner*[1], GD Collins[2], CW Cahoon[2], ZR Taylor[3], AC Blythe[2], W Everman[2], SA Hoffman[2]; [1]NC State University, Mount Olive, NC, [2]NC State University, Raleigh, NC, [3]NC State University, Sanford, NC (155)

ABSTRACT

Cutleaf groundcherry (*Physalis angulata* L.) is controlled well by glyphosate but research is limited on control of this weed by 2,4-D or glyphosate + 2,4-D. In 2018, a cotton producer complained of poor cutleaf groundcherry by Enlist Duo® (2,4-D choline + glyphosate). Seed from this population was collected and a preliminary greenhouse screening was conducted. The results of the preliminary screening indicated glyphosate controlled cutleaf groundcherry well, but treatments containing 2,4-D choline and 2,4-D choline + glyphosate did not. This led to the initiation of greenhouse studies to test for antagonism. Treatment structure consisted of a 3 by 3 factorial including 3 rates of 2,4-D choline by 3 rates of glyphosate. Rates of 2,4-D choline included 0, 532 (1/2X), and 1064 (1X) g ae ha^{-1} whereas of rates of glyphosate were 0, 433 (1/2X), and 866(1X) g ae ha^{-1}. Treatments were arranged in a RCBD with 4 replications. A separate 3 by 3 factorial experiment was conducted to evaluate cutleaf groundcherry control by dicamba, glyphosate, and combinations of dicamba and glyphosate. Dicamba rates included 0, 280 (1/2X) and 560 (1X) g ae ha^{-1}; rates of glyphosate included 0, 1/2X and 1X. One and 2 runs of the dicamba and 2,4-D experiments were completed during 2019, respectively. Treatments were applied in a CO_2 pressurized spray chamber when cutleaf groundcherry height averaged 6.5 to 10.5 cm. Visual estimates of percent weed control were collected 14 and 28 days after application (DAA). Additionally, cutleaf groundcherry height and biomass were collected 28 DAA. Data were subjected to ANOVA using the PROC GLIMMIX procedure in SAS and means separated using Fisher's Protected LSD at $p \leq 0.05$. Colby's method was used to calculate expected weed control as well as expected biomass as a percent of the nontreated check (NTC) for combinations of 2,4-D choline and glyphosate. A separate ANOVA using PROC GLIMMIX was used to compare expected values calculated using Colby's method to observed weed control by combinations of 2,4-D choline and glyphosate. Both rates of 2,4-D choline controlled cutleaf groundcherry < 10% 28 DAA. In contrast, glyphosate alone at the 1/2X and 1X rate .controlled cutleaf groundcherry 70 and 94%, respectively. The 1/2X rate of 2,4-D + glyphosate 1/2X provided 46% cutleaf groundcherry control compared to an expected value of 70%; 2,4-D 1X + glyphosate 1/2X resulted in 45% control compared to 71% expected. The 1/2X rate of 2,4-D + glyphosate 1X controlled cutleaf groundcherry 72% compared to 95% expected whereas 2,4-D 1X + glyphosate 1X controlled the weed 54% compared to expected control of 94%. In general, control by combinations of 2,4-D choline + glyphosate provided less control than glyphosate alone, and the observed control by combinations were statistically less than expected control calculated using Colby's method. In contrast, treatments containing dicamba controlled cutleaf groundcherry = 98% and no evidence of antagonism was observed. These experiments demonstrate that 2,4-D antagonizes control of cutleaf groundcherry by glyphosate while no such interactions were observed between dicamba and glyphosate.

COTTON FIBER QUALITY RESPONSE FOLLOWING EXPOSURE TO LOW RATES OF DICAMBA. KR Russell*[1], PA Dotray[2], IL Pabuayon[1], GL Ritchie[1]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX (156)

ABSTRACT

Since the release of dicamba-tolerant cotton (*Gossypium hirsutum*) in 2016, preplant and postemergence applications of dicamba to control glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats) has increased. With the increase in acreage treated with dicamba, the risk of off-target movement to non-target crops has also increased. A field study was conducted at the Texas Tech University New Deal Research Farm equipped with subsurface drip irrigation in 2017 and 2018 to evaluate cotton response to dicamba when applied at four crop growth stages (first square + two weeks, first bloom, first bloom + two weeks, and first bloom + five weeks). 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 CO_2-pressurized backpack sprayer using a carrier volume of 140 liters per hectare and TTI11004 nozzles. Plots, four rows spaced 102 centimeters apart by 9.14 meters in length, were replicated three times. Only the middle two rows received the herbicide treatments. Average stand density across the trial was four plants per foot. 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 and fiber quality measurements were analyzed at the Fiber & Biopolymer Research Institute at Texas Tech University. When applications were made at first square + two weeks, a shift in boll nodal position was apparent following dicamba at 1/50X in 2017 and at 1/10X in 2018 when compared to the non-treated control. A shift in boll distribution from the 1/50X rate of dicamba was apparent at the first bloom application in 2017, but not in 2018. When applications were made at first bloom + two weeks, boll number was reduced following dicamba at 1X. Relative to the non-treated control, no change in boll number and boll position was apparent following any dicamba rate when applied at first bloom + five weeks in either 2017 or 2018. Dicamba at 1/500X, 1/100X, and 1/50X did not affect yield at any application timing when compared to the non-treated control. When dicamba was applied at 1/10X, the greatest yield loss was observed when dicamba was applied at first square + two weeks followed by first bloom and first bloom + two weeks. Micronaire increased following dicamba at 1/10X when applied at first square + two weeks, first bloom, and first bloom + two weeks in 2017. In 2018, micronaire decreased following dicamba at 1/10X when applied at first bloom + five weeks. Shifts in boll production have the potential to influence fiber quality and lint production; however, dicamba at =1/50X did not affect fiber quality or lint production.

OPTIMIZATION OF CARBON SOURCES FOR WEED CONTROL IN AN ASD (ANAEROBIC SOIL DISINFESTATION) ENVIRONMENT. WP Wechter[1], M Katawczi[1], G Singh*[2], MA Cutulle[2]; [1]USDA ARS, Charleston, SC, [2]Clemson University, Charleston, SC (157)

ABSTRACT

Weed control continues to be one of the biggest challenges for organic field crop producers. Certain varieties of vegetables have been bred for resistance to key pathogens and insects, yet no type of inherent resistance mechanisms exists in crops that will directly resist weed infestation. Additionally, no selective herbicides are registered for use in organic vegetable production. Many organic growers rely on hand-weeding, which can be labor-intensive and costly. With high weed pressure, management costs for tomato in the southeast can range between $1,000 to $1,500 per acre in the absence of herbicides. Alternative strategies for weed control are needed. Anaerobic soil disinfestation (ASD) methods, first developed in Japan and the Netherlands is a pre-plant soil treatment that uses carbon-rich soil amendments, increased soil moisture, followed by tarping the field using transparent impermeable film which rapidly creates an anaerobic environment that kills many of the oxygen-loving plant pathogens. Organic acids (e.g. acetic and butyric acids) formed during the anaerobic decomposition of labile C have been reported as major control mechanisms of pathogens in ASD. ASD was initially developed to control soilborne pathogens but has also been studied for effectiveness against weed suppression. A preliminary ?eld study was conducted in the beginning in summer 2019 in USDA-ARS Vegetable research, Charleston, SC to utilize ASD for control of weed and Soil-borne pathogens in the Organic Vegetable system. Carbon Treatments included: 1) untreated control, 2) Molasses and Chicken manure, 3. Molasses and cottonseed meal in ASD and non-ASD Environment. Water was applied based on moisture and redox potential measurements throughout the trial. Percent weed emergence and weed biomass were recorded after six weeks of the experiment started. Accumulated soil anaerobic conditions and weed control results were significantly greater in all ASD treatments. Following this preliminary study, a greenhouse study was planned including more treatment combinations for checking the effectiveness in weed and disease suppression in native South Carolina organic soil. The greenhouse bucket study was initiated on 15 October 2019 to determine if specific carbon source and allelopathic treatment combinations affect weed suppression and disease incidence in native coastal soil in the greenhouse. Treatment factors included a combination of Molasses (carbon source) with four allelopathic-organic herbicides amendments (sweet potatoes, Liquid Corn gluten, Chicken manure, and mustard meal) in ASD and non-ASD environment. Each bucket was seeded with barnyard grass (*Echinochloa crusgalli*), Palmer amaranth (*Amaranthus palmeri*) and Crabgrass (*Digitaria spp.*). Mesh bags containing 20 grams of *Ralstonia solanacearum* inoculated soil buried at 20- 25 cm deep in the soil, then topped off with soil. Accumulated Anaerobic conditions were significantly greater in all treatments with plastics cover. Weeds suppression was also significantly greater in all ASD treatments with plastics cover. ASD treatments also showed positive impacts in killing bacterial inoculum buried in the soil.

COTTON TOLERANCE TO MULTIPLE EXPOSURES OF 2,4-D. AC Blythe*[1], CW Cahoon[1], LE Steckel[2], W Everman[1], GD Collins[1], ZR Taylor[3], JD Joyner[4]; [1]NC State University, Raleigh, NC, [2]University of Tennessee, Jackson, TN, [3]NC State University, Sanford, NC, [4]NC State University, Mount Olive, NC (158)

ABSTRACT

Vast majority of cotton acreage is planted to cultivars tolerant to 2,4-D (Enlist) or dicamba (XtendFlex). Furthermore, these technologies are commonly grown in close proximity to each other. As a result, it is not uncommon to see off-target movement of either herbicide damage a neighboring crop. Cotton tolerance to 2,4-D at multiple rates and growth stages has been well documented. Most notably, cotton tolerance to 2,4-D is greatly reduced when plants begin to bloom. However, cotton tolerance to multiple exposures occurring during vegetative or early reproductive stages has not been well studied. The objective of this study is to determine cotton tolerance to multiple exposures of 2,4-D during vegetative and early reproductive growth. Researchers hypothesized a reduction in yield when cotton is exposed to 2,4-D multiple times. Additionally, reduction in yield would result at the 1/100X rate but not at the 1/1000X rate. Field research was conducted near Clayton and Rocky Mount, NC during 2019. Dicamba-tolerant cotton cultivar DP1646B2XF was planted during mid-May into conventionally prepared raised beds with a row spacing of 91 cm. Treatment structure consisted of a 2 herbicide rates by 7 application timing factorial. Treatments were arranged in a randomized complete block design with 4 replications. Herbicide rates included 2,4-D choline applied at 1 (1/1000X) and 11 g ai ha^{-1}(1/100X). Application timings included 2-leaf, 6-leaf, 10-leaf, 2- and 6-leaf, 2- and 10-leaf, 6- and 10-leaf, 2-6- and 10-leaf. A nontreated check was included for comparison. Herbicides were applied with a CO_2-pressurized backpack sprayer delivering 140 L ha^{-1} utilizing TeeJet™ AIXR11002 nozzles. Only the center 2 rows of each plot were treated; the two outside rows served as a border between plots. Cotton injury was visually estimated 14 days after (DA) 2-leaf application, 14 DA 6-leaf, 14, 28 and 42 DA 10-leaf. Plant mapping was conducted prior to defoliation in mid-September. Data collected at this time included cotton height, total nodes, node of first fruiting branch, and percent open bolls. Cotton was harvested in October and weighed to determine yield. All data were subjected to ANOVA using PROC GLIMMIX (SAS version 9.4) and means separated using Fisher's Protected LSD at alpha equal to 0.05. Results of visual ratings were as expected; 2,4-D choline at the 1/100X rate injured cotton greater than the 1/1000X rate at all growth stages. Cotton height was not greatly influenced by 2,4-D choline rate or timing. Maturity of cotton exposed to the 1/100X rate was delayed; percent open bolls in treated plots ranged 2 to 23% and 5 to 52% compared to 54% and 79% in nontreated checks at Clayton and Rocky Mount, respectively. The 1/1000X rate of 2,4-D choline did not influence cotton yield. In contrast, the 1/100X rate reduced cotton yield approximately 19 to 66% compared to the nontreated check. Furthermore, greater cotton yield reductions were observed when applications occurred later in the season and when cotton was exposed to 2,4-D choline multiple times compared to a single event. This research demonstrated that 2,4-D choline at 1/100X rate is capable of reducing cotton yield even when exposure occurs during vegetative or early reproductive stages. Additionally, multiple exposures at the 1/100X rate are likely to cause significant yield reductions. However, the 1/1000X rate, regardless of timing, did not affect cotton yield.

PALMER AMARANTH CHLOROPHYLL FLUORESCENCE RESPONSE TO DIURNAL AUXINIC HERBICIDE APPLICATIONS. JR Kalina*[1], CB Corkern[2], TL Grey[1], DG Shilling[3], NT Basinger[3]; [1]University of Georgia, Tifton, GA, [2]Bayer CropSciences, Tifton, GA, [3]University of Georgia, Athens, GA (159)

ABSTRACT

Palmer amaranth (*Amaranthus palereri* S.Watts.*)* has been one of the most troublesome pests for cotton production in the state of Georgia. New technology utilizing auxinic herbicides has been bred into specific cotton lines allowing these biotypes to be tolerant to PRE and POST applications applications of certain formulations of these herbicides. The proper utilization of these herbicides is key to maintaining their utility and efficacy. What time of day the herbicide is applied has been shown to influence how the targeted pests respond. In order to elucidate results from what data were observed from previous experiments, physiological data was collected using fluorometry to measure what differences could be found affecting plant stress between light adapted and dark adapted Palmer applied with certain herbicides. Differences were noted across all herbicides with respect to dark adapted applications and light adapted applications.

CROP TOLERANCE AND WEED MANAGEMENT IN HERBICIDE SYSTEMS UTILIZING ISOXAFLUTOLE IN HPPD TOLERANT COTTON. DC Foster*[1], PA Dotray[2], C Thompson[3], G Baldwin[4], F Moore[5]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]BASF, Abernathy, TX, [4]BASF, Research Triangle Park, NC, [5]BASF, Lubbock, TX (160)

ABSTRACT

The southern US produces 90% of the nation's cotton (*Gossypium hirsutum L.*) with the Texas High Plains region being the largest contiguous region. Since 2011, Texas cotton production has been threatened by glyphosate-resistant Palmer amaranth (*Amaranthus palmeri S. Watson*) and alternatives to glyphosate-based systems are needed. Integrating soil residual herbicides such as isoxaflutole into a weed management system is an effective strategy to control glyphosate resistant weeds before they emerge. BASF Corporation is developing hydroxyphenylpyruvate dioxygenase (HPPD) tolerant cotton, which will allow growers to utilize isoxaflutole in future weed management systems. In 2019, field experiments were conducted in New Deal, Lubbock, and Halfway, Texas to determine HPPD-tolerant cotton response to isoxaflutole applied preemergence (PRE) or early-postemergence (EPOST) when cotton was 2- to 4-leaf as well as to determine the efficacy of isoxaflutole when used as part of a weed management system. Crop response experiments at New Deal and Lubbock included the following treatments: 1.35 kg ai/ha prometryn PRE followed by (fb) 0.88 kg ai/ha glufosinate + 1.4 kg ai/ha *S*-metolachlor EPOST, 0.11 kg ai/ha isoxaflutole + prometryn PRE fb 0.84 kg ai/ha dimethenamid + glufosinate EPOST, isoxaflutole + 1.12 kg ai/ha pendimethalin PRE fb dimethenamid + glufosinate EPOST, isoxaflutole + prometryn + pendimethalin PRE fb dimethenamid + glufosinate EPOST, isoxaflutole + 0.67 kg ai/ha (½ rate) prometryn PRE fb glufosinate + *S*-metolachlor EPOST, isoxaflutole + prometryn PRE fb glufosinate + *S*-metolachlor EPOST, isoxaflutole + 1.12 kg ai/ha fluometuron PRE fb glufosinate + *S*-metolachlor EPOST, prometryn PRE fb isoxaflutole + glufosinate EPOST, and prometryn PRE fb isoxaflutole + glufosinate + 2.1 kg ai/ha glyphosate EPOST. A blanket mid-postemergence (MPOST) glyphosate + glufosinate application was made at first bloom and some treatments received diuron postemergence-directed (PDIR) when cotton was at the bloom stage. At New Deal, no cotton injury was observed following any PRE treatment. Following the EPOST application, injury did not exceed 13% 14 days after application (DAA) and did not exceed 5% 28 DAA. No cotton injury was observed after the MPOST and PDIR applications. No treatment adversely affected yield when compared with the nontreated weed-free control. At the Lubbock location, injury following PRE treatments did not exceed 15% for any treatment and prometryn was responsible for most of this injury. One week after the EPOST application, all treatments exhibited 10 to 15% injury, which declined to less than 10% 14 DAA. Cotton lint yield following all herbicide treatments was similar to the nontreated weed-free control. In a non-crop weed control study at Halfway, treatments mimicked the cotton response trials with the addition of two treatments: isoxaflutole + prometryn PRE fb glyphosate + 0.56 kg ai/ha dicamba EPOST and prometryn PRE fb isoxaflutole + glyphosate + dicamba EPOST. These two treatments included glyphosate + dicamba MPOST. Fourteen days after the PRE application, all treatments controlled Palmer amaranth >94% except for isoxaflutole + pendimethalin PRE (88%). Twenty-one days after the EPOST application, all treatments controlled Palmer amaranth >90%. When evaluated 21 days after the PDIR application, treatments that did not receive PDIR application ended the season with up to 20% less control of Palmer amaranth. The opportunity to use isoxaflutole in cotton will improve season-long control of Palmer amaranth when used as part of an overall weed management program.

EFFICACY AND CROP RESPONSE OF HERBICIDE PROGRAMS IN ISOXAFLUTOLE TOLERANT SOYBEANS (GLYCINE MAX). DJ Black*; NC State University, Franklinville, NC (161)

ABSTRACT

Weed resistance has become a major concern for growers across the world, especially in the Southeastern United States where species such as Palmer amaranth (*Amaranthus palmeri*) have evolved resistance to several different herbicides. 4-Hydroxyphenylpyruvate Dioxygenase (HPPD) tolerant soybean varieties, will allow growers to apply isoxaflutole, an HPPD-inhibiting herbicide, to control herbicide-resistant weeds. Two studies were conducted during the 2018 and 2019 growing seasons evaluating isoxaflutole for efficacy, crop response and crop yield. Eight herbicide programs and one nontreated control were implemented for the experiments both years. Efficacy data was taken 7, 14, 21, 28 and 35 days after application. Post emergence applications were applied at the V2 to V4 stage of the crop. Tolerance data was taken on a percent Phytotoxicity scale for 7, 14, 21, 28, 35, 42, and 49 days after application. Post-emergent applications were done at the same V2 to V4 stage for the crop. For both efficacy and tolerance studies, post-emergent applications were typically around 21 days. Data analysis of weed control by isoxaflutole were not different to those of *S*-metolachlor and flumioxazin. Combinations of isoxaflutole and *S*- metolachlor did not change the efficacy or crop response when applied alone. Crop response to isoxaflutole showed no adverse effects on plant health and only when flumioxazin is use pre-emergent and fomesafen is applied post-emergence, is the crop response statistically different to all other treatments. Weed control and crop response showed predictable trends between herbicide programs and yields. There was no difference in yields across treatments for the tolerance study. Efficacy yield data showed differences in yield across treatments as yield increased as herbicide programs became more efficacious.

DETERMINING BEST MANAGEMENT PRACTICES FOR WEED SEED REDUCTION IN COTTON. RB Farr*, JK Norsworthy, GL Priess, MC Castner, JA Patterson; University of Arkansas, Fayetteville, AR (162)

ABSTRACT

Multiple herbicide-resistant weeds have resulted in a need to adopt a multifaceted approach to reduce selection pressure and mitigate the evolution of herbicide resistance. Previous studies have suggested that cover crops, deep tillage, zero-tolerance mechanical weed control, and the use of residual herbicides along with postemergence herbicides can all disrupt the emergence of weeds and reduce weed seedbank populations. A long-term study was initiated in Marianna, AR during fall of 2018 to evaluate the influence of a one-time deep tillage, rye cover crop, dicamba- and non-dicamba-based herbicide programs, and zero-tolerance weed removal on Palmer amaranth (*Amaranthus palmeri* S. Watson) emergence and density in the soil seedbank. This study was arranged as a split, split, split-plot with zero-tolerance being the whole-plot factor, deep tillage the sub-plot factor, cover crops the sub-sub-plot factor and herbicide programs the sub-sub-sub-plot factor. Weed densities and emergence were measured in four, quarter meter squares per plot at 21, 42, 63, and 72 days after the initial herbicide application and weed counts were taken at harvest. Soil cores were taken before and after the season to determine the difference in soil seedbank density. Results from 2019 suggest that the use of deep tillage and zero-tolerance both reduced the amount of weed seed returned to the seedbank. Deep tillage reduced the amount of inflorescence producing weeds at the end of the season by 75%, reducing Palmer amaranth from 1423 plants/ha to 357 plants/ha. Zero-tolerance reduced inflorescence producing Palmer amaranth populations at the end of the season by 63% from 1297 plants/ha to 483 plants/ha. Deep tillage also reduced cumulative, in-season Palmer amaranth emergence by 74%, from 262,719 plants/ha to 63415 plants/ha. Deep-tillage also reduced the amount of time to hand weed a hectare by 0.7 hours or 42 minutes. This information will be beneficial in assisting crop producers to determine how to effectively control and reduce weed populations in an integrated manner.

RELATIVE SOYBEAN RESPONSE TO AMINOCYCLOPYRACHLOR, 2,4-D, DICAMBA, AND AMINOPYRALID. TC Mueller, TI Clark*; University of Tennessee, Knoxville, TN (163)

ABSTRACT

This research compared the visual symptomology of four auxin herbicides applied at three rates to simulate tank contamination on non-dicamba tolerant soybeans. The herbicides were aminocyclopyrachlor (ACP), 2,4-D, dicamba, and aminopyralid; the standard labeled rates (SLR) used to base the application rates were 0.11, 1.17, 1.12, and 0.12 kg ae/ha respectively. These four herbicides exhibit similar symptoms on soybeans which is problematic when diagnosing soybean response. One goal of this project was to obtain high-quality images of the four herbicide's effect on soybeans, with the hope of being able to discern the herbicides solely from visual symptoms. Each herbicide was applied at three different rates: 0.1X, 0.01X, and 0.001X of the SLR. The application was made at the R1 soybean stage. A randomized complete block design with three replications was utilized. Border rows for each plot were inspected for injury to assess potential drift between plots. The plots were visually evaluated for herbicide response at 3, 7, 14, and 21 days after treatment (DAT). Two trifoliate leaves were collected during each evaluation for future chemical analysis (data not shown). At 21 DAT, all 0.1X treatments had greater than 20% crop injury. The 0.001X rate for each herbicide exhibited different symptomology when compared to 0.1X rate. Leaf cupping and galls were more prominent on soybeans at lower herbicide dosages. Increasing the herbicide dosage changed symptomology from leaf cupping and galls to necrosis, leaf curling, and epinasty. There were no profoundly distinct visual differences between herbicides. Soybean yield and herbicide dosage were inversely related, and each herbicide affected soybeans differently. No 2,4-D treatments reduced yield. Dicamba at 0.001X reduced soybean yield 19%. Aminopyralid and ACP at 0.01X reduced soybean yields 43% and 16%, respectively. Future research will determine the herbicide concentrations in the leaves and relate them to crop response.

PALMER AMARANTH HOSTS TARNISHED PLANT BUGS WHICH IMPACT COTTON GROWTH AND YIELD. TM Randell*, LC Hand, AS Culpepper, PM Roberts; University of Georgia, Tifton, GA (164)

ABSTRACT

For over a decade, Palmer amaranth has been the most impactful pest affecting Georgia cotton production. Significant research has documented the weed's ability to effectively emerge and compete with cotton throughout the growing season for light, water, nutrients and space. An increased occurrence of cotton with damaged or aborted terminals was observed within weed management trials at an on-farm location, where high populations of Palmer amaranth were present. While research has defined the potential impact of thrips to seedling cotton and tarnished plant bugs on squaring cotton, more information is needed investigating the influence of Palmer amaranth on the population levels of these insects and their subsequent impact on cotton terminal development during seedling stages. Two field studies and one laboratory bioassay were each conducted twice from 2017 to 2019 to investigate the influence of Palmer amaranth on early-season insect pressure and damaged cotton terminals. The experimental design of the first field study was a split-split-plot design, with weed management system (plots maintained weedy or weed-free) as the whole-plot, at-plant insecticide seed treatment as the split-plot (imidacloprid plus thiodicarb at 0.375 mg ai seed^{-1} or untreated), and supplemental foliar insecticide applications (foliar acephate 200 g ai ha^{-1} or no acephate) as the split-split-plot. When emerged with cotton for the first 30 d after planting (DAP), the presence of Palmer amaranth increased tarnished plant bug populations 10-fold (24 DAP) and increased damaged cotton terminals 14 to 24% when compared to the weed-free control; yields decreased with increased terminal damage in one of two years. Maximum thrips pressure, 21 DAP, was effectively controlled with at-plant insecticide, and no significant correlation was present between populations, Palmer amaranth, damaged cotton terminals, or yield loss. Supplemental foliar insecticide applications did not impact the occurrence of damaged terminals in either year. A laboratory bioassay evaluated the influence of the same at-plant insecticide seed treatment on tarnished plant bug feeding on seedling cotton. Combined across years, when at-plant insecticide was utilized, tarnished plant bug mortality was 97%, compared to 37% when seed was not treated. In the second field study, damaged terminals were assessed within weed-free cotton planted adjacent to Palmer amaranth allowed to proliferate on the cotton's east side. Maximum damaged terminals of 51% were observed on the cotton row planted directly next to the weedy area (0 m), with the furthest cotton row (44 m) noting only 8% terminal damage; yield increased as distance between cotton and Palmer amaranth increased. The presence of Palmer amaranth in and around cotton fields increased infestations of tarnished plant bugs, leading to an increase in damaged cotton terminals, resulting in lower cotton yields.

SOYBEAN RESPONSE TO SUB-LETHAL DICAMBA RATES AT VARIOUS PLANTING DATES.

MA Fajardo Menjivar*; NC State University, Raleigh, NC (165)

ABSTRACT

Soybean (Glycine max) production locate USA as the leader in terms in production worldwide and the second country with the highest exports of the grain. Animal protein feed and vegetable oil production are the main final processing products of soybeans. Different varieties and maturity groups adapted to the different regions of the country had become in greater yield productions along past years. Dicamba tolerant beans have created the opportunity to farmers to improve weed management and reducing the injury rates of their production fields. Along this the potential of increasing other susceptible crops injury has risen. Defining the different effects of sub lethal Dicamba rates, when exposed at vegetative (V4) or reproductive stages (R2) and with two different planting dates (May or June) in terms of injury and subsequently in yield was the objective of this research. Two different maturity groups (V and VI), each with Dicamba tolerant and non-tolerant soybean varieties were used. The location of the research was the Upper Coastal Plain Research Station at Rocky Mount, NC. The rates of Dicamba to soybeans applied were 0.0, 1.08, 4.35, and 17.40 g ae ha-1. Evaluations were conducted at 14, 21, 28, 35 and 42 days after treatment (DAT). Results provides evidence that there was significant difference of yield between the soybean planting dates.

SCREENING OF CHROMOSOME SUBSTITUTION (CS) COTTON LINES FOR WEED-SUPPRESSING POTENTIAL. GA Fuller*, T Tseng, BC Schumaker; Mississippi State University, Mississippi State, MS (166)

ABSTRACT

One of the most problematic weeds in cotton production is Palmer amaranth (*Amaranthus palmeri*). Since the introduction and overuse of chemical weed control tools, Palmer amaranth populations have developed resistance to many common herbicides, most notably glyphosate. To slow the evolution of herbicide-resistant weed populations, alternative weed control methods and tools must be developed. Forty-five chromosome substitution (CS) cotton (*Gossypium hisurtum* L.) lines were screened in the greenhouse to determine their weed-suppressing abilities (objective 1: pot screening). The top-performing lines determined in the pot screening were then screened using a modified stair-step method (objective 2: stair-step screening). In the pot screening and the stair-step screening, all plants were measured on the day of the establishment, and at 7, 14, and 21 days after establishment (DAE). Results from both screenings were analyzed using one-way ANOVA (a=0.05) on JMP software, where $H_0= \mu_1=\mu_2=\ldots\mu_3$, respectively. In the pot screening, eleven CS lines maintained PA height reduction values higher than 34 cm, with an F-factor of >.0001. The null hypothesis was rejected indicating a significant difference between the treatments. In the stair-step screening, two CS lines reduced Palmer amaranth height by up to 10%. The F-factor was calculated to be 0.3973, and we failed to reject the null hypothesis indicating no significant difference between treatments. To cultivate competitive characteristics in cotton plants, it is imperative to identify cotton lines that produce high levels of allelochemicals. These highly competitive cotton lines can eventually be entered into breeding programs to produce cotton varieties with competitive, weed-suppressing charateristics.

PRELIMINARY EFFECT OF CHLOROACETAMIDE HERBICIDES AND GLYPHOSATE ON DICAMBA VOLATILITY. JM Taylor*, G Oakley, BJ Varner, SM Reeves, DB Reynolds; Mississippi State University, Mississippi State, MS (167)

ABSTRACT

Chloroacetamide herbicides are often added to dicamba applications to provide additional residual control in a single application. The known tendency of dicamba vapor movement makes an understanding of the interaction of these tank-mix partners imperative to mitigate dicamba volatility, injury, and yield loss. Preliminary field and greenhouse trials were established to evaluate the effect of chloroacetamide herbicides on dicamba volatility when applied alone or in combination with glyphosate. Field applied treatments included 2.24 kg ae/ha of the diglycolamine (DGA) salt of dicamba (XtendiMax plus VaporGripä), 2.24 kg ae/ha dicamba + 4.40 kg ai/ha S-metolachlor (Dual Magnumä), 2.24 kg ae/ha dicamba + 5.04 kg ai/ha acetochlor (Harnessä), 2.24 kg ae/ha dicamba + 5.06 kg ai/ha acetochlor (microencapsulated in Warrantä), and a pre-mix formulation containing 2.2 kg ae/ha dicamba + 4.48 kg ai/ha S-metolachlor (Tavium plus VaporGripä) applied alone and in combination with 3.47 kg ae/ha of the potassium salt of glyphosate (RoundUp PowerMaxä). These application rates represent a 4X rate of application and were used to ensure symptomology. Applications were made using an enclosed track sprayer at a delivery volume of 140 L/ha and flats were then transported to the field test site. Each treatment was applied to greenhouse flats filled with soil wetted to field capacity. Treated flats were placed between two rows of soybeans in the center of each 15.24 m plot. A 6.2 x 1.5 m low tunnel dome covered with plastic was placed over the center of each plot and was not removed until 48 hours after application. Visual injury (%) and plant height (cm) was recorded in 30 cm increments from 0 to 762cm from the treated soil. Data were collected 14 and 28 days after treatment (DAT). Each low tunnel contained an air pump pulling air through a polyurethane foam tube (PUF) to capture dicamba molecules that had vaporized from the treated soil surface. PUF concentrations were analyzed using LC/MS to record concentration in ng/PUF. Data were subjected to analysis with PROC GLIMMIX and means were separated by LSMEANS (a=0.05). The same treatment combinations were evaluated at a 1X rate in a closed humidome system. Humidome treatments included 0.56 kg ae/ha of dicamba, 0.56 kg ae/ha dicamba + 1.12 kg ai/ha S-metolachlor, 0.56 kg ae/ha dicamba + 1.26 kg ai/ha acetochlor (Harness™), 0.56 kg ae/ha dicamba + 1.26 kg ai/ha acetochlor (microencapsulated in Warrant™), and a pre-mix formulation of 0.56 kg ae/ha dicamba + 1.12 kg ai/ha S-metolachlor. Each application of chloroacetamide and dicamba was tested with and without the addition of 0.86 kg ae/ha glyphosate. Humidomes contained a treated soil flat and were sealed with humidity domes. Each dome was fitted with an air pump pulling air through a polyurethane foam tube (PUF) to catch dicamba molecules that vaporize from the treated soil surface. Field data showed no interaction between chloroacetamide and glyphosate. -The addition of a chloroacetamide herbicide to dicamba did not increase visual injury or volatility as measured by concentrations in the air. However, the addition of microencapsulated acetochlor decreased volatility. The addition of glyphosate increased soybean injury and dicamba volatility as measured by air-samples regardless of tank mixture. No differences were found among treatments as measured by the humidome trial. These are preliminary data and additional experiments will be conducted in 2020.

2,4-D AND DICAMBA APPLIED PREPLANT IN PLASTICULTURE: HERBICIDE DISSIPATION AND CUCURBIT CROP RESPONSE. LC Hand*, KM Eason, TM Randell, TL Grey, AS Culpepper; University of Georgia, Tifton, GA (168)

ABSTRACT

Numerous vegetable crops are grown on a single installation of plastic mulch in Georgia. Although fumigants and cover crops often provide weed control for the first crop, herbicides are essential to prepare for weed-free planting in subsequent crops. Glyphosate and paraquat are used extensively as they can be removed from mulch with rainfall or irrigation, but weed escapes are becoming common. Research in 2018 and 2019 helped better understand the potential for using 2,4-D or dicamba in these systems. A factorial with treatments arranged in an RCBD with four replications included 3 herbicide options including dicamba plus glyphosate (560 + 1,125 g ae ha^{-1}) and 2,4-D plus glyphosate (1,065 + 1,125 and 2,130 + 2,250 g ae ha^{-1}) applied over mulch at four application intervals of 45, 30, 15, and 1 d before planting (DBP); two non-treated controls were included for comparison. Dissipation was analytically quantified by UPLC/MS along with squash (*Cucurbita pepo* L.) and watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) bioassays. Analytical analysis indicated dicamba concentrations present on plastic mulch at planting were nearly 16 times greater than that of 2,4-D when herbicides were applied 15 to 45 DBP. As a result, dicamba injured squash 12, 65, 75, and 95% when applied 45, 30, 15, or 1 DPB, respectively. Squash widths and fresh weight biomass were similarly reduced when dicamba was applied 1 to 30 DBP. When harvested 30 times, yield losses of 45 to 98% was observed when dicamba was applied within 30 DBP. Averaged over rate, 2,4-D treatments caused 2, 4, 7, and 73% squash injury at the aforementioned application intervals with reductions in squash widths, fresh weight biomass, and yield only noted with applications 1 DBP. Dicamba injured watermelon 13, 39, 42, and 94% while applications of 2,4-D resulted in 1, 2, 4, and 94% injury at the aforementioned application intervals. Vine length response was similar to the injury for dicamba applied 1 to 30 DBP and 2,4-D applied 1 DBP, resulting in significant reductions, while biomass was only reduced when herbicides were applied 1 DBP. Watermelon recovery was remarkable noting yield loss only with 1 DBP treatments. Herbicide option, crop, and rainfall accumulated prior to planting ($\geq$ 11.3 cm, $\geq$ 9.3 cm, $\geq$ 3.7 cm, and 0 cm with applications 45, 30, 15, or 1 DBP, respectively) significantly influenced the outcome.

EVALUATION OF HERBICIDE PROGRAMS FOR BARNYARDGRASS AND PALMER AMARANTH CONTROL IN FURROW-IRRIGATED RICE. JW Seale*, JA Bond, BR Golden; Delta Research and Extension Center, Stoneville, MS (169)

ABSTRACT

Furrow-irrigated rice (*Oryza sativa* L.) is an alternative to the delayed flood production system and this has been adopted by some growers in the Mississippi rice production area. This production system may require additional herbicide applications due to wetting and drying cycles stimulating new weed emergence after herbicide application. Barnyardgrass (*Echinochloa crus-galli* L. Beauv.) and Palmer amaranth (*Amaranthus palmeri* S. Wats.) are among the most common weeds of rice in Mississippi. Furthermore, these species commonly emerge throughout the growing season, so they are troublesome in furrow-irrigated rice. Therefore, field studies were conducted at the Delta Research and Extension Center in Stoneville, MS, to evaluate barnyardgrass and Palmer amaranth control utilizing herbicide programs in furrow-irrigated rice. Four field studies (Non-Clearfield Study, Clomazone Timing Study, Barnyardgrass POST Timing Study, Palmer Amaranth POST Timing Study) were focused on evaluating herbicide programs for barnyardgrass and Palmer amaranth control in furrow-irrigated rice. Treatments in the Non-Clearfield Study were arranged as a three-factor factorial within a randomized complete block with four replications. Factor A was preemergence (PRE) treatment and included no PRE and clomazone at 420 g ai ha^{-1}. Factor B was postemergence (POST) treatments applied to two- to three-leaf rice (EPOST) and included no EPOST treatment and propanil at 3,360 g ai ha^{-1} plus quinclorac at 420 g ai ha^{-1}. Factor C was POST treatments applied to four-leaf to one-tiller rice (LPOST) and included no LPOST treatment and mixtures of pendimethalin plus clomazone at 1,430 g ai ha^{-1} with bispyribac-sodium at 30 g ai ha^{-1} or florpyrauxifen-benzyl at 29 g ai ha^{-1}. The Clomazone Timing Study utilized a two-factor factorial treatment arrangement in a randomized complete block design with four replications. Factor A was clomazone POST timing and consisted of no clomazone POST and a premix of pendimethalin plus clomazone at 1,430 g ha^{-1} included in the first or second POST application. Factor B was POST treatment and consisted of sequential applications of imazethapyr at 105 g ai ha^{-1} with quinclorac at 420 g ha^{-1} included in the first or second application. Sequential POST applications were applied 14 d apart with the initial treatment at EPOST or at three- to four-leaf rice (MPOST) stage. The Barnyardgrass POST Timing and Palmer Amaranth POST Timing studies were both designed as a randomized complete block with four replications. In both studies, weeds were allowed to grow until 7, 14, 21, 28, or 35 d after rice emergence (DAE). At the prescribed timing, herbicide treatments were initiated. Herbicide treatments were designed specifically for barnyardgrass or Palmer amaranth with the goal of attaining 95% control and maintaining that level of control until rice harvest. Data collection varied across the four studies, but all included visible estimates of rice injury, weed control, and rice yield. All data were subjected to ANOVA and estimates of the least square means were utilized for mean separation with $p = 0.05$. In the Non-Clearfield Study, at least two herbicide applications were required for barnyardgrass control = 92% at 28 d after the last application. No differences in barnyardgrass control were observed among treatments that included clomazone PRE and one or two POST applications. Propanil plus quinclorac EPOST followed by bispyribac-sodium plus pendimethalin plus clomazone LPOST controlled barnyardgrass similar to treatments that included clomazone PRE and one or two POST applications. Rough rice yields varied with herbicide programs in the Non-Clearfield Study; however, rough rice yields were optimized following treatments that included at least two herbicide applications. Barnyardgrass control 21, 28, and 35 d after the last application was = 98% and was not influenced by the treatments in the Clomazone Timing Study. Rough rice yields were similar following all treatments except clomazone PRE followed by imazethapyr MPOST followed by imazethapyr plus quinclorac 14 d after MPOST. In the Barnyardgrass POST Timing Study, rough rice yields in plots where herbicide treatments were initiated 7, 14, or 21 DAE were similar to those in plots maintained weed free throughout the growing season. When herbicide treatments were delayed to 28 or 35 DAE, rough rice yields were reduced = 14% compared with the weed-free check. When the initial herbicide treatment was delayed until 28 or 35

DAE, Palmer amaranth control never exceeded 68% in the Palmer Amaranth POST Timing Study. These results indicate that barnyardgrass and Palmer amaranth can be managed with timely herbicide treatments in furrow-irrigated rice. In a non-Clearfield system, at least two herbicide treatments that included clomazone PRE and one or two POST applications were needed to optimize barnyardgrass control and rough rice yield. Clomazone or quinclorac should be mixed with imazethapyr in the first POST herbicide application in a Clearfield system. Weed control was greatest when herbicide treatments targeting barnyardgrass or Palmer amaranth were initiated not later than 21 DAE.

TOLERANCE OF BLUEBERRY, STRAWBERRY AND MUSCADINE GRAPE TO 2,4-D CHOLINE.

KC Sims*[1], K Jennings[2], D Monks[2], W Mitchem[3]; [1]NC State University, Goldsboro, NC, [2]NC State University, Raleigh, NC, [3]NC State University, Mills River, NC (170)

ABSTRACT

Field studies were conducted in 2018 and 2019 to determine tolerance of small fruit crops to 2,4-D choline directed to the soil in southern highbush blueberry (*Vaccinium corymbosum* L.) and muscadine grape (*Vitis rotundifolia* Michx.), or to the row middle between polyethylene mulched raised beds in strawberry (*Fragaria ×ananassa* Duch.). Treatments for all crops included 2,4-D choline at 0, 0.53, 1.06, 1.60, and 2.13 kg ha^{-1} applied alone, and sequential treatments at the same rates except strawberry in which sequential treatments consisted of only the two lowest rates. The 2,4-D choline treatments alone and initial applications for the sequential treatments were applied in January during dormancy for blueberry and May during active growth for muscadine grape. The second application in the sequential treatments was applied in April for blueberry and July for muscadine grape when these crops were actively growing. In strawberry, the initial treatments were applied in December 2018 and the second application of the sequential treatments was applied in April. Strawberry was actively growing in December and April. Visual foliage injury to blueberry, muscadine grape, and strawberry was 0, <5, and 0%, respectively. No differences were observed among treatments for fruit yield, pH and Brix in blueberry, muscadine grape and strawberry. However, titratable acidity of blueberry and strawberry fruit differed among treatments, with titratable acidity being highest for Legacy blueberry in the sequential treatment (high rate), and highest in strawberry in the 1.60 kg ha^{-1} rate (single application) of 2,4-D choline.

PATTERNS OF PPO RESISTANCE EVOLUTION IN PALMER AMARANTH FROM MID-SOUTHERN US. M Machado Noguera*[1], G Rangani[1], T Bararpour[2], LE Steckel[3], JW Heiser[4], RL Nichols[5], N Roma-Burgos[6]; [1]University of Arkansas, Fayetteville, AR, [2]Delta Research and Extension Center, Stoneville, MS, [3]University of Tennessee, Jackson, TN, [4]University of Missouri, Portageville, MO, [5]Cotton Incorporated, Cary, NC, [6]Univeristy of Arkansas, Fayetteville, AR (172)

ABSTRACT

PPO-inhibitors are important herbicides for the management of glyphosate- and ALS-resistant Palmer amaranth [*Amaranthus palmeri* (S.) Wats.] populations. The evolution of PPO-resistance in this species is of great concern and its spread should be monitored. Thus, 167 Palmer amaranth accessions were collected from soybean and cotton fields between 2017 and 2018 from Arkansas (AR), Missouri (MO), Mississippi (MS) and Tennessee (TN). A labeled dose of fomesafen (264 g ha^{-1}) was sprayed on 100 seedlings (5- to 8-cm tall) of each accession. Counting of dead and alive plants was made at 21 days after treatment, and survivors were scored individually for injury, sampled, and subjected to a Taqman qPCR assay to detect the presence of four known target-site mutations in the *PPO* gene: ?G210, R128G/M and G399A. Accession responses to fomesafen differed significantly. Accessions were grouped into five clusters with progressive resistance levels. Arkansas had the highest proportion of susceptible populations (92%), while MO accessions comprised the majority (65%) of those in the most resistant cluster 5. Eighty-eight percent of MS samples were grouped in cluster 4, which had low mortality (44%), but high injury of survivors (77%), indicating early-phase low-level resistance to PPO inhibitors. Target-site mutations are the major resistance mechanism to PPO-inhibitors. Of 120 genotyped accessions, 91 accessions carried at least one mutation. The most common mutations were ?G210 (18%) and ?G210 + G399A (17%). The presence of four mutations in one population was rare, occurring in only 3 accessions. Twenty-four percent of accessions with survivors did not carry any mutations. Further studies are needed to determine resistance mechanisms. Across four states, 51 counties have PPO-resistant *A. palmeri* populations, or susceptible populations with rare individuals that carry resistance-endowing mutation(s). If selection pressure continues, these populations will evolve field-level resistance to PPO inhibitors in 3 to 4 years based on previous cases

EARLY SEASON RESIDUAL HERBICIDE STRATEGIES IN UPLAND RICE PRODUCTION. LC Webster*, EP Webster, BM McKnight, WB Greer, DC Walker, SY Rustom; LSU AgCenter, Baton Rouge, LA (173)

ABSTRACT

Upland rice (*Oryza sativa* L.), has recently gained popularity in Mid-South rice production. A study was conducted in 2019 at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate overlaying residual herbicides in upland rice production. Plot size was 3-m by 11.3-m with 16-19.5 cm drill-seeded rows of 'CLXL-729' at 39 kg ha^{-1}. The study was a randomized complete block with a two-factor factorial arrangement of treatments with three replications. Factor A consisted very early postemergence (VEPOST) applications of 1) no VEPOST application, 2) a prepackaged mixture of imazethapyr plus quinclorac at 560 g ai ha^{-1}, 3) imazethapyr at 70 g ai ha^{-1} mixed with clomazone at 211 g ai ha^{-1}, 4) imazethapyr at 70 g ha^{-1} mixed with pendimethalin at 1120 g ai ha^{-1}, 5) imazethapyr at 70 g ha^{-1} mixed with a prepackaged mixture of clomazone plus pendimethalin at 717 g ai ha^{-1}, or 6) imazethapyr at 70 g ha^{-1} mixed with a prepackaged mixture of halosulfuron plus prosulfuron at 83 g ai ha^{-1}. Factor B consisted of either no late postemergence (LPOST) application or a LPOST application of imazethapyr at 70 g ha^{-1} plus bispyribac at 34 g ai ha^{-1}. A uniform standard treatment of clomazone at 211 g ha^{-1} was applied preemergence. All herbicide applications were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 93.5 L ha^{-1}. Visual evaluations for the study included barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.] and Texasweed [*Caperonia palustris* (L.) St. Hil.] control at 14 days after the VEPOST (DAVEPOST) application and 21 days after the LPOST (DALPOST) application. Rough rice yields were obtained and adjusted to 12% moisture. At 14 DAVEPOST, barnyardgrass was controlled 91 to 93% when treated with a prepackaged mixture of imazethapyr plus quinclorac. All other herbicide combinations applied VEPOST controlled barnyardgrass 74 to 87% at 14 DAVEPOST. At the 21 DALPOST rating date, barnyardgrass was controlled 45 to 76% across all herbicide mixtures applied VEPOST with no LPOST application; however, when a LPOST application imazethapyr plus bispyribac was applied barnyardgrass control was 85 to 92% at 21 DALPOST. At 14 DAVEPOST, Texasweed was controlled 90 to 91% when treated with imazethapyr mixed with a prepackage mixture of halosulfuron plus prosulfuron applied VEPOST, and 78 to 79% when treated with a prepackaged mixture of imazethapyr plus quinclorac applied VEPOST. These results suggest to overlay residual herbicides throughout the growing season in upland rice production. This study indicates the addition of a prepackaged mixture of imazethapyr plus quinclorac at the VEPOST application timing provides an extended period of broad spectrum residual control before an LPOST herbicide application is needed.

EFFECTS OF POSTEMERGENCE HERBICIDES ON RICE GROWTH FOLLOWING PARAQUAT EXPOSURE. TL Sanders*, B Lawrence, HM Edwards, JA Bond; Delta Research and Extension Center, Stoneville, MS (175)

ABSTRACT

Paraquat-based herbicide treatments are recommended for weed control in Mississippi, particularly in the Delta region where glyphosate-resistant weeds are prolific. In the Delta, rice is routinely drill-seeded at same time preplant and/or preemergence herbicide treatments to corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), and soybean [*Glycine max* (L.) Merr.] are applied. Therefore, off-target movement of paraquat-based herbicide treatments onto rice planted adjacent to these crops is likely to occur. In an off-target herbicide movement event, as much as 25% of herbicide can move from a few meters up to several kilometers from the target, resulting in crop injury and yield loss of non-target crops. Therefore, research was conducted to evaluate rice response to postemergence (POST) herbicides after exposure to a sub-lethal concentration of paraquat and characterize rice response to exposure to a sub-lethal concentration of paraquat at different reproductive growth stages. Two field studies (POST Herbicide Study and Reproductive Timing Study) were conducted in 2019 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate rice response to labeled herbicides after exposure to a sub-lethal concentration of paraquat and characterize rice response to exposure to a sub-lethal concentration of paraquat at different stages of reproductive growth. In the POST Herbicide Study, treatments were arranged as a two-factor factorial within a randomized complete block design and four replications. Factor A was herbicide treatment and consisted of no herbicide treatment, imazethapyr at 105 g ai ha^{-1}, quinclorac at 420 g ai ha^{-1}, propanil at 3,363 g ai ha^{-1}, bispyribac-sodium at 28 g ai ha^{-1}, cyhalofop at 31 g ai ha^{-1}, and florpyrauxifen-benzyl at 29 g ai ha^{-1} applied to rice in the three- to four-leaf (MPOST) growth stage. Factor B was paraquat exposure and consisted of paraquat applied at 0 and 84 g ai ha^{-1} to spiking to one-leaf rice (VEPOST). In the Reproductive Timing Study, the experimental design was a randomized complete block with four replications. Paraquat was applied at 28 g ha^{-1} to rice at panicle differentiation (PD), 2.5-cm internode elongation (IE), 7.5-cm IE, 12.5-cm IE, 5% heading, milk, soft dough, hard dough, and 25% moisture content. A nontreated control was included in the Reproductive Timing Study for comparison. In both studies, visible estimates of aboveground rice injury were recorded 3, 7, 14, and 28 d after treatment (DAT). Rice height was recorded 21 DAT (POST Herbicide Study), 14 DAT (Reproductive Timing Study), and at maturity (both studies). In the POST Herbicide Study, the number of d to 50% heading was recorded as an indication of rice maturity, d to canopy closure, and green normalized difference vegetative index (NDVI) were recorded. In the Reproductive Timing Study, rough rice yield was collected at maturity and sub-samples were collected to determine whole and total milled rice yield. All data were subjected to ANOVA with means separated with estimates of the least square means at P=0.05. In the POST Herbicide Study, no differences in rice injury were detected 3, 7, 14, and 21 DAT among postemergence herbicide treatments ($\geq$50%) except injury from propanil (43%) was less than other treatments 21 DAT. In the Reproductive Timing Study, rice injury 3 and 7 DAT was greatest following paraquat exposure at PD, 2.5-cm IE, and 25% moisture content. Injury was $\geq$40% and $\geq$ 58% following exposure at PD and 2.5-cm IE 14 and 28 DAT, respectively. Rice height was reduced $\geq$ 23% following exposure at PD, 2.5-, and 7.5-cm IE compared with the nontreated control. Rough rice yield was reduced at all stages of reproductive growth compared with the nontreated control. The greatest yield reduction occurred following rice exposure to paraquat at 12.5-cm IE (1,345 kg ha^{-1}) compared with yield of the nontreated control (12,777 kg ha^{-1}). Both studies indicate rice growth and development was compromised following rice exposure to sub-lethal concentrations of paraquat. Applications of paraquat-based herbicide treatments to fields in proximity to rice should be avoided if conditions are conducive for off-target movement. After rice has been exposed to paraquat, weed management is still necessary and choice of POST herbicide should be based on weed spectrum. Rice exposure to paraquat during the early reproductive stages, when the rice plant is rapidly growing and number of grain is increasing, has a detrimental effect on rough rice yield and should be avoided.

CONTROL OF GLYPHOSATE-RESISTANT DIGITARIA INSULARIS WITH HERBICIDE AND GROWTH REGULATOR MIXTURES. FG Machado*[1], RF Santos[1], WD Matte[2], J Constantin[1], RS Oliveira Jr.[1], NR Burgos[3]; [1]Universidade Estadual de Maringa, Maringa, AR, [2]Universidade Estadual de Maringa, Maringa, MS, [3]University of Arkansas, Fayetteville, AR (176)

ABSTRACT

Sourgrass (*Digitaria insularis*) is a perennial grass spread across crop production areas in South America which evolved glyphosate resistance and it constitutes now one of the most troublesome weed species in Brazil. Sequential POST applications of ACCase inhibitors is one of the most used strategies to manage sourgrass in Brazil, as the number of alternative herbicides is low. The addition of plant growth regulators (PGRs) may increase herbicide efficacy for sourgrass control. To evaluate the effects of plant regulators on sourgrass, field and greenhouse studies were carried out. The first study was conducted in a greenhouse, with four replications with randomize complete blocks design (RCBD) for evaluate the sourgrass control of trinexapac-ethyl (TE) applied at 0, 75, 150, 300, 600 and 1200 g ha^{-1}. The second study was made in a factorial scheme (5x3) with four replications in CBRD. The first factor consisted of different PGR: TE (300 g ha^{-1}), mepiquat-chloride (100 g ha^{-1}), ethephon (158 g ha^{-1}), sulfometuron (15 g ha^{-1}) and control without growth regulator (check). The second factor consisted of glyphosate (gly) (1500 g ha^{-1}), clethodim (96 g ha^{-1}) and control without herbicides applied at two and five tillers, pre-flowering and flowering stages. The dose of TE that causes 50% of control was 242 g ha^{-1} (ED_{50}). Sulfometuron + gly provided 86.3% and 97.5% control in plants with two and five tillers, respectively. The control of TE + gly was two-fold higher than the isolated application of gly. When the application occurred at a later stage of development of sourgrass, the same treatment did not provide control higher than 80%. The use of PGR in mixture with herbicides or alone can be a good alternative to improve resistant weed management. control of trinexapac-ethyl (TE) applied at 0, 75, 150, 300, 600 and 1200 g ha^{-1}. The second study was made in a factorial scheme (5x3) with four replications in CBRD. The first factor consisted of different PGR: TE (300 g ha^{-1}), mepiquat-chloride (100 g ha^{-1}), ethephon (158 g ha^{-1}), sulfometuron (15 g ha^{-1}) and control without growth regulator (check). The second factor consisted of glyphosate (gly) (1500 g ha^{-1}), clethodim (96 g ha^{-1}) and control without herbicides applied at two and five tillers, pre-flowering and flowering stages. The dose of TE that causes 50% of control was 242 g ha^{-1} (ED_{50}). Sulfometuron + gly provided 86.3% and 97.5% control in plants with two and five tillers, respectively. The control of TE + gly was two-fold higher than the isolated application of gly. When the application occurred at a later stage of development of sourgrass, the same treatment did not provide control higher than 80%. The use of PGR in mixture with herbicides or alone can be a good alternative to improve resistant weed management.

EVALUATION OF THIOBENCARB AND CLOMAZONE IN MISSISSIPPI RICE HERBICIDE PROGRAMS. HD Bowman*[1], JA Bond[2], JW Seale[2], JD Peeples[2]; [1]Mississippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS (177)

ABSTRACT

Herbicide resistant barnyardgrass (*Echinochla crus-galli* L.) can be especially difficult to control in rice (*Oryza sativa* L.). Uncontrolled barnyardgrass, as well as other weeds, can reduce grain yield by competing for light, soil nutrients and moisture. In Mississippi, four-way herbicide-resistance in barnyardgrass has been confirmed. Therefore, research was conducted to identify other herbicide options for control of barnyardgrass. In 2019 two experiments were conducted to evaluate control options for barnyardgrass and other weeds in rice, at the Delta Research and Extension Center in Stoneville, MS. Experimental design was a randomized complete block design for both test which included clomazone at 560 g ai ha^{-1} and thiobencarb at 3363 g ai ha^{-1} applied alone delayed-preemergence (DPRE) and in combination. Delayed-preemergence-applications were followed by quinclorac at 420 g ai ha^{-1}, bispyribac-sodium at 30 g ai ha^{-1} or imazosulfuron 336 g ai ha^{-1} mid-postemergence (MPOST), to three- to four-leaf rice. Visible weed control was assessed 14 days after DPRE (DA-DPRE) and 14 days after MPOST applications (DA-MPOST), to evaluate weed control. Visible crop injury ratings were also taken at 14 DA-DPRE and 14 DA-MPOST. Data were subjected to Analysis of Variance (ANOVA) using SAS 9.4 and means were separated using fisher's protected LSD ($p \leq 0.05$). Both experiments included a non-treated control for comparison of weed control and crop injury, which was excluded from the statistical analysis. Generally, 14 DA-PRE no difference in control of barnyardgrass (95%) was seen when clomazone and thiobencarb were applied together DPRE over that of clomazone alone (88%). However, clomazone provided higher control levels of barnyardgrass over that of thiobencarb (73%). No visible rice injury was observed from any herbicide application. The greatest control of barnyardgrass (98%) 14 DA-MPOST was seen when clomazone DPRE was followed by byspyribac-sodium MPOST. When only a PRE or MPOST application was made unacceptable levels of barnyardgrass were achieved < 63%. These results indicate that control options for herbicide resistant barnyardgrass in Mississippi rice cropping systems exist. It is important to note that single herbicide applications will not provide adequate control of barnyardgrass. However, incorporation of a full herbicide program including both PRE and MPOST can provide a high level of control, while also not causing injury to rice.

COMMERCIAL SPRAYER RETENTION OF DICAMBA RESIDUE FOLLOWING TRIPLE RINSE WITH WATER: ALABAMA STATEWIDE SURVEY. FB Browne*, S Li, KJ Price; Auburn University, Auburn, AL (178)

ABSTRACT

Field and laboratory experiments were conducted in 2017 and 2019 to investigate the risk for sprayer contamination following dicamba applications. Three commercial sprayers were evaluated in 2017 for dicamba residue retention following four cleanout protocols. Hagie Upfront STS 10, John Deere 6700, and SprayCoupe 4660 sprayers with tank capacities of 3570 L, 1590 L, and 1580 L, respectively, were used to apply dicamba (Clarity) at 1.12 kg ae ha^{-1} with a carrier volume of 93.5 L ha^{-1}. One cleaning method was triple rinse with water and the remaining three included a first rinse of 3% v/v ammonium, 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 378.5 L water, respectively. For each rinse, 378.5 L of water and assigned cleaning agent were added. Half of the cleaning solution was sprayed out before rinsate samples were collected from the left, middle, and right sections of the boom simultaneously for each rinse. A fourth rinse using only water was included to demonstrate the cleaning efficacy of each triple-rinse protocol. All cleaning protocols were repeated three times in the field. Higher dicamba concentrations were detected in the Haige Upfront STS 10, suggesting sprayers with larger tank capacities may be more difficult to clean. However, concentrations of final rinsates did not exceed 1.25 ppm (equivalent to 0.12 g ae ha^{-1} at 93.5 L ha^{-1} output) regardless of cleanout method or sprayer and at least 99% of initial dicamba contaminant was removed by the third rinse. Furthermore, fourth rinsates were applied to sensitive soybean and no yield response was observed. These data suggest triple rinse with water is sufficient for dicamba removal from sprayer equipment. To further test efficacy of this protocol, a survey of 25 commercial agriculture sprayers was conducted in 2019. Sprayers were mixed for 15% tank capacity with dicamba (Xtendimax) at 560 g ae ha^{-1} + a drift reduction agent (Intact) at 0.5% v/v and calibrated for a carrier volume of 140 L ha^{-1}. Following applications, four rinses of water were conducted at 15% tank capacity and rinsates were collected from the left, middle, and right sections of the boom at each of the four rinses. Similar to the replicated study, majority of sprayers retained less than 1% of initial dicamba contaminant by the third rinse. Rinsates collected at the fourth rinse did not exceed 0.2 ppm for 88% of the sprayers tested (22 sprayers). The remaining 3 sprayers had concentrations of 0.47 to 1 ppm. However, these concentrations are not likely to induce a plant response. Dicamba clean out efficacy was not affected by tank size and boom length in this survey. Concentrations detected in left, middle, and right sections of the boom did not differ for individual rinses. New dicamba formulation labels require a triple rinse cleanout procedure following applications. These data suggest triple rinse with water is sufficient for dicamba removal regardless of formulation used.

EVALUATION OF FLORPYRAUXIFEN-BENZYL ACTIVITY ON AQUATIC WEEDS IN LOUISIANA RICE AND CRAWFISH PRODUCTION. SY Rustom*, EP Webster, BM McKnight, LC Webster, WB Greer, DC Walker; LSU AgCenter, Baton Rouge, LA (179)

ABSTRACT

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

DICAMBA ANTAGONISM EFFECT ON CONTROL OF ECHINOCHLOA. CM Perkins*[1], LE Steckel[1], TC Mueller[2], M Hay[3], ET Parker[4]; [1]University of Tennessee, Jackson, TN, [2]University of Tennessee, Knoxville, TN, [3]Kansas State University, Manhattan, KS, [4]Syngenta Crop Protection, Vero Beach, FL (180)

ABSTRACT

Junglerice *(Echinochloa colona* L.) and barnyardgrass *(Echinochloa crus-galli)* populations have progressively become more of a pest in soybeans and cotton in recent years in Tennessee and across the Mid-South. The initial thought was glyphosate resistance was present in these populations until recent research found that tank mixing glyphosate and/or clethodim with dicamba was also contributing to poor control. Growers have increasingly reported poor control of junglerice with a tank mixture of dicamba plus glyphosate. Therefore research was initiated that evaluated the effect of typical tank mixtures and other label requirements on glyphosate and clethodim efficacy on junglerice. Both field and greenhouse studies were conducted. The field experiment was replicated across three locations and arranged in a split plot design with nozzle type being Factor A and herbicide treatment representing Factor B. TTI nozzles and AIXR flat fan nozzles were tested in this experiment. The second factor was herbicide treatment and included a non-treated check, glyphosate, clethodim, dicamba, glyphosate + clethodim, glyphosate + dicamba, clethodim + dicamba, and glyphosate + clethodim + dicamba. This field design was replicated in a spray chamber in the greenhouse with the same nozzles and herbicide treatments. Treatments were made on junglerice and barnyardgrass samples collected from fall 2018 with 26 populations from Tennessee. A drift reduction agent (DRA) was applied to dicamba applications to determine its effect on weed control. Applications were made when plants reached .5-10.1 cm (3-4 inches) in height. Junglerice and barnyardgrass control were visually assessed on a scale of 0 to 100% where 0 = no injury and 100 = plant death at 7, 14, 21, and 28 days after treatment. Results indicated that tank mixing dicamba with either glyphosate or clethodim, results in roughly 30% less control. Even without dicamba in the tank, only about 80% control was achieved, on average, with glyphosate or clethodim alone. Another factor in the antagonism situation is using the nozzles labeled for use with Engenia/XtendiMax (TTI nozzles) rather than AIXR (flat fan) nozzles. In addition to the average 30% control loss from dicamba in the tank, we lose an additional 4% control from using these TTI nozzles. The same result is observed when spraying straight glyphosate or clethodim when using the TTI nozzles. In addition, these results showed that utilizing a drift reduction agent (DRA) when spraying dicamba can reduce control on average by 39%. This is believed to be caused by changing the droplet spectra and reducing control on grass weed species. This research suggests that dicamba needs to be left out of the tank and sequential applications of glyphosate and clethodim need to be utilized when controlling the *Echinochloa* complex of weeds. If both Palmer amaranth and *Echinochloa* are present in the field, some preliminary data shows that spraying dicamba followed by glyphosate or clethodim at least 72 hours later provides good control. Splitting applications are time consuming as well as an added cost but it is the best option moving forward to adequately control both Palmer and *Echinochloa*.

WEED CONTROL WITH HALOSULFURON PLUS PROSULFURON APPLIED PRE. FR Kelly*, JA Bond, B Lawrence, HM Edwards, JD Peeples; Delta Research and Extension Center, Stoneville, MS (181)

ABSTRACT

The introduction of acetyl coA carboxylase (ACCase)-resistant rice (*Oryza sativa* L.) cultivars has allowed producers to use alternative herbicide modes of action to combat early-season grass species. Palmer amaranth (*Amaranthus palmeri* S. Wats.) and hemp sesbania [*Sesbania herbacea* (P. Mill.)] are problematic and difficult to control in rice production in the midsouthern U.S. Halosulfuron plus prosulfuron is an acetolactate synthase (ALS)-inhibiting herbicide mixture that has been a viable option for postemergence (POST) control of broadleaf species in rice. Residual herbicides applied preemergence (PRE) are important tools to manage problematic weeds in Mississippi rice production and in recent years saflufenacil applied PRE has been the foundation herbicide treatment for problematic broadleaf weed species. The addition of the halosulfuron plus prosulfuron mixture to saflufenacil could increase the spectrum of broadleaf weed species controlled with PRE treatments in midsouthern U.S. rice production. Therefore, research was conducted to evaluate residual control of broadleaf weeds with PRE applications of different herbicide mixtures in ACCase-resistant rice. Research was conducted in 2019 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to compare broadleaf weed control with different residual herbicides applied PRE. Soil texture was a Sharkey clay with a pH of 7.5 and 2.4% organic matter. The experimental design was a randomized complete block with four replications. Treatments included clomazone (Command) at 420 g ai ha^{-1} alone and in combination with halosulfuron plus prosulfuron (Gambit) at of 55, 83, and 11 g ai ha^{-1}, and saflufenacil (Sharpen) at 50, and 75 g ai ha^{-1} applied at time of planting. A non-treated control was included for comparison of weed control. Visible estimates of above ground rice injury and control of hemp sesbania, Palmer amaranth, and ivyleaf morning glory (*Ipomoea hederacea* Jacq.) were recorded at 14, 21, and 28 d after treatment (DAT). All data was subjected to ANOVA, and estimates of the least squared means were utilized for mean separation with p=0.05 No rice injury was observed at any evaluation. All treatments including halosulfuron plus prosulfuron and/or saflufenacil controlled broadleaf weeds greater than clomazone. Hemp sesbania control 21 and 28 DAT with halosulfuron plus prosulfuron at 11 g ai ha^{-1} was greater than with the two lower rates of halosulfuron plus prosulfuron and saflufenacil at 75 g ai ha^{-1}. The addition of either rate of saflufenacil to halosulfuron plus prosulfuron did not improve hemp sesbania control 21 and 28 DAT compared with halosulfuron plus prosulfuron alone. All treatments that included halosulfuron plus prosulfuron controlled ivyleaf morningglory = 96% 21 and 28 DAT. Saflufenacil at 50 and 75 g ai^{-1} controlled less ivyleaf morningglory than all treatments with halosulfuron plus prosulfuron. Palmer amaranth control 21 and 28 DAT was greater with any treatment containing saflufenacil compared with halosulfuron plus prosulfuron at 55 and 83 g ai ha^{-1}. By 28 DAT, only treatments with saflufenacil controlled Palmer amaranth = 80%. The suggested treatment for residual control of Palmer amaranth in Mississippi rice production is saflufenacil at 50 g ai ha^{-1} mixed with glyphosate and clomazone. These data indicated that saflufenacil at 50 g ai ha^{-1} alone or in mixture with halosulfuron plus prosulfuron provided better control of Palmer amaranth than halosulfuron plus prosulfuron at 55 and 83 g ai ha^{-1}. However, treatments containing halosulfuron plus prosulfuron controlled more hemp sesbania and ivy-leaf morning-glory than saflufenacil at 50 g ai ha^{-1}. Mixture of halosulfuron plus prosulfuron with saflufenacil were required for control of all three species evaluated. Although PRE applications containing halosulfuron plus prosulfuron and saflufenacil could be cost prohibitive, this treatment would provide residual control of broadleaf weeds common in Mississippi rice.

EFFECT OF NOZZLE SELECTION ON WEED CONTROL AND YIELD IN MISSISSIPPI COTTON. JS Calhoun*, JC Ferguson, KL Broster, LH Merritt, MT Wesley Jr.; Mississippi State University, Mississippi State, MS (182)

ABSTRACT

Field studies were conducted at two locations in Mississippi to understand the effect of nozzle type and herbicide application timing on weed control in cotton. Studies also compared applications made with an eight-nozzle tractor sprayer compared to a four-nozzle backpack sprayer. Herbicide applications were made at four different timings: preemergence (PRE), early post (EPost), early-mid post (EMpost), and late post (LPost) corresponding to the preemergent, 2-3 leaf, 4-6 leaf, and match head square stages respectively. Treatments included a standard herbicide treatment (140 L ha^{-1}) applied at each growth stage, with the nozzle and sprayer as variables by each timing. Results indicated no differences in treatments applied with backpack and tractor mounted sprayers. Also, no differences were observed between nozzle types used. Differences were observed among herbicide application timing. Treatments receiving a PRE followed by an EPOST followed by a LPOST averaged 95 and 96 percent broadleaf and grass control across all nozzle and sprayer types, respectively. Control for this system was not significantly different from treatment receiving an EPost and LPost treatments only where control for broadleaf and grass species was 94 and 93 percent, respectively. Both programs produced greater control compared to the EMPost only treatments, which averaged 88 and 83 percent broadleaf and grass control. Herbicide application timing was also significant with respect to cotton yield with treatments receiving EPost and LPost treatments yielding greater than the other two programs. Differences however may be attributed to crop injury caused by acetochlor PRE in 2019. Literature has documented cotton growth reduction caused by acetochlor applied PRE during unfavorable growing conditions.

COMPARISON OF FALL VS SPRING HERBICIDE APPLICATIONS FOR WINTER WEED CONTROL IN PASTURES. WC Greene*; Virginia Tech, Blacksburg, VA (183)

ABSTRACT

Weed control in pastures is a critical component of any high producing forage system. Herbicidal control of weeds is often one of the most effective and economical methods to control certain weed species. Timing of herbicide application is critical for maximizing weed control and thus maximizing economic return. Studies were conducted in Blacksburg and Amelia County, Virginia in order to determine whether herbicide applications are more effective on winter weed control when made in late fall versus early spring. Herbicide applications were made on November 16, 2018 and April 24, 2019 in Blacksburg and November 19, 2018 and April 17, 2019 in Amelia County. Herbicide treatments consisted of: 1) florpyrauxifen-benzyl + 2,4-D, (2) aminopyralid + 2,4-D, (3) 2,4-D + dicamba, (4) 2,4-D, (5) 2,4-D + triclopyr, (6) metsulfuron, and (7) triclopyr + fluroxypyr applied in the fall and spring. A randomized complete block design with four replications was utilized. Visible control data were subject to ANOVA and subsequent means separation was performed using Fisher's Protected LSD (a=0.05). Contrast statements were performed in order to determine the effect of application timing on herbicide efficacy. For the fall herbicide treatments, all treatments other than 2,4-D + dicamba, 2,4-D alone, and triclopyr + fluroxypyr provided greater than 75% visible control of bulbous buttercup (*Ranunculus bulbosus*) 90 days after application. Mouseear chickweed (*Cerastium fontanum*) control was greatest with aminopyralid + 2,4-D (88%). All treatments other than florpyrauxifen-benzyl + 2,4-D (0%), resulted in greater than 93% white clover injury. At 150 days after fall herbicide application all herbicide treatments provided greater than 80% bulbous buttercup control. White clover injury was least with florpyrauxifen-benzyl (1%) and 2,4-D alone (12%). At 210 days following fall herbicide applications florpyrauxifen-benzyl + 2,4-D, aminopyralid + 2,4-D, and 2,4-D + dicamba provided the most buttercup control with 87%, 95%, 82% control, respectively. For the spring applied herbicide applications, all treatments provided greater than 95% bulbous buttercup control 30 days after application. Stickweed control was greatest with aminopyralid + 2,4-D (100%) and 2,4-D + dicamba (100%). Horsenettle control was greatest with aminopyralid + 2,4-D (99%) and 2,4-D + dicamba (88%). All herbicide treatments resulted in greater than 88% white clover injury other than florpyrauxifen-benzyl (0%). At 90 days following spring herbicide applications, all treatments resulted in greater than 83% bulbous buttercup control. Horsenettle control was greatest with aminopyralid + 2,4-D (100%) and 2,4-D + dicamba (88%). All herbicide treatments other than florpyrauxifen-benzyl (0%) resulted in greater than 72% white clover injury. Contrast statements indicated that spring herbicide applications, on average, resulted in greater levels of buttercup control at the end of the season. Tricolpyr + fluroxypyr and 2,4-D provided significantly higher levels of end of season buttercup control when applied in the spring verses the fall. Contrast statements indicate that end of season clover injury was significantly greater with spring applications than fall applications, regardless of herbicide. Metsulfuron, triclopyr + fluroxypyr, 2,4-D, and 2,4-D + dicamba all caused greater end of season white clover injury when herbicides were applied in the spring versus the fall. This research supports that both fall and spring herbicide applications can be effective in managing pasture weeds, and also that white clover has a very high level of tolerance to florpyrauxifen-benzyl + 2,4-D, despite initial injury.

STEWARDSHIP PRACTICES IN XTENDFLEX COTTON AND ECONOMIC ANALYSIS. R Vulchi*[1], J McGinty[2], SA Nolte[3]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Extension Service, Corpus Christi, TX, [3]Texas A&M AgriLife Extension, College Station, TX (184)

ABSTRACT

Herbicide resistant weeds became a menace in cotton production systems in various parts of United States. To battle this menace, third generation herbicide tolerant cultivars with stacked resistance to multiple mode of action were introduced in cotton. The XtendFlex cropping system is a stacked trait system utilizing traits that confer resistance to the herbicides dicamba, glyphosate and glufosinate to improve weed control in soybean and cotton. XtendFlex cotton (DP 1646 B2XF) was introduced in 2015 and is currently 22.3% of 5.4 million hectares of total upland cotton grown throughout the United States. Going back in time, the exceptional success of the second generation herbicide tolerant cultivars at marketplace made the conservation tillage and no-till systems popular. Herbicides slowly replaced the use of different indigenous tillage practices and crop rotation systems for weed control. However, in recent times, weeds resistant to multiple modes of action especially glyphosate, were reported in different parts of the United States. This brought us to a point where the real world weed management practices have to be integrated and tested for their long-term efficacy in terms of weed control, cost effectiveness for market success and sustainability in terms of herbicide resistance management. Therefore, field level research is being carried out at three different locations in Texas for three years integrating three different tillage practices, rotating cotton with sorghum in each tillage and using two different herbicide programs with in-season residuals to provide growers with economic and long term weed control options.

MANAGING BERMUDAGRASS SENSITIVITY TO HERBICIDES WHILE CONTROLLING GOOSEGRASS IN THE TRANSITION ZONE. J Brewer*, JM Craft, S Askew; Virginia Tech, Blacksburg, VA (185)

ABSTRACT

In all bermudagrass (*Cynodon dactylon* (L.) Pers.) turf systems, goosegrass (*Eleusine indica* (L.) Gaertn.) ranks as one of the toughest weeds to control. The need for effective post-emergent herbicide options for goosegrass is vital for these turf areas. Topramezone, registered in 2013 by BASF, has been proven to be an effective goosegrass control option in cool-season turfgrass systems and has recently been labeled in bermudagrass. Unfortunately, bermudagrass is very sensitive to topramezone even at one quarter of the labeled rate in which the injury is observed as bleaching of the foliage. This injury is transient in nature and bermudagrass recovers in 2 to 3 weeks. Like many others around the southeast, we have been working vigilantly at Virginia Tech to find appropriate programs to reduce the severity and duration of this bleaching injury. In the past few years, we began to evaluate programs with topramezone and metribuzin. Our objective has been to evaluate a range of topramezone rates applied with metribuzin to reduce bermudagrass injury while maintaining effective goosegrass control. From 2018 to 2019, a total of 8 bermudagrass tolerance studies and 5 goosegrass control studies have been completed to evaluate topramezone plus metribuzin compared to topramezone alone at various rates. These trials were established at the Turfgrass Research Center and Glade Road Research Facility in Blacksburg, VA. All studies were arranged in a randomized complete block design with 4 replications. Treatments were applied with a CO_2-pressurized sprayer calibrated to deliver 374 L ha^{-1}. Treatments for all studies included topramezone applied at 1.22 g ai ha^{-1}, 3.68 g ai ha^{-1}, and 6.14 g ai ha^{-1} which were mixed with metribuzin applied at 280.2 g ai ha^{-1} and topramezone applied alone at 6.14 g ai ha^{-1} as comparison. All treatments were applied with methylated seed oil at 0.5% V/V. All treatments had secondary applications that occurred 3 weeks after initial. The tolerance studies were rated weekly for 6 weeks with a final rating at 8 weeks and ratings included percent total injury, percent bleaching, and NDVI. The goosegrass control studies were rated at 1, 2, 4, 6 and 8 weeks after initial application and ratings included percent goosegrass cover, percent control, and final plants counts. During all 8 bermudagrass tolerance trials in 2018 and 2019, our recommended program of topramezone applied at 3.68 g ai ha^{-1} plus metribuzin at 280 g ai ha^{-1} injured bermudagrass from 28 to 58% and typically half as much as topramezone applied alone (82 to 99%). Also bleaching from topramezone applied alone ranged from 76 to 99% while the combination with metribuzin bleached bermudagrass from 0 to 38% (in only 1 of 8 studies did we observe greater than 20% bleaching). In 2018, topramezone applied at 3.68 g ai ha^{-1} plus metribuzin at 280 g ai ha^{-1} controlled goosegrass more rapidly than topramezone applied alone at up to 4 weeks after application. By 6 weeks after treatment, both the combination and topramezone alone treatments controlled goosegrass similarly. At the final rating, both treatments controlled goosegrass 97% or greater. In 2019, topramezone plus metribuzin controlled goosegrass greater than topramezone alone for the first 4 weeks after initial application, but by the final rating both treatments controlled goosegrass 96% or greater. Both treatments averaged less than 4 plants m^{-2} remaining in plots at season's end in 2018 and 2019, while the untreated plots averaged 67 and 38 plants m^{-2}, respectively.

PALMER AMARANTH (AMARANTHUS PALMERI) AND THRIPS (THRIPS SP.) CONTROL WITH VARIOUS DICAMBA + INSECTICIDE TANK-MIXES IN COTTON. JP McNeal*[1], DM Dodds[1], AL Catchot[1], J Gore[2], G Kruger[3], LX Franca[1], JJ Williams[1], BJ Norris[1], SD Hall[1], WJ Rutland[1]; [1]Mississippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]University of Nebraska - Lincoln, North Platte, NE (186)

ABSTRACT

In 2018 and 2019, a field experiment was conducted to evaluate the effect of carrier volume and spray droplet size on the efficacy of dicamba + insecticide tank mixtures to control both Palmer amaranth (*Amaranthus palmeri*) and thrips (*Thrips sp.*) in cotton (*Gossypium hirsutum*). This experiment consisted of two field locations: the Delta Research and Extension Center in Stoneville, Mississippi, and Hood Farms in Dundee, Mississippi. Four row plots were planted with a single cotton variety: DP 1646 B2XF, and plot dimensions were 3.9m x 14.2m (Stoneville, MS) and 3.8m x 9.1m (Dundee, MS). Applications were initiated when cotton reached the 4-leaf growth stage. Applications were made with a Capstan Pinpoint Pulse-Width Modulation (PWM) sprayer on a high-clearance Bowman Mudmaster at a speed of 14.5 km hour^{-1}. A single formulation of dicamba: (XtendiMAX® with VaporGrip) applied at 1.5 kg ha^{-1}, and two insecticides: acephate (Acephate 97UP) applied at 0.2 kg ha^{-1} and dimethoate (Dimethoate 4EC) applied at 0.4 kg ha^{-1} were utilized. This experiment utilized two carrier volumes: 140 and 280 L ha^{-1} and two droplet sizes: 200µm and 800µm. Pesticide - Carrier Volume - Droplet Size treatment combinations included [1] dicamba-141 L ha^{-1}-800 µm, [2] dicamba + acephate-141 L ha^{-1}-800 µm, [3] dicamba + dimethoate-141 L ha^{-1}-800 µm, [4] dicamba + acephate-280 L ha^{-1}-800 µm, [5] dicamba + acephate-280 L ha^{-1}-800 µm, [6] acephate-141 L ha^{-1}-200 µm, [7] acephate-141 L ha^{-1}-800 µm, [8] dimethoate-141 L ha^{-1}-200 µm, [9] dimethoate-141 L ha^{-1}-800 µm. Each replication contained both a weed/pest free check in addition to a non-treated control. Visual Palmer amaranth control (0-100) was evaluated at 7, 14, 21, and 28 DAT, and visual cotton injury (0-100) was rated at 7, 14, and 21 DAT. Visual thrips damage ratings (1-5) and thrips counts (immatures) were taken at 1, 3, and 7 days after treatment (DAT). Seedcotton yield was collected using a spindle picker modified for plot research. Additionally, 25 boll -samples were collected prior to mechanical harvest and ginned on a laboratory micro-gin to determine lint turnout. The experimental design was a randomized complete block and data were analyzed using PROC MIXED in SAS v. 9.4. Means were separated using Fisher's Protected LSD at an alpha level of 0.05. In 2018 and 2019, Palmer amaranth was not present at the Stoneville location. Palmer amaranth control varied due to year, and thrips control varied due to both year and location. Therefore, these data were ran by site-year and are presented accordingly. For Dundee, Mississippi in 2018, immature thrips counts 7 days after treatment (DAT) varied due to treatment ($p = 0.001$). All treatments reduced immature thrips at least 62% relative to the non-treated control. Additionally, all treatments resulted in the same level of control as the pest free control. For Stoneville, MS in 2018, immature thrips varied due to treatment ($p = < 0.0001$). All treatments reduced immature thrips at least 90% relative to the non-treated control. Additionally, all treatments resulted in the same level of control as the pest free control. For Dundee, Mississippi in 2018, visual Palmer amaranth control varied due to treatment ($p = <.0001$). All treatments resulted in greater Palmer amaranth control than the non-treated control. Dicamba + acephate or dimethoate applied at 280 L ha^{-1} provided 14% greater Palmer amaranth control than dicamba + dimethoate at 140 L ha^{-1}. For Dundee, Mississippi in 2019, visual Palmer amaranth control varied due to treatment ($p = <.0001$). All treatments resulted in greater Palmer amaranth control than the non-treated control. Additionally, each dicamba + insecticide tank-mix resulted similar levels of Palmer amaranth control as dicamba applied alone. For thrips treatments, seedcotton yield varied due to site year ($p = = 0.0001$) and was at least 72% (3068 kg ha^{-1}) higher in Stoneville than Dundee. Seedcotton yield for Dundee was not obtained in 2019 due to wet conditions at harvest. For Palmer amaranth treatments, seedcotton yield varied due to treatment ($p = 0.0003$). All treatments resulted in higher yields than the non-treated control. Additionally, all treatments resulted in similar yield to the weed-free control. These data indicate that Palmer amaranth and thrips control did not vary due to tank mix, droplet size, or carrier

volume. Therefore, dicamba + insecticide tank-mixes have utility to control Palmer amaranth and thrips in cotton. Finally, while pesticide efficacy was not negatively impacted due to the parameters in this study, these data indicate that Palmer amaranth and thrips control are may not achieved with a single application.

TOLERANCE OF HYBRID BERMUDAGRASSES TO APPLICATIONS OF TOPRAMEZONE AND SPEEDZONE® FOR POSTEMERGENCE GOOSEGRASS (ELEUSINE INDICA) CONTROL. DE Carroll*[1], J Brosnan[2], G Breeden[1], E Reasor[1]; [1]University of Tennessee, Knoxville, TN, [2]Univeristy of Tennessee, Knoxville, TN (187)

ABSTRACT

Topramezone and carfentrazone + 2,4-D + mecoprop-p + dicamba (SpeedZone® EW) are herbicides labeled for postemergence goosegrass (*Eleusine indica* L. *Gaertn.*) control in hybrid bermudagrass (*C. dactylon* x *C. transvaalensis* Burtt-Davy). Field research was conducted in Knoxville, TN during the summer of 2019 to evaluate goosegrass control and turfgrass tolerance with these herbicides applied alone and in mixture. Turfgrass tolerance was assessed on four hybrid bermudagrass cultivars ('Northbridge', 'Tifway','Tahoma 31', and 'TifTuf') at the East Tennessee AgResearch and Education Center. Separate trials were conducted for each cultivar using 1.5 m^2 plots arranged in a randomized complete block design with four replications. Herbicides were applied in all trials on 12 August 2019 using a CO_2-pressurized backpack sprayer calibrated to deliver 281 L ha^{-1} via 8002 nozzles. Treatments included topramezone (12.2 g ha^{-1}), SpeedZone® [carfentrazone (33.6 g ha^{-1}) + 2,4-D (1029 g ha^{-1}) + mecoprop-p (322 g ha^{-1}) + dicamba (91 g ha^{-1})] and SpeedZone® + topramezone (12.2, 6.1, 3.6, or 2.4 g ha^{-1}). A non-treated control was included in all trials for comparison. Turfgrass tolerance was assessed 3, 7, 14, 21, and 28 days after treatment (DAT) via visual ratings of turfgrass injury and measurements of normalized difference vegetation index. All data were analyzed using SAS mixed procedure as a three-way ANOVA. When applied alone, topramezone injured all cultivars (72 to 89%) 7 DAT. Comparatively, SpeedZone® resulted in 14 to 51% injury in all cultivars 7 DAT. Topramezone + SpeedZone®, regardless of rate, was less injurious (14 to 64%) than topramezone alone following treatment to Northbridge, Tahoma 31, and TifTuf 7 DAT. When applied at 12.2 g ha^{-1}, topramezone + SpeedZone® injured Tifway similar to topramezone alone 7 DAT; however, all other topramezone + SpeedZone® mixtures reduced injury by 20 to 31%. By 21 DAT, no differences were detected among herbicides and non-treated control plots of Tifway and Tahoma 31. A similar response was observed on Northbridge with all treatment effects dissipating by 28 DAT. On TifTuf, injury with mixtures of topramezone + SpeedZone® persisted through the termination of the study. This response may be the result of TifTuf tolerance to SpeedZone® applied alone being poor (80% injury 3 DAT). These data highlight that several hybrid bermudagrass cultivars are tolerant to applications of topramezone + SpeedZone® for postemergence goosegrass control.

UNRAVELLING 2,4-D RESISTANCE IN INTERSPECIFIC CHROMOSOME SUBSTITUTION LINES OF COTTON (GOSSYPIUM HIRSUTUM L.). LM Perez*[1], IS Werle[2], S Saha[1], JN Jenkins[3], DM Stelly[4], JF Dean[1], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]MISSISSIPPI STATE UNIVERSITY, Starkville, MS, [3]USDA-ARS, Mississippi State, MS, [4]Texas A&M University, College Station, TX (188)

ABSTRACT

Numerous herbicide-resistant weeds have arisen due to the intense selection caused by excessive use of glyphosate and glyphosate-resistant crops. Given that most glyphosate-resistant weeds can be controlled with 2,4-dichlorophenoxyacetic acid (2,4-D), we have screened cotton germplasm to identify novel herbicide resistance genes effective against 2,4-D. Although wild cotton species have long been known to harbor novel genetic variation, conventional breeding with interspecific germplasm has resulted in little tangible success at the cultivar level. Chromosome substitution (CS) is an alternative breeding method whereby interspecific germplasm is introgressed into a common genetic background, usually before trait evaluation. Here, we report the discovery of potential sources of gene(s) for 2,4-D tolerance by screening Upland CS lines. Each of the 50 CS lines of *G. barbadense* L. (CS-B), *G. tomentosum* Nuttal ex Seeman (CS-T), and *G. mustelinum* Meers ex Watt (CS-M), in the genetic background of *G. hirsutum* L. Texas Marker-1 (TM-1) were screened for resistance to a field-recommended rate (1.12 kg ai ha^{-1}) of 2,4-D in a completely randomized design with sub-sampling ($r=3$) in the greenhouse, and in a randomized complete block design ($r=4$) in two field sites, Starkville and Pontotoc MS. Injury from 2,4-D applied in the greenhouse at two weeks after seedling emergence ranged from 25-100% at 7-21 days after application (DAA). The seven lines CS-T04-15, CS-B12, CS-B15sh, CS-T04, CS-B22sh, CS-T07, and CS-B04-15 exhibited the lowest injury levels, possibly indicating the presence of 2,4-D tolerance gene(s). Under field conditions, CS-T04-15 and CS-B15sh consistently showed the lowest injury when 2,4-D was applied at 4 and 7 weeks after emergence of cotton seedlings. Progenies of CS-B15sh exhibited a 50% reduction in injury compared to TM-1 (97%) and UA48 (78%) at 21 DAA. Molecular analyses are underway to find markers possibly associated with tolerance to 2,4-D in cotton. Findings from this study could help discover novel 2,4-D tolerant cotton germplasm that can be used for breeding and genetic improvement, and ultimately reducing herbicide injury due to spray drift and improving weed management options in Upland cotton cultivation.

CURRENT LEACHATE COMPETITION STUDY IN POA ANNUA AT CLEMSON UNIVERSITY.

JW Taylor*; Clemson University, Clemson, SC (189)

ABSTRACT

Current programs implemented to control annual bluegrass (*Poa annua* L.), a troublesome weed in managed turfgrass systems, predominately rely on using herbicides. Control has become more challenging with annual bluegrass developing herbicide resistance to the major herbicides used in turf systems. Therefore, alternative cultural practices, such as turfgrass species and variety selection, need to be evaluated and developed to combat herbicide resistance. Greenhouse studies at Clemson University are being conducted to determine whether soil leachate collected from selected turfgrasses affect germination of annual bluegrass seed. Leachate was collected from four lysimeters of each treatment. Leachate treatments included: centipedegrass, St. Augustinegrass, fertilized (without any turf species) control, and nonfertilized (without any turf species) control. To determine if germination is affected by turfgrass leachates, annual bluegrass is germinated in Petri dishes containing 8 mL of a turfgrass leachate solution, control leachate solution, or a distilled water treatment. Moisture is replenished at 7 and 14 d after initiation (DAI) by adding 3 mL of the corresponding solution to each Petri dish. At 7, 14, and 21 DAI germination is recorded, seedlings considered to be germinated upon radicle or coleoptile emergence from the caryopsis, removing germinated seedlings after counting. Compared to fertilized and non-fertilized controls, centipedegrass and St. Augustinegrass leachates did not have an impact on annual bluegrass germination.

DOES HIGH USE OF S-METOLACHLOR ACCELERATE DEGRADATION OF S-METOLACHLOR APPLIED THEREAFTER? J Kouame*[1], R Grewe[2], E Grantz[2], MC Savin[1], C Willett[2], N Burgos[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Akansas, Fayetteville, AR (190)

ABSTRACT

Residual herbicides are necessary tools for effective management of recalcitrant and resistant weeds. Therefore, accelerated degradation of residual herbicides is a major concern as it reduces herbicide effectiveness. A field experiment and an incubation study were conducted in summer 2019 to evaluate the effect of prior within-season field applications of *S*-metolachlor on herbicide dissipation in spiked soils. The field experiment was conducted at the University of Arkansas, Fayetteville on a Captina silt loam soil using a randomized complete block design with 4 replicates. Four treatments were tested: preemergence followed by postemergence (PRE *fb* POST), preemergence only (PRE), postemergence only (POST), and a nontreated control. Soil samples were collected from each plot, 57 and 34 d after PRE and POST application, respectively. Soil samples were sieved, spiked with 0.94 ppm of analytical grade *S*-metolachlor on the same day, and incubated in the growth chamber in duplicates at 25°C and 100% relative humidity. The concentration of *S*-metolachlor in spiked soil was analyzed at seven time points (0, 1, 4, 7, 14, 28, 56 d after spiking) using a triple quadrupole GCMS. Experimental data was fitted to the Single First Order and the Gustafson and Holden biphasic models. Model selection was done using information criterion and the goodness of fit evaluated with the root mean square error (RMSE). Results showed that *S*-metolachlor dissipation was most appropriately described by the biphasic with the lowest AICc values. RMSE values for the top model ranged from 6.2 to 8.3. Prior application of the herbicide in the field in the same season did not accelerate the dissipation of *S*-metolachlor in spiked soil. Key words: *S*-metolachlor, dissipation, half-life, model

EARLY PREDICTION OF COMPETITIVE INTERACTIONS BETWEEN ITALIAN RYEGRASS AND WHEAT USING UNMANNED AERIAL SYSTEMS. BB Sapkota*, V Singh, MV Bagavathiannan; Texas A&M university, College Station, TX (191)

ABSTRACT

Italian ryegrass (*Lolium perenne* ssp. *multiflorum*) is a highly competitive weed in winter wheat (*Triticum aestivum*), severely affecting its growth and yield. Estimation of ryegrass infestation in wheat fields and early prediction of its impact on wheat grain yield can assist farmers with management decision making. In this study, digital images obtained using an unmanned aerial system (UAS) (DJI Phantom 4) at an early wheat growth stage was utilized for predicting end-of-season ryegrass biomass and seed production as well as wheat biomass and yield impact. The experiments were conducted at two field sites near College Station, Texas during 2018-2019. Artificial Neural Networks were used to detect and map ryegrass infestation in wheat. The field distribution and coverage (%) of ryegrass estimated using image analysis was regressed against end-of-season above-ground biomass and seed yield of ryegrass and wheat to develop predictive models. The models developed in this research showed high to very high prediction accuracies, with r^2 values of 0.87, 0.74, 0.72, and 0.69 for ryegrass biomass, ryegrass seed yield, wheat biomass, and wheat yield reduction (%), respectively. Results show that UAS imagery collected using early-season can be utilized to reliably predict competitive outcomes between ryegrass and wheat.

HOW DO REDUCED RATES OF FLORPYRAUXIFEN APPLIED TO SOYBEAN AFFECT SOYBEAN YIELD COMPONENTS? DC Walker*[1], EP Webster[1], DO Stephenson[2], BM McKnight[1], SY Rustom[1], LC Webster[1], WB Greer[1]; [1]LSU AgCenter, Baton Rouge, LA, [2]LSU Ag Center, Alexandria, LA (192)

ABSTRACT

In the Southern United States, there are many areas where rice (*Oryza sativa* L.) and soybean [*Glycine max* (L.) Merr.] are grown in close proximity. Many of the herbicides used in rice or soybean are only labeled for one crop and can be injurious to other crops. Due to this, there are many instances where herbicide applications move off-target and deposit on susceptible vegetation. Florpyrauxifen-benzyl is a synthetic auxin that has activity on select broadleaf, grass, sedge, and aquatic weeds in rice. Soybean have shown to be extremely susceptible to off-target florpyrauxifen deposition, like other synthetic auxin herbicides. Therefore, a study was conducted to determine the impact of application timing and florpyrauxifen rate on soybean yield components. Treatments were arranged in a 2-factor factorial, with factor A consisting of application timing at either the V4 to V5 or R1 to R2 growth stage and factor B consisting of a rate titration of florpyrauxifen to simulate a range of concentrations that may deposit on susceptible soybean. Rates were based off of the full labeled rate of 29.44 g ai ha^{-1}. Florpyrauxifen rates used were: 1/4x, 1/16x, 1/64x, 1/256x and 1/1024x of the previously mentioned full labeled rate. Dicamba was also included in the study at two known rates that cause injury and yield reduction to compare to florpyrauxifen. The dicamba rates used were 7.085 g ae ha^{-1} (1/32x) and 0.227 g ae ha^{-1} (1/1000x) of the full labeled rate of 226.72 g ae ha^{-1}. Herbicide applications were made using a CO_2 pressurized backpack sprayer calibrated to deliver 140 L ha^{-1} of spray solution. Individual yield components including: total branch length, branch number, node number, reproductive node number, pod number, seed number, and seed size were counted and measured at physiological maturity of the NTC. Results indicated that yield components were affected up to the 1/256 rate with decreases in total branch length, pod number and seed number occurring as well. However, 1/4x and 1/16x rates of florpyrauxifen applied to soybean were the only rates that affected all the measured yield components. These two rates resulted in complete plant death and were responsible for many negative effects including completely stopping seed production. This research suggests that florpyrauxifen applied near soybean has a high potential to cause significant damage to yield components. Growers should consider environmental conditions and use properly calibrated equipment before making an application of florpyrauxifen.

EFFECT OF FOUR WINTER COVER CROP SPECIES AND TERMINATION TIMING ON WEED SUPPRESSION, SOIL MOISTURE, AND YIELD IN COTTON. SL Samuelson*[1], MV Bagavathiannan[2]; [1]Texas A&M University, Bryan, TX, [2]Texas A&M University, College Station, TX (193)

ABSTRACT

Cover cropping has witnessed limited adoption in South Texas, despite long growing seasons and continued accumulation of heat units after cash crop harvest. Some of the major limitations for cover crop adoption include a general lack of knowledge to facilitate cover crop selection, insufficient biomass production of covers prior to cash crop planting in spring, and perceived soil moisture depletion caused by cover crop growth, which may affect subsequent cash crop yield. The objectives of this study were to determine the effect of four winter cover crop species (triticale, oat, shield mustard, and Austrian winter pea) and termination timing (6-weeks, 4-weeks, and 2-weeks prior to cotton establishment) on cover crop biomass production, weed suppression, soil moisture dynamics, and cotton performance. The study was conducted from fall 2018 to fall 2019 at two locations: The Texas A&M University Research Farm, College Station, TX and the Stiles Foundation Farm, Thrall, TX. Cover crop termination timing had significant impact on biomass production, cotton stand establishment, and lint yield. Terminating cover crops 2-weeks prior to cash crop planting had a positive long-term effect on soil moisture. Triticale and oat provided substantial suppression of early summer annual weeds through live biomass, and provided additional weed suppression through residue cover after termination. The knowledge generated from this study will be helpful for making informed decisions on cover crop species selection and termination timing based on production goals.

MAKING A BETTER GLUFOSINATE: IMPROVING EFFICACY AND ALLEVIATING ENVIRONMENTAL VARIABILITY. JK Norsworthy, GL Priess*; University of Arkansas, Fayetteville, AR (194)

ABSTRACT

Glufosinate efficacy is variable due to changes in light intensity, humidity, droplet size, and weed size. To improve the consistency of glufosinate, alleviating one or multiple of these application parameters will likewise improve efficacy and provide a more sustainable herbicide. Glufosinate metabolism has been documented in more than 20 weed species. When analyzing the molecular structure of glufosinate, and the common glufosinate metabolites produced by weeds, it can be hypothesized that plant detoxification of glufosinate may be accomplished by glutathione S-transferase enzyme(s). Therefore, a field experiment was conducted in Fayetteville, AR, in 2019, to assess the efficacy of glufosinate in addition with a broad-spectrum glutathione S-transferase inhibitor (4-chloro-7-nitro benzofurazan (NBD-CL) in low-light conditions. Glufosinate was applied alone and in combination with NBD-CL to 100-cm tall Palmer amaranth at 10 pm. The addition of NBD-CL to glufosinate resulted in 100% control of Palmer amaranth when applied at 10 pm. The addition of NBD-CL to glufosinate increased glufosinate efficacy by 26 and 40 percentage points, when compared to glufosinate alone at 10 am and 10 pm, respectively. The addition of a metabolic inhibitor to glufosinate increased the efficacy of the herbicide when applied in low-light conditions. Reduction in the light dependency of glufosinate can be attributed to the increase in stability of the herbicide molecule in the plant for a lengthened period. The addition of a metabolic inhibitor to glufosinate may improve the utility, decrease application parameters, and ultimately increase the sustainability if increased metabolism via glutathione S-transferase is the primary mechanism for resistance development.

CROP INJURY EVALUATION OF MID-SEASON APPLICATIONS OF PPO INHIBITOR HERBICIDES WITH DIFFERENT SURFACTANTS ON PEANUT. KJ Price*, S Li, FB Browne, RD Langemeier; Auburn University, Auburn, AL (195)

ABSTRACT

Due to the prevalence of ALS-inhibitor resistant weeds such as Palmer amaranth, more PPO-inhibitors are being utilized to control weeds in peanuts. Some PPO-inhibitors, such as carfentrazone and lactofen, are often used as late-season clean up options since they have short pre-harvest interval. However, PPO-inhibitors often cause crop injury or foliar burns. This issue can be further compounded by different surfactants, application timings, and interactions with environmental stresses, especially at the peanut reproductive stages. Studies were conducted in Henry and Escambia counties in AL in 2018 and 2019. The objectives evaluated were threefold, 1) the effect of PPO-inhibitor based treatments on dryland peanut growth and yield when applied during sensitive reproduction stages 60 (R4-R5), 75 (R6), and 90 days (R6-R7) after planting (DAP) and 2) study the role of surfactants and chloroacetamide herbicides on peanut injury. At 60 DAP, tank mixes of lactofen and 2,4-DB with pyroxasulfone, *S*-metolachlor, dimethenamid-P with high surfactant oil concentrate (HSOC) or non-ionic surfactant (NIS) were applied at recommended labeled rates. At 75 DAP tank mixes of lactofen, carfentrazone-ethyl, acifluorfen plus 2,4-DB with NIS or HSOC, were applied at 1) the recommended labeled rates and 2) 1.5 times over the label rate. At 90 DAP tank mixes of 2,4-DB, carfentrazone-ethyl, lactofen were applied at the highest labeled rates with either HSOC or NIS. Visual injury ratings were conducted at approximately 14, 21, and 28 days after treatment. Yield was collected at the end of the growing season. Results showed peanuts are more sensitive 75 days after planting to PPO inhibitors in combination with HSOC than any other application timing. Yields losses ranged from 20-31 % with carfentrazone-ethyl 52 g ai ha^{-1} + 2,4-DB 420 g ai ha^{-1} + HSOC 0.9 % v/v causing the most significant yield loss among all treatments evaluated. Treatments with chloroacetamides applied 60 days after planting did not cause a significant yield loss relative to the non-treated check (NTC). Carfentrazone-ethyl at 35 g ai ha^{-1} + 2,4-DB at 420 g ai ha^{-1} + HSOC 0.75% v/v applied at 90 DAP caused a 16% yield reduction compared to the NTC over both locations in 2018-19. Overall, treatments with HSOC and/or carfentrazone-ethyl were more likely to cause significant injury, as well as yield loss than treatments with NIS. Peanuts are most sensitive to injury from PPO-inhibitor herbicides at 75 days after planting (around R6 growth stage).

SURVEYING THE USE AND EFFICACY OF GLUFOSINATE IN NORTH CAROLINA ROW CROPS. EA Jones*[1], W Everman[1], RG Leon[1], CW Cahoon[2]; [1]NC State University, Raleigh, NC, [2]Virginia Tech, Painter, VA (196)

ABSTRACT

Glufosinate resistance has yet to evolve in any broadleaf weed globally. However since many broadleaf weeds, such as *Amaranthus palmeri* (Palmer amaranth) exhibit multiple herbicide resistance, glufosinate may be applied more extensively to control herbicide-resistant weeds. If this is indeed the fate for weed control, the evolution of glufosinate resistance is inevitable. Determination of farmer's glufosinate use was assessed by handing out a survey at the row crop extension meetings in the winter of 2019. The results of the survey indicated that farmers are using glufosinate for resistance management (48%), while some farmers were solely relying on glufosinate for weed control (17%). The surveyed farmers also responded that glufosinate was primarily applied at EPOST (25%), while applications of POST (10%) and EPOST+POST (15%) were represented. The descriptive statistics were used to construct an experiment to determine the control and fecundity of weeds when only glufosinate was applied in soybeans. The herbicide programs included applications of glufosinate at the following timings: EPOST, POST, LPOST; EPOST followed by (fb) POST; EPOST fb LPOST; POST fb LPOST; EPOST fb POST fb LPOST; nontreated. EPOST (98%) was the most efficacious single application followed by POST (73%) then LPOST (53%). Herbicide programs with two or three glufosinate applications controlled at least 90% of weeds. Plants surviving the POST and LPOST glufosinate applications produced the same amount of seeds as the nontreated plants (2000 seeds plant^{-1}). Plants surviving the EPOST fb LPOST (700 seeds plant^{-1}) and POST fb LPOST (170 seeds plant^{-1}) programs produced less seeds than the nontreated Palmer amaranth plants. Plants treated EPOST did not produce any seeds. The results of the experiment provide clear evidence that weeds can survive while remaining fecund with some application timings of glufosinate. Thus, farmers must realize that the evolution of glufosinate resistance will be accelerated if applications are untimely and no other control tactics are utilized.

ASSESSMENT OF COMMERCIAL SCALE DICAMBA AND 2,4-D DRIFT USING DRIFT REDUCING ADJUVANTS. RJ Edwards*[1], SA Fredericks[1], LC Magidow[1], JV Gednalske[1], GK Dahl[2]; [1]WinField United, River Falls, WV, [2]Winfield United, Eagan, MN (198)

ABSTRACT

Off target movement of dicamba and 2,4-D herbicides must be minimized by pesticide applicators using technologies effective in reducing the off target movement. Off target dicamba movement has been shown to be reduced when drift reducing adjuvants are added to spray mixtures. With the commercialization of the new 2,4-D technologies, drift reduction when combined with tank-mixtures and adjuvants required investigation. A commercial scale sprayer was used to assess the effects of different drift reducing materials when applied in windy field conditions. Data were collected downwind using repeated horizontal transects, air samplers and NDVI images from a fixed wing drone. Results showed drift reductions when paired with adjuvants were specific to the two chemistries tested. With dicamba, off target drift was greater than with 2,4-D regardless of adjuvant addition. When adjuvants were added to tank mixtures, visible reductions in off target movement were achieved.

IMPORTANCE OF NOZZLE SELECTION FOR GROUND AND AERIAL HERBICIDE APPLICATIONS. TR Butts*; University of Arkansas System Division of Agriculture, Lonoke, AR (199)

ABSTRACT

Spray nozzles are vital components for every herbicide application as they are the final piece of equipment that an applicator can manage which will influence application effectiveness. Nozzles play a role in droplet size formation, flow rate, spray overlap and coverage, and numerous other dynamics. As a result, nozzle selection is a critical management decision for every herbicide application from both ground spray equipment and agricultural aircraft. Multiple experiments were conducted to evaluate nozzle effects on the effectiveness of herbicide applications. The objective of these research projects was to assist applicators with nozzle selection decisions by identifying those nozzles and application practices which increase coverage, spray uniformity, and weed control. Results revealed several important considerations for selecting nozzles across application setups. Droplet size played a crucial role in weed control from several herbicides, contact and systemic, requiring appropriate nozzle selection to maximize efficacy. Nozzle selection for pulse-width modulation sprayers was uncompromising as results showed non-air-inclusion nozzles caused droplet size and tip pressure irregularities. Additionally, due to the large payload capacity of current agricultural aircraft, spray pressure and airspeed are difficult to manage; therefore, careful selection of nozzles is required for agricultural aircraft to influence spray droplet size. Changing nozzles on agricultural aircraft influenced effective swath width, overlap, and spray coverage. Overall, proper nozzle selection is dependent on the application type, equipment used, and other applicator requirements such as drift management and spray coverage. Applicators should take care to appropriately select a nozzle type for their specific application situations.

QUANTIFICATION OF SOYBEAN RESPONSE TO DICAMBA PARTICLE DRIFT AND VAPOR.

FB Browne*, S Li, KJ Price, RD Langemeier; Auburn University, Auburn, AL (200)

ABSTRACT

Increased usage of dicamba following commercialization of crops with engineered resistance has led to unprecedented numbers of drift complaints across the US. Particle drift and volatilization of dicamba have been targeted as primary sources of off-target movement. In order to compare soybean response at early bloom to dicamba particle drift and vapor, field studies were conducted in Macon County, AL and Lincoln County, NE. Broadcast applications of dicamba at 0.03, 0.14, 0.70, 3.51, 14.04, 35.07, and 140.28 g ae ha^{-1} were used to simulate particle drift in 2017, 2018, and 2019. Vapor drift was simulated through plastic tunnels placed over two rows of soybean to concentrate vapor emitted from soil pans treated with dicamba at 0.56, 5.59, 56.42, 559.17, 5591.75, and 11183.51 g ae ha^{-1} in 2018 and 2019. Visual injury was recorded 7, 14, 21, and 28 days after treatment (DAT) in addition to yield at harvest. Dicamba particle drift was more injurious to soybeans as compared to vapor. Visual injury resulted from particle drift ranged from 3% to 100% across site-years. However, soybean visual injury resulted from vapor exposure did not exceed 55% regardless of dosage. The lowest rate of dicamba particle drift to result in soybean yield loss across all site-years was 1.4 g ae ha^{-1}. Alternatively, vapor emitted from the highest rate of dicamba tested at 11183.51 g ae ha^{-1} did not result in soybean yield loss relative to the nontreated control. Nonlinear regression suggests yield was highly responsive to dicamba particle drift. However, no significant relationship between vapor dosage and yield was observed. Similarly, soybean yield was correlated to visual injury resulted from particle drift and not vapor. These data suggest visual injury is a poor indicator of yield loss. Soybean response to dicamba particle drift is not comparable to vapor.

TWO YEAR ASSESSMENT OF THE INTEGRATED HARRINGTON SEED DESTRUCTOR IN ARKANSAS. T Barber*[1], JK Norsworthy[2], TR Butts[1], N Pearrow[3]; [1]University of Arkansas System Division of Agriculture, Lonoke, AR, [2]University of Arkansas, Fayetteville, AR, [3]University of Arkansas System Division of Agriculture, Newport, AR (201)

ABSTRACT

Herbicide resistance continues to increase at alarming levels in Arkansas. Populations of Palmer amaranth that are resistant to 6 herbicide modes of action exist in some areas. In addition, scattered barnyardgrass populations have been found resistant to as many as 5 herbicide modes of action. With the increasing spread of herbicide resistant weeds it is apparent that cultural and mechanical methods are needed in an integrated weed management approach for control of key weed species. The Harrington Seed Destructor was invented by farmer Ray Harrington in Australia. The concept of harvest weed seed control has been adopted by many growers in his region due to the lack of herbicide options for resistant weed species. Through cooperation with Debruin Engineering, a single mill integrated Harrington Seed Destructor was delivered to Newport, Arkansas and installed in the rear of a John Deere 9760 STS combine, equipped with a conventional 30ft draper head, in August 2018. Studies were designed to determine the effectiveness of the integrated Harrington Seed Destructor on Palmer amaranth seed and thus reduction to the soil seedbank. Initial trials indicate that the design of the single mill Harrington Seed Destructor may not suffice in its current form, for Arkansas soybean harvest. Results from first harvest runs with the destructor in 2018 reveal that weed-free soybean can be harvested at normal speeds with no issues. Unfortunately, any moisture from green plant tissue parts in weedy areas of the field end up in the lower chaff fraction and result in the rapid clogging of the seed destructor mill. However, following a killing frost in November of 2018, soybean heavily infested with Palmer amaranth was successfully harvested at 5 mph, which is further indication that all plant vegetation must be dried or desiccated prior to harvest to prevent clogging and allow for adequate destruction of the lower chaff fraction. From 2018-2019, several modifications to the seed destructor were made. First, a newly designed funnel was installed in attempt to increase the steady flow of the lower chaff fraction into the mill. In addition, modifications of the large chaff separator plate were designed to improve separation of large and small chaff residue preventing stems and larger plant parts from entering the cage mill of the destructor. A harvest aid application of paraquat (0.5 lb ai/A) plus sodium chlorate (5 lb ai/A) was made to the field in 2019, 15 days prior to harvest for desiccation of any green plant tissue. Results from 2019 indicate that if at least 95% desiccation of green vegetation occurs, the seed destructor does not clog at slower harvest speeds (3mph). However, if the amount of weed vegetation moving through the combine increases, or if harvest speed is increased, then the potential for clogging the seed destructor also increases. It has been determined that another funnel design will be necessary for successful continuous movement of the lower chaff fraction into the seed destructor. It is also theorized that the addition of a second mill will reduce clogging and increase harvest speed. Trials will continue with the single mill in 2020, with plans to acquire a larger combine (class 9) and evaluate a 2-mill seed destructor system for comparison.

NEW CNF(R) ACTIVATOR ADJUVANT. NA Forbes*; Flotek, Houston, TX (202)

ABSTRACT

Flotek has developed a new activator adjuvant based on proprietary CnF® (Complex NanoFluid) technology, which combines surfactant with a citrus oil to soften the waxy plant cuticle. The microemulsion disperses into the aqueous tank mix as nanodroplets to provide a uniform high coverage of solvent across the foliage surface. The plant-derived oil reversibly softens the wax cuticle to promote uptake of the active across the cuticle, without causing long-term damage to the plant. Field trials in corn, soybeans, and horticulture crops show strong weed control and reduced antagonism between clethodim and acetochlor in volunteer corn. The adjuvant also enhances nutrient uptake and fungicide performance. We will introduce the new adjuvants and show recent greenhouse and field trial results.

WHAT'S NEW FROM SYNGENTA. BD Black*[1], D Bowers[2]; [1]Syngenta Crop Protection, Searcy, AR, [2]Syngenta Crop Protection, Greensboro, NC (203)

ABSTRACT

Tavium® Plus VaporGrip® Technology herbicide is a premix of *S*-metolachlor and dicamba together with VaporGrip® Technology. This combination product received EPA registration in 2019 and provides consistent control of emerged broadleaf weeds and excellent pre-emergence control of grasses and small seeded broadleaves like Palmer amaranth in Roundup Ready 2 Xtend® Soybeans or Bollgard II® XtendFlex® Cotton. Coming soon is Acuron® GT is a premix of *S*-metolachlor, mesotrione, bicylclopyrone, and glyphosate for postemergence use in glyphosate tolerant corn. Upon registration, Acuron GT will provide improved postemergence and residual control of broadleaf weeds while maintaining the high level of crop safety experienced with Syngenta's Halex GT® herbicide. Gramoxone® SL 3.0 is a new formulation of paraquat containing 3.0 lbs. of paraquat active ingredient per gallon. This formulation provides improved cold tolerance over Gramoxone SL 2.0 and containers less than 120 gallons will be sold in SecuraLink™ closed-system packaging for improved handling stewardship. Gramoxone SL 3.0 will be available for use in all burndown, post-directed, and harvest aid applications currently available in Syngenta's paraquat formulation Gramoxone SL 2.0. To provide greater residual control and flexibility in soybean weed management programs, Syngenta has submitted changes to the Dual Magnum® and Dual II Magnum® labels to allow for increases in the maximum seasonal use rates of *S*-metolachlor in soybeans. Upon EPA approval, these changes will also increase the maximum post-emergence single application use rate and reduce the pre-harvest interval from 90 days to 75 days after application. Syngenta's other *S*-metolachlor containing products used in soybean will also align with these changes. *Acuron® GT is not yet registered for sale or use in the United States and is not being offered for sale. Tavium Plus VaporGrip Technology is a Restricted Use Pesticide.*

EVALUATION OF RATE AND TIMING OF HERBICIDE APPLICATION DURING THE ESTABLISHMENT OF A LIVING WHITE CLOVER (TRIFOLIUM REPENS) MULCH FOR FIELD CORN PRODUCTION. NT Basinger*, NS Hill; University of Georgia, Athens, GA (204)

ABSTRACT

With increasing focus on controlling herbicide resistant weeds many producers have turned to annual cover crops to aid in controlling these resistant weeds. Recent studies have suggested that perennial cover crops such as white clover (*Trifolium repens* L.) may have weed control benefits in corn production systems while also providing additional N and stabilizing soil. However, white clover is slow to establish in the fall and winter and winter weeds such as wild radish (*Raphanus raphanistrum* L.), cutleaf evening primrose (*Oenothera laciniata* Hill), and common vetch (*Vicia sativa* L.) often compete with the establishing clover, leaving bare ground areas within the cover crop. Field studies were conducted in the fall and winter of 2018 at the J. Phil Campbell Research and Education Center in Watkinsville, GA and the Southeast Georgia Research and Education Center in Midville, GA. White clover was seeded at each site. Herbicides were applied either as a PRE (pendimethalin; 672.5 g ai ha^{-1}) or POST when clover reached 2-3 trifoliate. POST applications of imazethapyr (70 g ai ha^{-1}), bentazon (840.6 g ai ha^{-1}) flumetsulam (5g ai ha^{-1}; 10 g ai ha^{-1}), or combinations of 2,4-D (105 g ai ha^{-1}), 2,4-DB (1492 g ai ha^{-1}), and flumetsulam (5g ai ha^{-1}). Six weeks after the initial application, a sequential application of bentazon (840.6 g ai ha^{-1}), flumetsulam alone (5 g ai ha^{-1}) and combinations of combinations of 2,4-D (105 g ai ha^{-1}), 2,4-DB (1492 g ai ha^{-1}), and flumetsulam (5 g ai ha^{-1}) were applied over designated plots. Visual ratings for clover injury, and weed control by species were collected at (1, 2, 4, 6, 7, 8, and 10 weeks after initial application). Clover biomass and weed biomass by species was collected prior to field corn planting in the spring. Visual ratings at Midville, GA at 6 weeks after application showed, 94%, 87,% and 83% control of cutleaf evening primrose, and 90%, 88%, and 66% control of wild radish for flumetsulam (10 g ai ha^{-1}), 2,4-D + 2,4-DB + flumetsulam (5 g ai ha^{-1}), and 2,4-D + 2,4-DB respectively. At 10 weeks after application, a single application of flumetsulam (10 g ai ha^{-1}) resulted in 94% control of both cutleaf evening primrose and wild radish. Sequential applications of 2,4-D + 2,4-DB resulted in 97% and 75% control of cutleaf evening primrose and wild radish, respectively at 10 weeks after application. 2,4-D + 2,4-DB + flumetsulam (5 g ai ha^{-1}) resulted in 93 and 97% control of cutleaf evening primrose and wild radish, respectively. All POST applications resulted in greater weed control than the pendimethalin treatment, and clover biomass was unaffected by any herbicide treatment at both sites. At the Midville, GA location single applications of flumetsulam (10 g ai ha^{-1}) or a tank mix of 2,4-D, 2,4-DB and flumetsulam (5 g ai ha^{-1}) and sequential applications of 2,4-D + 2,4-DB were most effective in reducing cutleaf evening primrose and wild radish biomass. At the Watkinsville, GA location no POST option effectively controlled common vetch when compared to the control. Results indicate that all herbicides in the study were safe to use during the establishment of white clover living mulch at both locations and a single application of flumetsulam (10 g ai ha^{-1}) provided the most overall control of cutleaf evening primrose, wild radish, and common vetch.

GLYPHOSATE-RESISTANT JUNGLERICE (ECHINOCHLOACOLONA) FROM MISSISSIPPI AND TENNESSEE:MAGNITUDE AND RESISTANCE MECHANISMS. V Nandula*[1], GB Montgomery[2], A Vennapusa[3], M Jugulam[3], D Giacomini[4], J Ray[1], JA Bond[5], LE Steckel[6], P Tranel[4]; [1]USDA-ARS, Stoneville, MS, [2]Bayer CropScience, Rives, TN, [3]Kansas State University, Manhattan, KS, [4]University of Illinois, Urbana, IL, [5]Delta Research and Extension Center, Stoneville, MS, [6]University of Tennessee, Jackson, TN (205)

ABSTRACT

Recently, several incidents of glyphosate failure on junglerice [*Echinochloa colona* (L.) Link] have been reported in the midsouthern United States, specifically in Mississippi andTennessee. Research was conducted to measure the magnitude of glyphosate resistance and to determine the mechanism(s) of resistance to glyphosate in E. colona populations from Mississippi and Tennessee. ED_{50} (dose required to reduce plant growth by 50%) values for a resistant MSGR4 biotype, a resistant TNGR population, and a known susceptible MSGSpopulation were 0.8, 1.62, and 0.23 kg ae ha $^{-1}$ of glyphosate, respectively. The resistance index calculated from the these ED_{50} values indicated that the MSGR4 biotype and TNGR population were 4- and 7-fold, respectively, resistant to glyphosate relative to the MSGS population. The absorption patterns of ^{14}C]glyphosate in the TNGR and MSGS populations were similar. However, the MSGS population translocated 13% more [^{14}C]glyphosate out of the treated leaf compared with the TNGR population at 48 h after treatment. *EPSPS* gene sequence analyses of TNGR *E. colona* indicated no evidence of any point mutations, but several resistant biotypes, including MSGR4, possessed a single-nucleotide substitution of T for C at codon 106 position, resulting in a proline-to-serine substitution (CCA to TCA). Results from quantitative polymerase chain reaction analyses suggested that there was no amplification of the *EPSPS* gene in the resistant populations and biotypes. Thus, themechanism of resistance in the MSGR population (and associated biotypes) is, in part, due to a target-site mutation at the 106 loci of the *EPSPS* gene, while reduced translocation of glyphosate was found to confer glyphosate resistance in the TNGR population.

RESISTANCE TO CLETHODIM IN ITALIAN RYEGRASS (LOLIUM PERENNE SSP. MULTIFLORUM) FROM MISSISSIPPI AND NORTH CAROLINA. V Nandula*[1], D Giacomini[2], B Lawrence[3], W Molin[1], JA Bond[3]; [1]USDA-ARS, Stoneville, MS, [2]University of Illinois, Urbana, IL, [3]Delta Research and Extension Center, Stoneville, MS (206)

ABSTRACT

Clethodim, an acetyl-CoA carboxylase (ACCase)-inhibiting herbicide, is one of the few postemergence chemical control options available to growers of Mississippi to manage glyphosate and/or other herbicide resistant Italian ryegrass populations. Recently, clethodim failed to adequately control Italian ryegrass populations across Mississippi. A sethoxydim, also an ACCase inhibitor, -resistant Italian ryegrass population from North Carolina was cross-resistant to clethodim. This research characterized the magnitude and mechanisms of clethodim resistance in the Mississippi and North Carolina Italian ryegrass populations via whole-plant herbicide dose response, cross resistance, and metabolism studies, and molecular analysis. Two clethodim-resistant biotypes from Mississippi, MS24 and MS37, were 10- and 4-fold resistant, respectively, relative to a susceptible (SUS1) biotype. A North Carolina biotype, NC21, was 40-fold resistant to clethodim compared to SUS1. Two additional biotypes from North Carolina, NC22 and NC 23, recorded shoot dry weight reduction of only 17 to 30% of nontreated at the highest clethodim dose of 2.17 kg ha^{-1}, (8X). The NC22 biotype was cross-resistant to sethoxydim, fluazifop, quizalofop, and pinoxaden. Metabolic inhibitors such as piperonyl butoxide and 4-chloro-7-nitrobenzofurazan did not affect resistance of MS37, MS51, and NC22 biotypes to fenoxaprop, clethodim, or pinoxaden. The MS37 biotype had three target site mutations, I2041N, C2088R, and G2096A. Another clethodim-resistant biotype from Mississippi, MS51, had only the C2088R substitution. The NC22 and NC23 biotypes had I1781L, I2041N, and D2078G replacements. This study shows that the mechanism of resistance to clethodim in Italian ryegrass from Mississippi and North Carolina is due to target site modifications in the *ACCase* gene leading to broad cross-resistance to other ACCase-inhibiting herbicides.

TARGET SITE-BASED RESISTANCE TO ALS INHIBITORS, GLYPHOSATE, AND PPO INHIBITORS IN A PALMER AMARANTH ACCESSION FROM MISSISSIPPI. V Nandula*[1], D Giacomini[2], W Molin[1]; [1]USDA-ARS, Stoneville, MS, [2]University of Illinois, Urbana, IL (207)

ABSTRACT

Widespread adoption of glyphosate-resistant (GR) crops and the associated use of glyphosate has resulted in evolution of GR weeds in several states of the US including Mississippi. GR Palmer amaranth populations are widespread across the state with some exhibiting multiple resistance to acetolactate synthase (ALS)-inhibiting herbicides such as pyrithiobac. A GR and ALS inhibitorresistant accession was also resistant to the protoporphyrinogen oxidase (PPO)-inhibiting herbicide fomesafen. The PPO inhibitor resistance profile and multiple herbicide resistance mechanisms in this accession were investigated. In addition to fomesafen, resistance to postemergence applications of acifluorfen, lactofen, carfentrazone, and sulfentrazone was confirmed. There was noresistance to preemergence application of fomesafen, flumioxazin, or oxyfluorfen. Molecular analysis of the ALS gene indicated the presence of point mutations leading to single nucleotide substitutions at codons 197, 377, 574, and 653, resulting in proline-to-serine, -arginine-to-glutamine, tryptophan-to-leucine, and serine-to-asparagine replacements, respectively. The resistant accession contained up to 87-fold more copies of the EPSPS gene compared to a susceptible accession. A mutation leading to a deletion of glycine at codon 210 ('G210) of PPO2 gene was also detected. These results indicate that the mechanism of resistance in the Palmer amaranth accession is target-site based, i.e., altered target site for ALS- and PPO-inhibitor resistance and gene amplification for glyphosate resistance.

NO SEED MEANS NO WEEDS OR NO HERBICIDE-RESISTANT WEEDS. T Bararpour*, RR Hale, JA Bond, HM Edwards, JD Peeples; Delta Research and Extension Center, Stoneville, MS (208)

ABSTRACT

Currently, herbicide-resistant weeds present an economic threat to U.S. agriculture. A field study (year 1 out of 5) was conducted in 2019 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate weed management strategies targeting glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) seed production and soil seedbank in Mississippi soybean. Soybean was planted on April 30, 2019 and emerged on May 6. Plot size was 12 m [12 rows (1 m row^{-1})] by 9 m. There were 6 m alleys between each replication. Approximately 18,000 glyphosate-resistant Palmer amaranth seed were broadcasted per plot for uniform Palmer amaranth population per plot as much as possible. The herbicide programs as follows: 1) glufosinate (Liberty) at V2-V3 soybean followed by (fb) V4-V6; 2) glufosinate at V2-V3 fb weed flowering; 3) glufosinate at V4-V6 fb weed flowering; 4) glufosinate at V2-V3 fb V4-V6 fb weed flowering; 5) glufosinate at V2-V3 fb weed flowering fb 14-20 days sequential; 6) glufosinate at V4-V6 fb weed flowering fb 14-20 days sequential; and 7) glufosinate at V2-V3 fb V4-V6 fb weed flowering fb 14-20 days sequential. A nontreated control was included. Before soybean harvest, two one-meter square samples of weed (from 4 center rows of soybean) were harvested (September 24) for recording number of plants, weed above-ground biomass and weed seed production by species per plot. Soybean yield from four-center rows was harvested at maturity (October 4). Glufosinate rate was 0.66 kg ai ha^{-1}. Glyphosate-resistant Palmer amaranth control was 94, 91, 56, 98, 98, 79, and 100% for herbicide program 1 through 7, respectively. Soybean canopy coverage was 76, 85, 78, 89, 89, 80, and 98% from herbicide program 1 through 7, respectively (by August 26). Also, the herbicide program 5 and 7 provided 97 and 99% control of barnyardgrass (*Echinochloa crus-galli*), 99 and 100% control of broadleaf signalgrass (*Urochloa platyphylla*), 100 and 100% control of hemp sesbania (*Sesbania herbacea*), pitted morningglory (*Ipomoea lacunosa*) and prickly sida (*Sida spinosa*), respectively. The visual observation of overall weed (Palmer amaranth, hemp sesbania, pitted morningglory, prickly sida, barnyardgrass, and broadleaf signalgrass) seed production for herbicide program 1 through 7 were 46.8, 15.4, 43.8, 3.6, 0.6, 9.1, and 0.03% as compared to nontreated control, respectively. Number of glyphosate-resistant Palmer amaranth present on September 24 was 1, 4, 16, 1, 1, 10, and 0 m^{-2} and above-ground dry weight was 1.4, 11.3, 56.4, 0.7, 3.6, 10.8, and 0 g m^{-2} for herbicide program 1 through 7, respectively. The nontreated control had 6 m^{-2} glyphosate-resistant Palmer amaranth with above-ground dry weight of 567 g m^{-2}. Glyphosate-resistant Palmer amaranth seed deposition to the soil seedbank was 27; 1,155; 5,784; 102; 456; 972; and 0 seed m^{-2} from the application of herbicide program 1 through 7, respectively. Palmer amaranth seed deposition in nontreated control was 255,347 seed m^{-2}. Soybean yield was 3,598; 4,640; 3,988; 4,237; 4,344; 4,708; and 5,044 kg ha^{-1} for plots that received the application of treatment 1 through 7, respectively. The nontreated control yielded only 1,143 kg ha^{-1}. These results indicate that herbicide application at V2-V3 fb V4-V6 fb weed flowering fb 14-20 days sequential is necessary to stop glyphosate-resistant Palmer amaranth (and other weeds present) seed deposition to the soil seedbank 100%. The results indicate that stopping weed seed deposition to the soil seedbank or stopping/delaying the evolution of herbicide-resistant weeds and preserving the technology or the herbicides may be possible.

CONTROL OF TRASHY GRASS SPECIES IN BERMUDAGRASS (CYNODON DACTYLON) PASTURES. H Quick*[1], JD Byrd, Jr.[1], DP Russell[1], J Belcher[2]; [1]Mississippi State University, Mississippi State, MS, [2]Bayer CropScience, Auburn, AL (209)

ABSTRACT

A field study established in 2019 evaluated seven herbicide combinations for control of knotroot foxtail (*Setaria parviflora*) and Vasey's grass (*Paspalum urvillei*). Eight single or sequential treatments in a randomized complete block design with four reps were applied March 2019 and May 2019 at 140 L/ha with a CO_2 pressurized sprayer. Visual response to herbicides were evaluated up to six months after treatment (MAT). All plots received 1040 g ai/ha of the potassium salt of glyphosate with March applications and 0.25% v/v NIS was included with all applications. Herbicide treatments that resulted in the greatest reduction in weed coverage included indaziflam applied at 44 and 73 g ai/ha alone or tank mixed with metsulfuron methyl + chlorsulfuron at 5.51 + 1.72 g ai/ha. Treatments followed by sequential applications in May of indaziflam at 44 g ai/ha or metsulfuron methyl + chlorsulfuron + diglycolamine salt of dicamba at 5.51 + 1.72 + 560 g ai/ha did not improve control when compared to single applications made in March, nor did indaziflam at 44 g ai/ha applied in May. Pendimethalin at 2130 g ai/ha alone or tank mixed with metsulfuron methyl + chlorsulfuron at 5.51 + 1.72 g ai/ha or metsulfuron methyl + chlorsulfuron + diglycolamine salt of dicamba at 5.51 + 1.72 + 560 g ai/ha did not provide significant reductions in weed coverage. This study will be repeated in 2020 to evaluate efficacy of indaziflam on knotroot foxtail.

EVALUATION OF ALS-INHIBITING HERBICIDES FOR CONTROL OF JOHNSONGRASS IN PASTURES. MB Bertucci*; University of Arkansas, Fayetteville, AR (210)

ABSTRACT

Field trials were conducted in Batesville, AR to evaluate efficacy of several ALS-inhibiting and auxinic herbicides for control Johnsongrass (*Sorghum halepense* L. Pers.) in pasture systems. Herbicides included for this trial included sulfosulfuron (53 and 70 g a.i. ha^{-1}), metsulfuron methyl (12.6 and 16.8 g a.i. ha^{-1}), dicamba + 2,4-D (280 g a.e. ha^{-1} + 804 g a.e. ha^{-1}), aminopyralid + metsulfuron methyl (86.8 g a.e. ha^{-1} + 13 g a.i. ha^{-1}), and nicosulfuron + metsulfuron methyl (49 g a.i ha^{-1} + 5.3 g a.i. ha^{-1}) as well as several combinations of rates and chemicals listed. In all, twelve herbicide treatments were applied and compared to one untreated check. All herbicides were applied postemergence to a dense stand of Johnsongrass when the plants were 50 cm tall. Visual ratings were assessed at six intervals over a three-month period to assess Johnsongrass control relative to an untreated check. Johnsongrass plant heights were measured two times, 7 and 14 days after application. Johnsongrass plant heights were significantly reduced by all herbicide treatments, relative to the untreated check. Sulfosulfuron and tank mixes containing sulfosulfuron at 53 or 70 g ha^{-1} provide excellent control (=90%) of Johnsongrass. In addition, nicosulfuron + metsulfuron methyl (49 g ha^{-1} + 5.3 g ha^{-1}) provided good to excellent control (=80%). Metsulfuron methyl, aminopyralid + metsulfuron methyl, and dicamba + 2,4-D provided unacceptable levels of Johnsongrass control. Finally, no significant increase in Johnsongrass control was detected when tank-mixing sulfosulfuron with any other chemicals included in this trial. Thus, among the selected rates and chemistries, sulfosulfuron and nicosulfuron were the most effective chemicals for control of Johnsongrass.

EVALUATING THE EFFECT OF HEXAZINONE ON BRUNSWICKGRASS IN BAHIAGRASS PASTURES. C Cooper*; University of Florida, Lecanto, FL (211)

ABSTRACT

Brunswickgrass (*Paspalum nicorae* Parodi), sometimes referred to as "Brown seeded paspalum", is a problematic weed in summer perennial grass pastures in the southeast. In Florida we have seen increasing pressure to control this weed contaminate as it is becoming a major threat to livestock and bahiagrass seed industries. This rhizomatous grass is refused by cattle and seed could potentially restrict sales of contaminated bahiagrass seed lots. Currently, management options are limited; therefore, the objective of this research is to develop a management plan for Brunswickgrass in Bahiagrass seed production fields. Two experiments are currently underway with one being a continuation of a two-year titration study and the other focusing on application timing. Experiments were established at various locations within Citrus, Sumter and Pasco counties in 2018 to address Brunswickgrass response to the application of hexazinone at 0.14, 0.28, 0.56, 0.84, and 112 kg ai ha^{-1} . In 2019, an application timing study was established assessing control differences between month and rate. Applications were made monthly starting in May until September at rates of 0.56, 0.84, and 1.12 kg ai ha^{-1}.. In the titration study, hexazinone appears to have significant activity. With an application of 0.56 kg ha^{-1} e 80% Brunswickgrass control was achieved. When the rate was increased to at least 0.84 kg ha^{-1} control increased to at least 94%. During the timing study, percent control increased as application timing was delayed. In May 64% control was achieved across all treatment rates and locations, while percent control increased to 95% in September.

USE OF NITROGEN FERTILIZER AS A CARRIER FOR SMUTGRASS CONTROL WITH HEXAZINONE. BA Sellers*, J Noel; University of Florida, Ona, FL (212)

ABSTRACT

Smutgrass species (*Sporobolus indicus* and *Sporobolus jaquemontii*) have been problematic perennial tussock-forming grass weeds in perennial grass pastures of Florida since the 1950s. Hexazinone is the only selective herbicide that can control these smutgrass species. However, control of these smutgrass species can be challenging with this herbicide due to the interaction of hexazinone and the environment. For example, hexazinone applied prior to less than 6 mm and greater than 76 cm of rainfall often results in limited smutgrass control. As a result, many cultural techniques prior to hexazinone have been explored, but neither mowing, burning, nor roller-chopping smutgrass infested pastures prior to application of this herbicide has been beneficial. Similarly, grazing smutgrass prior to applying hexazinone does not increase control when using this herbicide. The use of nitrogen, specifically urea ammonium nitrate (UAN; 32%), as a herbicide carrier for hexazinone applications has not been investigated. Experiments were conducted in two different pastures near Ona, FL in 2019. A factorial arrangement of treatments included hexazinone at 0.56 and 1.12 kg ha^{-1} and nitrogen at 0 and 56 kg ha^{-1}; a non-treated check (with and without 32% UAN) was included for comparison. Treatments were applied in mid-July using a PTO-driven tractor sprayer calibrated to deliver 280 L ha^{-1}. Each treatment combination was replicated 4 times in a randomized complete block design. Visual estimates of smutgrass control were recorded from each plot at 60 days after treatment (DAT). A line-transect was established within each plot prior to the experiment to determine the number of live plants at the start of the experiment and at 60 DAT. The number of live plants at 60 DAT was converted to a percent by comparing with the initial density within each plot. The main effects of hexazinone and nitrogen as well as the hexazinone x nitrogen interaction were significant for visual estimates of smutgrass control. The interaction of nitrogen with hexazinone was evident only at the low rate of hexazinone, and smutgrass control was 1.4-times greater when nitrogen was used as a carrier. For the main effect of hexazinone, smutgrass control was 1.2-times greater when applied at 1.12 vs. 0.56 kg ha^{-1}. Using nitrogen as a carrier also resulted in smutgrass control being 1.2-times greater than when using water as a carrier for visual estimates of control. Similar to the visual estimates of control, the main effects of hexazinone and nitrogen as well as the interaction of hexazinone and nitrogen were significant for plant counts at 60 DAT. Smutgrass density was 2.2-times greater in plots that were treated with hexazinone at 0.56 kg ha^{-1} when water was used as a carrier compared to the same rate when nitrogen was used as the carrier. There were no differences when hexazinone was applied at 1.12 kg ha^{-1} in water or nitrogen as a carrier. The results of this research is promising, however, further research should be conducted to evaluate the effect of different rainfall volumes after application of hexazinone with 32% UAN.

EVALUATING HERBICIDE SOIL DISSIPATION IN GEORGIA PECAN. SJ Bowen*, KM Eason, TL Grey, L Wells; University of Georgia, Tifton, GA (213)

ABSTRACT

Georgia is one of the largest pecan producing states with an estimated farm gate value of $113,400,000. In October 2018, hurricane Michael devastated 17% of Georgia pecan ha. While this study was started prior to hurricane Michael, this research is helping growers make crucial decisions moving forward. Greenhouse and growth chamber studies were conducted in 2019 to evaluate dissipationof halosulfuron-methyl, flazasulfuron, simazine, flumioxazin, and diuron in Georgia pecan groves using bioassay techniques. Herbicides were applied on April 2016 and March 2017 in Webster County and March 2017 and February 2018 in Sumter County. Soil was collected from Webster County in 2016-2017 and Sumter County in 2017-2018. Soil was frozen until analysis at -20°C. For bioassay, soil was removed and thawed for 24-48 hr. Soil was sieved using a #10 sieve and placed into a 5 in cone-tainer. Four seeds of a susceptible crop were planted in each cone-tainer. Crop height (cm) and weight (mg) were collected at the two-true leaf stage. For Webster County, the sulfonylurea herbicides followed similar trends. In Sumter County, the sulfonylurea herbicides were overall more injurious than Webster County. For both counties, simazine showed quick dissipation. Flumioxazin and diuron had no bioassay activity for both counties. For additional research, we are analyzing the soil for dissipation data using a LC/MS system.

ANTIFEEDANT EFFECT OF SICKLEPOD (SENNA OBTUSIFOLIA) EXTRACT ON SOYBEAN LOOPER CHRYSODEIXIS INCLUDENS (LEPIDOPTERA: NOCTUIDAE). Z Yue*, T Tseng, N Krishnan; Mississippi State University, Mississippi State, MS (214)

ABSTRACT

Soybean is the most important crop in the midsouth and also the only major crop that suffers significant deer and insect defoliation in this area causing yield loss. To solve these problems, a water-based sicklepod extract has been developed as a deer repellent and an insecticide for the last three years. Sicklepod (*Senna obtusifolia*) is one of the top-ten troublesome weeds in the southern US, and it belongs to the *Leguminosae* family. Its seeds are famous for high anthraquinone derivative contents and often used as herbal medicine to treat constipation. The deer repelling effects of the water-based sicklepod extract was only second to commercial Liquid Fence (LF), and better than Hinder and Flight Control Plus (FCP). However, the extract viscosity limited its anthraquinone derivative concentration to 169 ppm. To increase the anthraquinone derivative concentration and improve its deer repellent and insecticidal property, the methanol-based extract was prepared from the sicklepod fruit meal. After complete methanol evaporation, a 1% nonionic surfactant was used to emulsify the dried methanol extract. For HPLC analysis, one mL of the emulsion was first freeze-dried, then dissolved in one mL methanol and filtered to load on the HPLC tray. The results show that the extract contained orantio-obtusin (150 ppm), emodin (22 ppm), chrysophanol (19 ppm) physcion (9 ppm), aloe-emodin (7 ppm), and rhein (5 ppm). The total anthraquinone derivatives were determined to be 212 ppm. Tentative field deer browsing test showed the sicklepod extract having similar deer-repelling efficacy as LF. Soybean looper leaf-disc feeding assay showed that the extract had similar anti-feeding efficiacy as the synthetic insecticide, Bifen. These findings in compbination with the low viscosity leads to the conclusion that the reformulated sicklepod extract was more effective as a deer-repellent and insecticide than the water-based extract.

EFFECT OF INCREASING SEVERITY OF ALTERNATE WETTING AND DRYING (AWD) IRRIGATION STRESS ON YIELD AND OUTCROSSING POTENTIAL OF RICE AND WEEDY RED RICE. DR Gealy*; USDA ARS DBNRRC, Stuggart, AR (215)

ABSTRACT

Alternate wetting and drying (AWD) is a water-conserving irrigation system for rice that, when imposed with limited stress, can produce yields as high as in a conventional flood (FLD). In more severe and stressful forms, however, yields can be reduced significantly and interactions between rice and weedy red rice can be altered unpredictably. An understanding of the influence of AWD stress severity on the complex yield interactions and potential outcrossing interactions in red rice-infested rice fields is lacking. Therefore, a two-year field study was conducted to assess yields and outcrossing in red rice and rice plants in a conventional FLD and three levels of AWD stress severity. Plots consisted of a single red rice row planted between four, 18-cm-wide rice rows on each side, were 7.6 m in length, and were drill-seeded into separate irrigation bays. “Low”, “Medium”, and “High” levels of stress severity, established by withholding water progressively longer from the irrigation bays while imposing AWD cycles during the reproductive stage, reduced average soil moisture levels to ~30%, 21%, and 15% volumetric water content (VWC), respectively, before reflooding, and the resulting plant canopy temperatures were inversely correlated with these VWC levels. Compared with the FLD, High stress severity reduced leaf photosynthesis rates by nearly 50%, which recovered to near-normal levels after reflooding. The red rice row and the three adjacent rice rows on each side were harvested and composited. Yields of red rice were always higher than rice when expressed as Kg/ha or Kg/m row. In the conventional FLD, yields were similar both years. In AWD plots, red rice yields decreased with increased AWD severity in both years, however, rice yields decreased only at the High stress level in the second year, 2017. High stress severity reduced yields of rice and red rice by as much as 50% and 60%, respectively. Outcrossing, as determined from six SSR molecular markers derived from seed from rice plants and red rice plants growing in the same plots, was variable for the different irrigation levels and years, ranging from as low as 0.075% for Medium stress-red rice in 2016 to as high as 0.72% (a 10X increase) for the same treatment in 2017. Outcrossing in rice plants trended lower than in red rice plants in the lowest-severity AWD treatments (FLD and Low), but often trended higher than in red rice plants in the highest-severity treatments (Medium and High). In the first year, when soil VWC was highly depleted during the flowering synchronization period, outcrossing tended to increase with AWD stress severity in rice plants while decreasing with stress severity in red rice plants. In an attempt to better understand the dynamics of cross pollination in rice and red rice plants over both years and all irrigation levels, the numbers of rice and red rice seed/plot were calculated from yield/plot and weight/seed for each genotype. These seed numbers/plot were used to infer the number of fertile florets in rice and red rice plots that potentially had been available for outcrossing during the flowering period. The calculated difference, (no. rice seed/plot) – (no. red rice seed/plot), explained much of the broad range and variability in outcrossing rates among AWD severity levels and between years, in that outcrossing rates in rice and red rice plants were negatively and positively correlated, respectively, with this difference in the apparent number of fertile rice and red rice florets within plots. From these results it can be inferred that within plots, lower densities of rice florets relative to red rice resulted in an excess of red rice florets and pollen, which facilitated greater outcrossing in rice plants, whereas higher densities of rice florets relative to red rice resulted in a relative excess of rice florets, which led to greater outcrossing in red rice plants. The AWD stress severity level appears to have affected floret fertility or pollen viability, which influenced yields, ultimately resulting in the range of outcrossing rates observed in plots. Although some trends emerged, consistent and predictable effects of AWD severity level on outcrossing rates in rice and red rice plants will require more precise control over the level of AWD stress imposed.

INTERSPECIFIC HYBRIDIZATION BETWEEN MALE STERILE SORGHUM BICOLOR AND S. HALEPENSE. C Sias*[1], D Hathcoat[1], G Hodnett[1], W Rooney[1], BL Young[2]; [1]Texas A&M University, College Station, TX, [2]Texas A&M University, La Vernia, TX (216)

ABSTRACT

The potential for gene flow between cultivated species and their weedy relatives poses agronomic and environmental concerns, particularly when there are opportunities for the transfer of adaptive or agronomic traits such as herbicide resistance into the weedy forms. One of the most widely cultivated crops in Texas, *Sorghum bicolor*, is a prime example of a crop that has a weedy relative, *S. halepense*, capable of exchanging genetic information. Previous findings have shown that *S. bicolor* (diploid; 2n=2X=20) and *S. halepense* (2n=4X=40) can hybridize under natural field conditions, but little is known as to how the frequency of hybridization is affected by sorghum genotype and cytoplasmic male sterility type. Field experiments were conducted to determine the frequency of hybridization across 12 different *S. bicolor* genetic backgrounds and three male sterility types (A1, A2, A3), with a natural population of *S. halepense* serving as the pollinator parent. Male sterility was considered in the study because about 25% of the F_2 seed from hybrid fields are expected to be male sterile; further, it represents a worst-case scenario for hybridization with a lack of self-pollen competition in *S. bicolor*. Results showed that the frequency of hybridization was greatly influenced by *S. bicolor* genotype and there was a significant genotype x cytoplasmic male sterility type interaction. Findings provide insights on hybridization frequencies at field conditions and help mitigate gene flow through selection of *S. bicolor* genotypes with less risk for hybridization.

SUMMER ANNUAL WEED SEED BANK AS INFLUENCED BY WINTER BRASSICA CARINATA PRODUCTION. R Tiwari*[1], P Devkota[1], RG Leon[2], MJ Mulvaney[1], T Reinhardt[2], P Kharel[1]; [1]University of Florida, Jay, FL, [2]NC State University, Raleigh, NC (217)

ABSTRACT

Introducing a new crop in an existing production system can influence weed seedbank dynamics, subsequently modifying weed density and weed management decisions. Field research was conducted at Jay, FL to determine the effect of growing carinata (*Brassica carinata*) as a winter crop on smooth pigweed (*Amaranthus hybridus*) soil seedbank. Experimental design was RCB split-plot with 4 replications. The main plot factors were cotton; peanut; or fallow, and the sub-plot factors included carinata with *S*-metolachlor; carinata without *S*-metolachlor; and a weedy fallow as a control. Before planting carinata, 25,000 smooth pigweed seeds were sown in a 1 m^2 quadrat. Carinata stand count, biomass, and yield were recorded. After harvesting carinata, 12 soil cores of 2.5 cm diameter and 20 cm depth were collected from each quadrat. Weed seed germination study was conducted in the greenhouse and weed emergence was recorded on a weekly basis for 3 months. Likewise, 150 g of soil sample was used for conducting extractable weed seedbank quantification. Carinata population was greater without *S*-metolachlor (89 plants m^{-2}) compared to *S*-metolachlor (75 plants m^{-2}) application. Carinata biomass was greater (9,142 kg ha^{-1}) after peanut compared to fallow (7,215 kg ha^{-1}) or cotton (7,162 kg ha^{-1}). Similarly, carinata yield was highest (2,071 kg ha^{-1}) after peanut, which was significantly different compared to after cotton (1,495 kg ha^{-1}). Smooth Pigweed emergence was maximum after peanut (78 seedlings m^{-2}) and cotton (69 seedlings m^{-2}) in weedy fallow compared to carinata with or without S-metolachlor application. There was no interaction and main effect of crop history and treatment for smooth pigweed seed count.

PHENOTYPE AND PHENOLOGY OF PALMER AMARANTH (AMARANTHUS PALMERI) POPULATIONS FROM THE EASTERN UNITED STATES. SC Beam[1], ML Flessner*[1], D Haak[1], SB Mirsky[2]; [1]Virginia Tech, Blacksburg, VA, [2]USDA ARS, Beltsville, MD (218)

ABSTRACT

Palmer amaranth (*Amaranthus palmeri* S. Watson) is a highly adaptive weed species that retains large proportions of its seed at crop harvest. Widespread adoption of harvest weed seed control could place selection pressure on weed species to adapt (e.g. earlier seed shattering) to this tactic. Since little information is available, a common garden experiment was conducted in Blacksburg, Virginia in 2018 to assess the differences among Palmer amaranth populations in flowering time, seed shatter phenology, and other phenotypic traits. Palmer amaranth seeds were collected from 30 crop fields from Florida to Pennsylvania in 2017, to capture populations that had differences in flowering time and presumably seed shatter based on *a priori* latitudinal adaptation. Maternal population collection latitude had no effect on seed shatter date and on the time from first flower to first seed shatter, which averaged 34.2 d. Both maternal latitude and daylength/emergence date influenced flowering date. In female plants, time to first flower was reduced 0.53 d for every degree of latitude further north the maternal population was collected from. The biggest driver of flowering time in Palmer amaranth was daylength. As plants emerged later in the season, the time to flower was reduced by 0.31 and 0.24 d for each day emergence was delayed for female and male plants respectively. Time from first flower and emergence to first seed shatter was reduced by 0.48 and 0.17 d, respectively, for each day emergence was delayed. Since latitude of maternal population only influenced time from emergence to first flower, this suggests that genetic variability exists and plays a role for this duration, making it a heritable trait that can adapt to HWSC. Further research is ongoing which will evaluate the underlying genetics among these populations that are likely driving these differences in phenology and phenotype.

CHARACTERIZATION OF MULTIPLE-HERBICIDE TOLERANCE IN ECHINOCHLOA SPP FROM ARKANSAS. G Rangani*[1], L Benedetti[2], P Carvalho de Lima[1], V Srivastava[1], N Roma-Burgos[3]; [1]University of Arkansas, Fayetteville, AR, [2]Federal University of Pelotas, Fayetteville, AR, [3]University of Arkansas, Fayetteville, Fayetteville, AR (219)

ABSTRACT

Control of multiple-herbicide-resistant (R) *Echinochloa* spp. is a major obstacle in Arkansas rice production. In this study we characterized seven *Echinochloa* populations that exhibit multiple resistance to the recommended dose of propanil and quinclorac. Whole-plant assays and candidate gene analysis were carried out to determine the level and molecular basis of multiple resistance in these accessions. Whole-plant assays revealed different levels of resistance to both herbicides among accession. ECO-45 and ECO-179 have extreme high resistance to propanil and quinclorac. The leaf transcriptome of ECO-45 indicated that multiple resistance is due to increased herbicide metabolism. The major candidate P450 and glycosyl transferase genes, likely to be involved in herbicide metabolism, were analyzed in R plants from all accessions. Molecular analysis showed that CYP709B1 was significantly upregulated by both herbicides and may be partly responsible for multiple resistance. UGT75D1 was highly induced upon quinclorac treatment, while CYP72A14 and UGT were differentially induced upon propanil treatment in all accessions. The differential induction of candidate genes identified through transcriptome study was verified in other multiple-R populations indicating the involvement of these genes in multiple resistance. The response of candidate genes differed across R accessions signifying diversity in NTSR mechanisms leading to the evolution of extreme high resistance to these herbicides.

CONTROL OF NATURAL PINE FOLLOWING JULY TREATMENTS OF IMAZAPYR AND GLUFOSINATE. JE Ezell*[1], AW Ezell[2], AB Self[3]; [1]Private Consultant, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State University, Grenada, MS (220)

ABSTRACT

The vast majority of chemical forestry site preparation in the South is completed in the August-November time frame. Being able to expand this time frame would be beneficial operationally. A concern associated with earlier applications is control efficacy, especially for control of natural pines. Two rates of glufosinate were tested as tank mixes with imazapyr and reduced rates of glyphosate. At the end of the first growing season, all treatments were very similar in control of natural pines. Control of grass/sedges, broadleaf forbs, natural pines and hardwoods will be presented.

CONTROL OF NATURAL PINES USING SITE PREPARATION MIXES WITH IMAZAPYR, GLYPHOSATE, SAFLUFENACIL, BAS #1, AND BAS #2. AB Self*[1], AW Ezell[2]; [1]Mississippi State University, Grenada, MS, [2]Mississippi State University, Mississippi State, MS (221)

ABSTRACT

Control of natural pine continues to be problematic in forestry site preparation efforts. Thirteen treatments were used in a study testing efficacy of two numbered BASF products (BAS #1 and BAS #2) for natural pine control in combinations with imazapyr and glyphosate. This study was established on a cutover forestry site in northeast Mississippi on August 31, 2018. Natural pine and hardwood stems were recorded prior to treatment applications and again at 14DAT, 56DAT, 90DAT, and 1YR. Results clearly indicate that addition of glyphosate is necessary for adequate control of natural pines and BAS #1 or BAS #2 serve to enhance glyphosate efficacy. In addition, neither BAS #1 or BAS #2 provided satisfactory levels of natural pine control in stand-alone treatments.

TWO-YEAR LOBLOLLY SEEDLING GROWTH FOLLOWING HERBACEOUS WEED CONTROL APPLICATIONS OF VARYING AMOUNTS OF SULFOMETURON, IMAZAPYR, HEXAZINONE. OR INDAZIFLAM. AW Ezell*[1], AB Self[2], J Belcher[3]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Grenada, MS, [3]Bayer CropScience, Auburn, AL (222)

ABSTRACT

Herbaceous weed control (HWC) applications are now a standard procedure in establishment of southern pine plantations. For years, it has been postulated that indaziflam provides competition control well beyond the expected 4-5 months during the first growing season and that seedling growth can be enhanced by this prolonged control. Nine active treatments were applied over recently planted loblolly pine seedlings in March, 2018. Three replications of all treatments and an untreated check were utilized i nthe study. Total height and groundline diameter (GLD) were measured on ten genetically improved loblolly seedlings in each replication prior to treatment application. Seedlings were measured again in October, 2019. Growth varied among replications and treatments.

METHODS UTILIZING UAVS TO ASSESS VOLUNTEER PINE AND HARDWOOD RESPONSE TO PREPLANT HERBICIDES. S Askew*; Virginia Tech, Blacksburg, VA (223)

ABSTRACT

Methods utilizing UAVs to assess volunteer pine and hardwood response to preplant herbicides Agroforestry research presents unique challenges to the weed scientist. Studies are often spread across large areas comprising difficult terrain. Existing vegetation can make accessing field plots difficult. Preplant vegetation control is necessary, in most cases, to ensure rapid establishment and growth of loblolly pine plantations. Targeted weeds include herbaceous broadleaf and grass plants, deciduous brush and trees, and volunteer pines. Control of volunteer pines is of particular interest as these plants exhibit different growth rates and quality characteristics compared to newer varieties that are intended to be introduced. Ground-based assessment of average plant response can be difficult over such large areas. Aerial imagery from UAVs offer several advantages over or in conjunction with ground-based assessment. Aerial imagery can detect anomalous plot characteristics, such as sprayer skips from helicopter application, so they can be avoided during data collection. Such imagery also allows for digital green cover assessment on a scale as large as 10+ acres and as small as individual species separation. In this methods presentation, techniques used in several Virginia field trials are discussed. Ground control points measuring 8 inch by 8 inch were used to mark random 30 feet by 50 feet plots for aerial image collection. Smaller, ground-treated plots were assessed by whole-replicate images. All images were assessed for digital green pixels using Field Analyzer software. To assess species-specific data, volunteer pines were manually selected using the lasso tool in Adobe Photoshop. All pines in each plot were filled with white pixels to allow for assessment of "nonpine vegetation" and the inverse selection was filled with white pixels to assess only volunteer pine green cover. Since drone images could be precisely positioned using three ground control points for each plot, these selections could be transferred to images from each new assessment date. The pine, nonpine, and total plot green cover assessments were made using Field Analyzer. Data derived from these techniques matched closely with visually-estimated data from each plot. Aerial imagery in these studies aided in the discovery that much of volunteer pine survival could be attributed to subcanopy pines that were protected from spray deposition by large trees such as poplar or maple. Challenges associated with UAVs included angle of sun, wind, and precise drone positioning.

ALTERNATIVE WEED CONTROL TECHNIQUES IN HORTICULTURE PRODUCTION. R Kanissery*; University of Florida, Immokalee, FL (224)

ABSTRACT

Weed management is a crucial component in Southwest Florida's horticulture production. The weather and soil conditions in the region promote rapid weed growth and make weed management a challenging task for citrus and vegetable producers. Concerns related to non-judicious use of herbicides, which include ground and surface water contamination, lack of herbicide efficacy on certain tolerant weed species, etc., have sparked a need for novel and alternative systems for weed management. We tested the possibility of using 'steaming' as an alternative weed management strategy in citrus production. A weed steamer was developed, and several steam treatments were utilized to control the growth of weeds in a citrus grove. The weed control treatments included various combinations of steam flows and tractor driving speeds, a post-emergent herbicide (paraquat) treatment, and an untreated check for comparison purposes. Based on the observations from this study, the steam application has the potential to be a less chemical and sustainable strategy for weed management in citrus tree rows. Additionally, in an ongoing project at the University of Florida's Southwest Florida Research and Education Center (SWFREC), we are evaluating the effectiveness of anhydrous ammonia as a pre-plant fumigant for controlling weeds in raised plastic mulched beds for vegetable production.

EVALUATING WEED SUPPRESSIVE SWEET POTATO CULTIVARS AND COVER CROPS FOR WEED MANAGEMENT IN SWEET POTATO. IS Werle[1], A Nuss*[1], SL Meyers[2], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]Purdue University, West Lafayette, IN (225)

ABSTRACT

Studies were conducted in a field production system in Pontotoc, MS, 2019, to determine the effect of spring and fall cover crops on weed density and yield of three sweet potato cultivars. The fall cover crop treatments were a combination of four species: rye (*Secale cereal*) + clover (*Trifolium* spp.); rye + vetch (*Vicia* spp.); rye + radish (*Raphanus raphanistrum*) + vetch, and a weedy fallow treatment. In the spring and summer, fields were plowed with a monoculture of buckwheat (*Fagopyrum esculentum*) or weedy fallow treatments. Three sweet potato cultivars were used: Beauregard, Heart-O-Gold, and 529, and each plot was broadcasted with a mixture of three weed species: yellow nutsedge, large crabgrass, and Palmer amaranth. Data collected included weed counts (% plants per plot, by weed species), and total storage root yield was recorded at harvesting. Weeds were entirely suppressed in the presence of buckwheat as a cover crop in all treatment plots. Analysis of the fall cover crops varied across smallflower morningglory and palmer amaranth coverage. The cultivars Heart-O-Gold, 529, and Beauregard affected the coverage of carpetweed and large crabgrass. These cultivars, however, did not influence the yellow nutsedge, Palmer amaranth, and smallflower morningglory coverage.

EXPLORATION OF CHELATED FE AS A SAFENER IN BROCCOLI. MW Farnham[1], D Couillard[1], S Robinson[1], ML Washington*[2], MA Cutulle[2], T Campbell[2]; [1]USDA ARS, Charleston, SC, [2]Clemson University, Charleston, SC (226)

ABSTRACT

Growing and optimizing weed control strategies in the southeastern US environment is important for the expansion of commercial broccoli in the region. Based on previous studies the best time for growing broccoli in SC is in the early fall with transplants. However, nutsedge species (Cyperus spp.) are very active in the fall in SC and can actively compete with the broccoli transplants. Currently, no herbicides are registered in broccoli that effectively control yellow and purple nutsedge. Bentazon is a herbicide that effectively controls nutsedge but is not registered in broccoli. The goal of this research was to find a safener that could be mixed with bentazon in order to reduce injury when applied with broccoli. A study was carried out to determine if chelated Iron effectively safened bentazon in broccoli. A greenhouse experiment was conducted as a randomized complete block, with 4 replications. The treatment design was a three level factorial, with 5 broccoli varieties, Emerald Crown, Eastern Crown, Iron Man, Belstar and BH-026 by 5 bentazon rates 0, 10, 100, 1000, 10000g ai/ha by 2 rates of Chelated Fe 0, 112 g ai/ha. Subsequently two years of field trials were conducted to elucidate the potential of chelated Fe to act as a herbicide safener in broccoli.

WEED MANAGEMENT WITH ETHANEDINITRILE IN PLASTICULTURE VEGETABLE PRODUCTION. N Boyd*; University of Florida, Balm, FL (227)

ABSTRACT

Vegetable growers in the Southeast rely predominately on combinations of 1,3-dichloropropene, chloropicrin for pre-plant pest management. Most registered fumigants are thought to have limited activity on seeds of broadleaf weeds and grasses. As a result, herbicide usage under plastic mulch has increased over time as growers look for ways to control weeds that emerge in the planting holes and compete directly with the crop. Fumigants that control weed seeds are desirable because they have the potential to directly reduce seedbanks over time. Ethanedinitrile (EDN Fumigas) is a soil fumigant currently being evaluated for use in a wide variety of fruit and vegetable crops in the USA. EDN is of interest in part because it has a high vapor pressure and low molecular weight which should enable it to move readily through the soil. Experiments were conducted at the Gulf Coast Research and Education Center in 2019 to evaluate the effects of 0, 50, 100, 200, 300, 400, 500, and 600 lbs/acre of ethanedinitrile on purple nutsedge and weed seed viability. Etjamedinitrile controlled 100% of *Richardia brasiliensis* seeds at rates above 100 lbs/acre. Complete control of *Portulaca oleracea, Solanum americanum* and *Eclipta prostrata* seeds was achieved at rates above 50 lbs/acre. Efficacy on nutsedge species varied with rate. These results indicate that Ethanedinitrile is highly effective on multiple weed species.

LIMA BEAN, SNAP BEAN, AND SOUTHERN COWPEA INJURY AND RESIDUE LEVELS FROM LOW-DOSE APPLICATIONS OF DICAMBA. HE Wright*[1], T Gray[2], J Shugart[3], AS Culpepper[1]; [1]University of Georgia, Tifton, GA, [2]Georgia Department of Agriculture, Athens, GA, [3]Georgia Department of Agriculture, Tifton, GA (228)

ABSTRACT

Agronomic growers have rapidly adopted dicamba-tolerant crops to combat weed management challenges. With this adoption has come the increased use of dicamba and a subsequent increase in the occurrence of injury from dicamba drift on non-target crops. Snap bean (*Phaseolus vulgaris* L.), lima bean (*Phaseolus lunatus* L.), and southern cowpea (*Vigna uniguiculata* (L.) Walp.) production in Georgia was valued at nearly $29 million in 2017, with snap beans contributing over $23 million in farm gate value. Field studies were conducted in Tifton, GA in 2015 and 2019 to evaluate the effect of low dose dicamba rates on these three crops. This experiment was conducted as a split-plot design with dicamba rate as the whole-plot factor (1/250X, 1/500X, 1/750X, 1/1,000X, 1/1,250X, 1/1,500X, and 0X with the X rate being 560 g ae ha^{-1}) and crop (lima bean, snap bean, and southern cowpea) as the sub-plot factor. Applications were made 19 to 22 d after planting (DAP) with maximum visual injury recorded 10 to 11 d after treatment (DAT) and plant heights and biomass collected 17 to 21 DAT. Additionally, mature fruit were collected from 1.5 m of row at crop maturity and weighed as a measure of yield. Lima bean and cowpea responded similarly with injury ranging from 38% at the 1/250X rate down to 12% at the 1/1,500X rate. Cowpea plant heights and biomass and lima bean biomass were reduced 9 to 40% relative to the control when applied at rates of 1/1,000X and higher. Plant height reductions of 8 to 17% were noted with lima beans at rates of 1/750X and higher. Yield loss ranging between 26 and 46% was noted with the two highest dicamba rates for both crops. Snap beans were the most sensitive crop with 50% injury at the 1/250X rate and 24% injury observed at the lowest rate. Snap bean height was reduced from the control by all rates of dicamba ranging from 20% at the 1/1,500X rate to 41% at the 1/250X rate. Biomass was reduced 12 to 44% by the 1/1,250X and higher rates while yield loss of 18% was noted with the 1/1500X rate of dicamba; the 1/250X rate reduced yield 63%. In 2015, plant samples were harvested 17 DAT and immediately prepared for analysis in accordance with standard procedures set by The Georgia Department of Agriculture. No dicamba was detected in 2015, however in 2019 plant samples were again taken this time at 7 DAT. In 2019, analysis noted dicamba detection ranging from 0.01964 PPM in plants treated with the 1/250X rate down to 0.00228 PPM from plants treated with the 1/1,1500 rate with no dicamba detected in the control. In both years, analysis of fruit taken at harvest noted no detection differences between treated systems and the control.

THE IMPORTANCE OF PESTICIDES AND AN OVERVIEW OF THE DEVELOPMENT AND REGISTRATION IN THE UNITED STATES. MU Dixon*; Syngenta Crop Protection, Greensboro, NC (229)

ABSTRACT

As population increases and arable land decreases, the need to be able to produce food both sustainably and increase dramatically. The use of pesticides play a vital role in accomplishing these goals by increasing the efficiency of crop production thereby increasing yields, slowing the need for additional land use in crop production and freeing labor for economic growth. The development of new crop protection products to meet these needs requires commitment of significant time and resources to gain registration. Once registered, the regulatory maintenance of these products requires ongoing science support to ensure these products meet the current regulatory guidelines as these evolve over time.

IS THE 'NO EFFECT LEVEL' FROM DICAMBA EXPOSURE THROUGH PHYSICAL DRIFT AND VOLATILITY SIMILAR? JK Norsworthy*[1], GL Priess[1], MC Castner[1], MM Zaccaro[1], T Barber[2], TC Mueller[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Tennessee, Knoxville, TN (230)

ABSTRACT

A record number of off-target dicamba complaints have occurred since its registration for in-crop applications in cotton and soybean in 2017. In some geographies, widespread, landscape damage from dicamba has been observed in the past three years. Physical exposure from movement of spray particles during application and volatilization of dicamba following treatment are two commonly given reasons for extensive injury. Research findings submitted by registrants to the Environmental Protection Agency (EPA) on soybean response to dicamba physical and volatile exposures were instrumental in establishing a 'no effect level' (NOEL) prior to the initial registration and the subsequent two-year extension of current product labels. Monsanto conducted and submitted one humidome trial to the EPA (MRID 50578901), which was the foundation for the establishment of a NOEL for dicamba volatiles. In the mentioned Monsanto's humidome experiment, symptomology on soybean was observed at all evaluated dicamba concentrations, and a NOEL was established by the EPA based on height reduction at 138 ng/m^3 following a 24-hour exposure. To date, field trials establishing a relationship between dicamba concentrations in air and symptomology or height reduction by soybean are lacking. Twelve field trials conducted in 2018 and 2019 to establish a relationship between volatile dicamba concentration in air and soybean response in terms of symptomology and height reduction. Additionally, comparisons were made to the previously mentioned Monsanto humidome trial (MRID 50578901). Based on observed soybean symptoms in response to dicamba volatilization, the crop was 55 times more responsive to the herbicide in the field than previously reported from the humidome trial. In the field, it was predicted that 0.3 ng/m^3/day was sufficient to elicit 5% injury symptoms to soybean. Furthermore, approximately 2 ng/m^3/day caused a 5% reduction in soybean height. There are several plausible reasons as to why the field results differ vastly from those for MRID 50578901. One reasonable explanation is there were differences in exposure duration because air was more stable in the field than the humidome. Removal of volatile dicamba from a small closed humidome at a rate of 2 liters/min results in minimal opportunity for exposure prior to capture of the volatile herbicide. Furthermore, some soybean plants in the field had up to a 96-hour exposure to volatile dicamba following application, rather than the 24-hour exposure in the humidome. Additionally, it is well established that non-dicamba soybean cultivars differ in sensitivity to low rates of the herbicide, and these differences may have contributed to the differential response between the two experimental setups. Additionally, environmental variability such as humidity and occurrence of dew in the field may have contributed to differences. An additional field trial was conducted in 2019 aimed at evaluating the response of soybean to physical drift of dicamba. This trial involved a low volatility formulation of dicamba applied during wind speeds conducive for physical drift but where daily air temperatures were less favorable for volatilization. From this trial, the predicted dicamba drift rate needed to cause 5% injury to soybean was 1/23,000X (0.024 g/ha), assuming 560 g ae/ha as a 1X rate for a postemergence application in dicamba-resistant cotton or soybean. This estimated dicamba rate is slightly lower than rates reported in the literature from simulated tank-contamination experiments involving soybean. Using the 0.3 ng/m^3 concentration of dicamba needed to cause 5% injury (symptomology) to soybean and assuming this concentration occurs in a 1 m by 1 m by 0.5 m volume (0.5 m^3), the actual rate of exposure is equivalent to 0.6 ng/m^2 or 1/93,000,000X of a 1X rate of dicamba. Knowing that dicamba uptake as a gas by stomata would be vastly different from physical exposure, these results lead to the conclusion that soybean is approximately 4,000X more sensitive to volatile dicamba than to physical drift of the herbicide. Considering these findings, landscape damage to soybean and other sensitive vegetation in geographies where extensive dicamba use occurs during summer months under stable air is not surprising. In the future, it is imperative to strengthen methodology and testing protocols to ensure that new herbicide technologies are brought forth in a manner

where adequate evaluations have been conducted to understand the environmental risks and impacts that may occur prior to product launch.

RISK-MITIGATION MEASURES FOR SAFE USE OF PARAQUAT. PD Laird*; Syngenta Crop Protection, Greensboro, NC (231)

ABSTRACT

An update of paraquat risk-mitigation measures, with a focus on the revisions to the paraquat stewardship training and new ways of providing training, as well as the coming closed-system requirement, will be provided. Questions will be encouraged.

THE CURRENT STATE OF ATRAZINE USE IN CORN. C Moore*; Syngenta Crop Protection, LLC, Greensboro, NC (232)

ABSTRACT

Atrazine is currently going through EPA's registration review process. An update is being provided on the status of this review, including an overview of EPA's recently released Preliminary Interim Decision (PID). Additionally, current atrazine usage data in corn will be presented.

ALTERNATIVES TO GLYPHOSATE FOR TURF RENOVATION. CG Goncalves*[1], JM Craft[1], J Brewer[1], K Miller[2], J Corbett[3], S Askew[1]; [1]Virginia Tech, Blacksburg, VA, [2]BASF Corporation, Chesterfield, VA, [3]Albaugh, Selma, NC (234)

ABSTRACT

A growing concern about cancer risks associated with glyphosate use has led to challenges in the turf and ornamentals industry. Several suppliers and distributors have removed all glyphosate products due to litigation risks. Communities and facilities are also preventing turf maintenance personnel from using glyphosate, leading turf managers to seek alternatives for turf renovation and other uses. Since glyphosate is either safer, more affordable, or more effective for turf renovation than any other product or practice, little research has been conducted to evaluate alternatives to glyphosate in the past. The objectives of this research were to evaluate (study 1) glufosinate products and compare with glyphosate as a possible replacement and (study 2) potential differences between application rates, speed of activity and environmental performance between two glufosinate products. Experiment 1 included applications of GlyStar Plus (1530 and 3050 g ai/ha), Cheetah Pro (890 and 1790 g ai/ha), Surmise (890 and 1790 g ai/ha), and Finale (1140 g ai/ha). For experiment 2, applications of Finale (1120 and 1680 g ai/ha) and Cheetah Pro (1120 and 1680 g ai/ha) were made. The sites were a mixture of grassy and broadleaf weeds. Control was evaluated relative to the nontreated on a 0 (no control) to 100 (complete plant death) scale. The glyphosate treatments were slower acting compared to the glufosinate treatments. Glufosinate generally controlled grasses poorer and white clover and dandelion better than glyphosate. Glufosinate mixtures or products did not differ with respect to weed control.

FURTHER EVALUATION OF TEMPERATURE EFFECTS ON ZOYSIAGRASS RESPONSE TO GLYPHOSATE AND GLUFOSINATE. JM Craft*, S Askew; Virginia Tech, Blacksburg, VA (235)

ABSTRACT

Glyphosate and glufosinate are labeled for use in dormant zoysiagrass but turf specialists rarely recommend this practice for fear that zoysiagrass may not be "completely dormant." Recent research at Virginia Tech found that as temperatures during the week of treatment increased, the rate of glyphosate and glufosinate activity on zoysiagrass increased. Glyphosate injured zoysiagrass less while exposed to cold temperatures, but injury was later manifest when shoots were moved to warmer temperatures 7 days after treatment (DAT). In this work, our objective was to explore the impact of extended periods (greater than 7 days) of three temperatures during or after non-selective herbicide applications on zoysiagrass response during spring green-up. A randomized complete block study was initiated on April 8, 2019. Treatments were arranged as a split plot with three temperature main plots and three herbicide subplots (glyphosate, glufosinate, and no herbicide). Dormant 'Meyer' zoysiagrass plugs were greenhouse incubated for 48 hours on April 6, 2019 until plugs had about 10% green cover in the upper turf canopy. The zoysaigrass plugs were then placed into three growth chambers set to constant 10°, 18°, and 26° C. After 12 hours, plugs were removed from growth chambers and over sprayed with glyphosate at 700 g ai ha^{-1} or glufosinate at 1680 g ai ha^{-1} then returned to chambers. At 14 DAT, plugs were moved to a greenhouse at 26°C and incubated an additional 42 days. During incubation, zoysiagrass green cover was assessed via aerial digital images that were analyzed to enumerate green pixels and a radiometer that was used to measure normalized difference vegetation index. Detected green pixels of treated plugs over time were subjected to appropriate regressions (2nd order polynomial and Gompertz) to determine time required for zoysiagrass plugs to reach 50% green cover (GC_{50}) in each experimental unit. The GC_{50} values for glyphosate- and glufosinate-treated plugs were converted to a ratio of the GC_{50} for nontreated turf plugs in each temperature regime. These resulting ratios were subjected to ANOVA with mean squares separated to account for temperature and herbicide effects and interactions. Appropriate means were separated with Fisher's Protected LSD at P = 0.05. Glufosinate increased time to reach GC_{50} 3.2 to 8.8 times longer than nontreated turf with a stepwise, temperature-dependent increase. Glyphosate only increased GC_{50} time at the two warmer temperatures and each of these increases were less than that of glufosinate. Glyphosate did not injure the zoysiagrass incubated at 10° C for the duration of the trial which contrasts with previous research where injury was absent while in the cold chamber but appeared after moving to the warmer greenhouse. All other trends were similar to previous research. These data further suggest glyphosate is less injurious to 'Meyer' zoysiagrass than glufosinate when cool temperatures prevail during and after treatment. These data also suggest extended periods of temperatures below 18° C could mitigate glyphosates injury to semi-green 'Meyer' zoysiagrass.

TROPICAL SIGNALGRASS CONTROL OPTIONS WITH ROUNDUP COMBINATIONS. NJ Gambrell*, LB McCarty, RB Cross; Clemson University, Clemson, SC (236)

ABSTRACT

Japanese stiltgrass (*Microstegium vimineum*) is an invasive annual found throughout the east coast, from New York to Florida, and west through Texas and Arkansas. Japanese stiltgrass is found in floodplains, woodlands, deep shade, and disturbed fertile soils. Limited data has been published in southeast on Japanese Stiltgrass. Therefore, purpose of this study was identify POST herbicides for control. Two field studies were conducted in Clemson, SC at Walker Golf Course in summer of 2019. Several herbicide treatments provided control. Initial treatments were applied on July 30, 2019 and August 13, 2019. Treatments included: Drive XLR8 1.5L @ 64 oz/ac, Metsulfuron 60DF @ 0.5 oz/ac, MSMA 6L @ 22 oz/ac, MSMA 6L @ 22 oz/ac + Sencor 75DF @ 0.33 lb/ac, Manuscript 0.42EC @ 9.6 oz/ac fb Manuscript 0.42EC @ 9.6 oz/ac two weeks after initial (WAIT), Tribute Total 61WDG @ 3.2 oz/ac, Dismiss 4L @ 8 oz/ac, Xonerate 70WDG @ 4 oz/ac, Plateau 2L @ 2 oz/ac, and Segment 1L @ 32 oz/ac. In the first study, all treatments provided < 20% control @ 2 WAIT. Two treatments provided > 90% control @ 4 WAIT. These included MSMA 6L @ 22 oz/ac and Segment 1L @ 32 oz/ac. Two treatments provided 100% control @ 4 WAIT. These included MSMA 6L @ 22oz/ac + Sencor 75DF @ 0.33 lb/ac and Xonerate 70WDG @ 4 oz/ac. Four treatments provided 100% control @ 8 WAIT. These treatments included: MSMA 6L @ 22 oz/ac, MSMA 6L @ 22 oz/ac + Sencor 75DF @ 0.33 lb/ac, Xonerate 70WDG @ 4 oz/ac, and Segment 1L @ 32 oz/ac. In the second study, all treatments provided < 50% control @ 2 WAIT. Four treatments provided 100% control @ 4 WAIT and 8 WAIT. These treatments included: MSMA 6L @ 22 oz/ac, MSMA 6L @ 22 oz/ac + Sencor 75DF @ 0.33 lb/ac, Xonerate 70WDG @ 4 oz/ac, and Segment 1L @ 32 oz/ac. Research will continue investigating japanese stiltgrass control with additional POST herbicides with and without PRE herbicides to determine additional options for control.

TROPICAL SIGNALGRASS CONTROL IN SEASHORE PASPALUM. T Stoudemayer*; Clemson University, Clemson, SC (237)

ABSTRACT

The purpose of these studies was to determine the efficacy of various tank-mixtures of herbicides for postemergence control of tropical signalgrass in seashore paspalum. Tropical signalgrass is a mat-like grass coarse, disruptive texture. It is characterized by hairy sheath and leaf blades, and the ligule having a short fringe of hair. Due to MSMA restriction in FL, tropical signalgrass has become a hard to control weed. Previous research proved that fall applications were more effective at control than summer applications. However, turf managers prefer summer applications due to the turf being able to recover from bare patches left behind from the tropical signalgrass infestation. Both studies were initiated at The Oaks in Osprey, FL in of 2019. Rating dates were June 4, June 25, July 16, and August 13, corresponding to 0, 21, 42, and 70 days after initial treatment, respectively. The first study was conducted with 6 treatments, including: Xonerate 2SC @ 9 oz/a; Xonerate 2SC @ 14.5 oz/a; Xonerate 2SC @ 9 oz/a + DismissNXT 3.5SE @ 5 oz/a; Xonerate 2SC @ 14.5 oz/a + DismissNXT 3.5SE @ 5 oz/a; Xonerate 2SC @ 9oz/a + DismissNXT 3.5SE @ 7.5 oz/a; and Xonerate 2SC @ 14.5 oz/a + DismissNXT 3.5SE @ 7.5 oz/a. All treatments were applied with a NIS at .25% v/v. The second study was conducted with 14 treatments, including: Xonerate 2SC @ 9 oz/a; Katana @ 3 oz/a; Drive XLR8 1.5SE XLR8 1.5SE @ 64 oz/a; Certainty WDG @ 1.25 oz/a; Dismiss @ 6 oz/a; Xonerate 2SC @ 9 oz/a + Katana @ 3 oz/a; Xonerate 2SC @ 9 oz/a + Certainty WDG @ 1.25 oz/a; Xonerate 2SC @ 9 oz/a + Dismiss @ 6 oz/a; Dismiss @ 6 oz/a + Katana @ 3 oz/a; Dismiss @ 6 oz/a + Certainty WDG @ 1.25 oz/a; Dismiss @ 6 oz/a + Drive XLR8 1.5SE @ 64 oz/a; Katana @ 3 oz/a + Drive XLR8 1.5SE @ 64 oz/a; and Certainty WDG @ 1.25 oz/a + Drive XLR8 1.5SE @ 64 oz/a. All treatments were applied with a NIS at .25% v/v. A sequential application of each treatment in both studies was made on June 25, 21 days after initial treatment. In study one, 10 WAIT, Xonerate 2SC @ 14.5 oz/a + DismissNXT 3.5SE @ 7.5 oz/a, provided the best control at ~60%. For study two, 10 WAIT, Certainty WDG @ 1.25 oz/a treatment provided the best control at ~70%. There was no significant turf injury recorded for all treatments in both studies. Future research will include screening additional products to improve control during the summer application. Future research will also include screening additional products in alternative warm season turfgrasses i.e. St. Augustinegrass.

COMPARISON OF A NEW AMINOPYRALID-BASED HERBICIDE FOR NATIVE OR REDUCED-MANAGEMENT AREAS. CG Goncalves*[1], J Brewer[1], JM Craft[1], DE Hillger[2], S Askew[1]; [1]Virginia Tech, Blacksburg, VA, [2]Corteva Agriscience, Thorntown, IN (238)

ABSTRACT

The golf course superintendents must consider every option to reduce management costs, and that includes native areas. Annual mowing and long-lasting control pesticide treatments on low-input areas should integrate weed management programs. Field trials were conducted during the growing season 2019 in Pete Dye River Course of Virginia Tech, Radford, VA, to examine the efficacy of a new aminopyralid-based (NativeKlean (aminopyralid, 2,4-D)) mixtures with several market-leading turfgrass herbicides (Dimension (dithiopyr), Turflon Ester Ultra (triclopyr), Spotlight (Carfentrazone-ethyl), Speedzone (2,4-D, mecoprop-p, dicamba, Carfentrazone-ethyl), and Trimec Classic (2,4-D, MCPP-p dicamba)) to improve long-lasting control of broadleaf weeds and native turf response in reduced-management area. All treatments were replicated four times and herbicides were applied with a CO_2-powered boom sprayer calibrated to deliver 40 gal/ac. Treatments included: NativeKlean at 34 fl oz/ac + Dimension at 32 fl oz/ac, NativeKlean at 34 fl oz/ac + Turflon Ester Ultra at 32 fl oz/ac + Dimension at 32 fl oz/ac, NativeKlean at 34 fl oz/ac + Spotlight at 20.5 fl oz/ac + Dimension at 32 fl oz/ac, Speedzone at 64 fl oz/ac + Dimension at 32 fl oz/ac, Trimec Classic at 64 fl oz/ac + Dimension at 32 fl oz/ac, and a nontreated check for comparison. Results from this trial indicate that all treatments injury fine fescue less than 20% at 28 DAT. Treatments containing a combination of (NativeKlean + Spotlight + Dimension) and (NativeKlean + Turflon Ester Ultra + Dimension) provides better control of late boneset, sericea lespedeza, wingstem, and common milkweed at 68 DAT. Applications of NativeKlean, tank mixed with Turflon Ester Ultra + Dimension and Spotlight + Dimension provide better season-long control of broadleaf weeds.

METHODS TO INCREASE SAFETY OF PINOXADEN ON ST. AUGUSTINEGRASS (STENOTAPHRUM SECUNDATUM). JM Peppers*[1], JS McElroy[2]; [1]Virginia Tech, Blacksburg, VA, [2]Auburn University, Auburn, AL (239)

ABSTRACT

St. Augustinegrass (*Stenotaphrum secundatum*) is a warm season turfgrass grown primarily in the southernmost portions of the US. St. Augustinegrass typically has low weed pressure due to the high turfgrass density of the species. However, there are no postemergence options for grassy weeds labelled for St. Augustinegrass. Pinoxaden is an ACCase inhibiting herbicide newly released for use in St. Augustinegrass turf. Pinoxaden controls a wide variety warm season grassy weeds that can be problematic in St. Augustinegrass turf. Due to injury concerns, pinoxaden is limited to St. Augustinegrass sod production. Turfgrass cultivar generally influences the susceptibility of a turfgrass species to herbicides and previous research has shown that tank mix combinations can reduce injury to desirable turfgrass species. Research was conducted to evaluate the response of four different St. Augustinegrass cultivars to pinoxaden and to explore potential tank mixture partners that may reduce pinoxaden injury to St. Augustinegrass. In 2018 and 2019, Raleigh, Floratam, Palmetto and Classic cultivars were examined when pinoxaden (1.56 kg ai ha^{-1}) was applied alone and in combination with chlorothalonil (7.35 kg ai ha^{-1}) and propiconazole (0.50 kg ai ha^{-1}). Turfgrass visual injury data were collected in both years and NDVI was measured in 2019 only. When pinoxaden was applied alone, cultivars could be ranked from most to least susceptible: Classic = Palmetto > Floratam > Raleigh. Chlorothalonil and propiconazole reduced St. Augustinegrass injury and increased NDVI in comparison to treatments of pinoxaden alone regardless of cultivar. In 2019, tank mixtures of pinoxaden plus metsulfuron (0.32 kg ai ha^{-1}) and halosulfuron (0.52 kg ai ha^{-1}) were examined on Floratam St. Augustinegrass. Both metsulfuron and halosulfuron reduced St. Augustinegrass injury and increased NDVI. Metsulfuron did this to a higher degree than halosulfuron, however both treatments were significantly less injurious than pinoxaden applied alone. From these studies, we conclude that chlorothalonil, propiconazole, metsulfuron and halosulfuron safen pinoxaden on St. Augustinegrass. More research is needed to determine the effect that these combinations have on pinoxaden weed control.

POTENTIAL ANTAGONISTS OF PINOXADEN FOR SMOOTH CRABGRASS CONTROL. J Brewer*[1], JM Craft[1], JM Peppers[2], JS McElroy[3], S Askew[1]; [1]Virginia Tech, Blacksburg, VA, [2]Auburn University, Horton, AL, [3]Auburn University, Auburn, AL (240)

ABSTRACT

Turf managers routinely combine multiple products (fertilizers, fungicides, herbicides, etc.) into one spray tank to save time, labor, and cost. Potential consequences these combinations can have on turf safety or weed control are often overlooked. A classic example is herbicide mixtures aimed at broadleaf and grass control such as 2,4-D-containing products with sethoxydim or fluazifop. These mixtures often lead to antagonism of the grass control component. Pinoxaden is a new grass control product for use in warm-season turfgrass and may be susceptible to antagonism by auxins, ALS-inhibitors, or other herbicides as has occurred with similar grass-control products in the past. Our objective was to test a range of different broadleaf herbicides in combination with pinoxaden compared to pinoxaden alone for smooth crabgrass (*Digitaria ischaemum* (Schreb.) Schreb. ex Muhl.) control. Two different studies were completed in the summer of 2019 evaluating potential antagonists to pinoxaden for smooth crabgrass control. One was initiated in Virginia at the Virginia Tech Turfgrass Research Center (VT) on June 6, 2019, and the second was initiated in Alabama at the Auburn University Sports Surface Field Laboratory (AB) on May 20, 2019. Both studies were arranged as a randomized complete block design with four replications. Treatments were applied with CO_2-pressurized sprayers with the VT sprayer calibrated to deliver 374 L ha^{-1} while the AB sprayer was 280 L ha^{-1}. Pinoxaden was applied at 154.6 g ai ha^{-1} for all VT treatments and 71.4 g ai ha^{-1} for all AB treatments. All treatments included Adigor surfactant at 0.5% v/v. All treatments had secondary applications following a two- or three-week interval. At the VT site, the second application was pinoxaden alone while the AB site applied the same treatments as the initial application. In Virginia or Alabama, smooth crabgrass control decreased when chlorothalonil, halosulfuron, iodosulfuron, metsulfuron, MCPP, MCPA, or trifloxysulfuron were mixed with pinoxaden. Mixtures with dicamba did not alter smooth crabgrass control. At the VT site, 2,4-D+dicamba+MCPP added to pinoxaden reduced smooth crabgrass control more than metsulfuron and trifloxysulfuron. By the final rating, pinoxaden controlled smooth crabgrass 91% while treatments with 2,4-D+dicamba+MCPP, metsulfuron, and trifloxysulfuron controlled smooth crabgrass 65, 78, and 69%, respectively. During the AB study, metsulfuron completely prevented smooth crabgrass control by pinoxaden while halosulfuron and chlorothalonil reduced control to 25 and 45%, respectively. These data suggest that pinoxaden, like other graminicides, can be sensitive to certain tank mixtures with respect to smooth crabgrass control.

BETTER TOGETHER? EVALUATING COVER CROP MULCHES, ORGANIC HERBICIDES, AND WEED SEED BIOLOGICAL CONTROL IN REDUCED-TILLAGE CROP SYSTEMS. MA Cutulle*[1], C Blubaugh[2], DG Lewis[3], RA Schmidt-Jeffris[4]; [1]Clemson University, Charleston, SC, [2]Clemson University, Clemson, SC, [3]Clemson University, Charlleston, SC, [4]USDA ARS, Wapato, WA (241)

ABSTRACT

Organic growers rely heavily on labor-intensive mechanical tactics for weed management. Using cover crop residues as weed-suppressive mulch has enabled some growers to reduce tillage, however weed pressure late in the season can be problematic after residues decompose. Recently-developed organic herbicides have the potential to mitigate this problem by extending weed suppression in cover crop mulch systems, but may adversely affect beneficial insects that consume weed seeds and crop pests. Here we compare three killed cover crop mulch treatments (cereal rye, crimson clover, and fallow) and three organic herbicide treatments (capric/caprylic acid, corn gluten meal, herbicide-free) in a two-year experiment to examine potential synergy between cultural, chemical, and biological weed management tools. Based on our field sampling in both experiments, the organic herbicides lead to no obvious reductions in beneficial insect activity nor weed seed biocontrol. With careful management, organic herbicides may be a viable supplemental weed management tool with limited non-target effects in reduced-tillage systems.

PESTICIDE EDUCATION IN AN ERA OF GLYPHOSATE LITIGATION. LESSONS LEARNED FROM THE FRONT LINES IN FLORIDA. SF Enloe*, J Ferrell; University of Florida, Gainesville, FL (242)

ABSTRACT

Glyphosate is the most widely used herbicide in the United States and the world. For decades, Extension Specialists and Industry Representatives alike have touted the herbicide as extremely safe, based upon numerous studies indicating an excellent toxicological profile. In 2015, this safety was brought into question when the International Agency for Research on Cancer (IARC) reclassified glyphosate as a probable carcinogen. Following the IARC decision, in 2017, the California Office of Environmental Health Hazard Assessment placed glyphosate on its Proposition 65 list of carcinogens. Subsequently, in 2018 and 2019, juries awarded over 2.3 billion dollars in the separate trials to plaintiffs who alleged glyphosate was the cause of their cancer. As a result of these actions, many cities and counties in Florida have considered bans on glyphosate and two counties have officially banned its use. These collective actions have resulted in a tremendous need for a new approach to educating both herbicide applicators, government officials, and the general public on the controversy surrounding glyphosate. This presentation will focus on how UF/IFAS is leading the effort to clarify what has transpired and present the science of glyphosate to a broad range of clientele.

DOES SPRAY TANK CONTAMINATION WITH AMS AND THE ADDITION OF THE POTASSIUM SALT OF GLYPHOSATE INCREASE DICAMBA VOLATILITY? MM Zaccaro*, JK Norsworthy, C Brabham, LB Piveta; University of Arkansas, Fayetteville, AR (243)

ABSTRACT

Dicamba formulation, tank-mix partners, and weather conditions are a few of the factors that affect dicamba volatility. Previous studies verified that the addition of glyphosate to dicamba increased dicamba volatility. A field experiment was conducted in 2019 with the purpose to determine dicamba volatility as a function of glyphosate and residue of ammonium sulfate (AMS) in the spray tank. The experiment was set as a factorial arrangement of treatments in a randomized complete block design with three replications. Factor-A was the presence or absence of glyphosate, and the factor-B was rates of AMS in the tank (0, 0.005, and 2.5% w/v) containing dicamba (XtendiMax) at 1,120 g ae/ha. Low tunnels measuring 6.4 m long were assembled to cover two rows of soybean (Glycine max (L.) Merr.). Herbicide treatments were applied to soil contained in 52 x 40 x 6 cm-trays approximately 1 km from the test site. After application, trays were placed at the center of each tunnel along with a high-volume air sampler. At 48 hours after application, the structure of the tunnels and the trays were discarded. Injury was evaluated at 14, 21, and 28 days after treatment. Furthermore, the pH of the spray solutions was recorded, and dicamba trapped by the air samplers was quantified. Maximum soybean injury was 42% and 30% from treatments with 2.5% w/v AMS with and without glyphosate, respectively. Laboratorial analysis detected 4,380 and 1,478 ng of dicamba in treatments with 2.5% w/v AMS with and without glyphosate, respectively. The presence of glyphosate to the spray solution resulted in greater acidification of the spray than the addition of AMS alone. The detection of dicamba was similar for treatments with 0.005% w/v AMS and no AMS. These results lead to the conclusion that a low rate of AMS at a level deemed as spray tank contamination was not sufficient to significantly increase dicamba volatilization or soybean injury in the presence or absence of glyphosate.

2019 XTEND WEED MANAGEMENT IN TENNESSEE: WE HAVE A PROBLEM. LE Steckel*[1], CM Perkins[1], TC Mueller[2]; [1]University of Tennessee, Jackson, TN, [2]University of Tennessee, Knoxville, TN (244)

ABSTRACT

In 2018 the Tennessee Department of Agriculture had fielded 45 official dicamba drift complaints. There were some issues on poor grass control but overall weed control was good. So what was the weed managment experience of Xtend crops in Tennessee in 2019? There was just 23 official dicamba related complaints brought to the attention of the TDA in 2019. Most of the reports have been on tree nurseries, trees in state parks and of course gardens and landscaping from home owners. Of the roughly 1.5 million acres of soybeans in our state no more than 30,000 acres is planted to anything other than Xtend soybeans. The almost complete change over to Xtend soybeans is a major reason for the reduction in official complaints. Not easily measured, but likely another reason for the few drift complaints would be the mandatory dicamba training which emphasized that applicators make good decisions when spraying dicamba. In 2019 the weed control in the Xtend system was not near as good as in the first few years this technology was used. In 2018 UT Extension only fielded about 50 lack of weed control complaints compared to 209 in 2019. Most notably the grass species, especially junglerice, goosegrass and Johnsongrass, have become very troublesome and expensive for growers to control. Several cotton growers this year stated their weed control costs have doubled to tripled trying to control grass in Xtend cotton. Moreover, prickly sida has become more of an issue and is in my mind a weed shift as glyphosate has never provided good control of that weed and it is clear that a 0.5 lb rate of dicamba is not improving that level of control. Also, in 2019, UT Extension fielded over 40 Palmer amaranth control complaints from applications of Engenia or XtendiMax + glyphosate Many Tennessee growers informed us that they feel Palmer amaranth control has slipped compared to when they first used that mixture in Xtend crops. To test this observation, we screened dicamba on Palmer collected from these fields to Palmer amaranth that was sourced back in 2014 prior to the introduction of Xtend crops. In order to get Palmer amaranth from this year we took soil from fields where dicamba had been disappointing in its' control and grew out seedlings. We screened both populations with an Engenia rate of a 0.25 lb, 0.5 lb (12.8 oz/A), 1 lb and 2 lbs. The first observation of this one test would suggest that their concerns were not without merit. At ten days after application the 0.25 lb rate of Engenia had provided complete control of the 2014 Palmer amaranth but only partial control of the 2019 population. This would be consistent with field visits where many of the escaped Palmer amaranth from Engenia + Roundup PM were often times found on field edges where sprayers would slow down resulting in less pressure from the pump to adjust for the speed and likely less coverage. The first couple years folks used dicamba they were getting control even on the field edges but not in 2019. There was also a noticeable difference ten days after application of the 0.5 lb (labeled rate). The 2014 Palmer amaranth was completely controlled while there are still some surviving from the 2019 population. This too would be consistent with field observations from this spring where a sequential application of a labeled dicamba product, or a follow-up application of Liberty, was often needed to finally get control. Complete control was seen with the higher Engenia rates. The status of the Xtend weed management system in Tennessee was mixed in 2019. First, official off-target dicamba complaints have come down which is a positive. However, most complaints now are from home owners and folks in the nursery industry which is a major concern. From a weed management perspective, we need a new game plan on grass control as what we are doing now is not working on barnyardgrass, junglerice, goosegrass or Johnsongrass. We also need a new plan on prickly sida. Finally, many have reported that more follow-up applications were necessary to control Palmer amaranth. In 2018 UT Extension fielded a total of 38 lack of weed control complaints from dicamba + glyphosate applications. In those cases only 1 weed had escaped the application typically a Echinochloa species. In 2019 UT Extension was asked to look at poor weed control in 32 fields where both an *Echinochloa species* and Palmer amaranth had escaped control. The trend from 2018 to 2019 is pointing down ward with respect to obtaining good weed control in Xtend crops.

DIMETRIC CHARGED: A NEW OPTION FOR BURNDOWN AND RESIDUAL WEED CONTROL.

RJ Edwards*[1], GK Dahl[1], EP Spandl[1], MA Risley[1], AD Makepeace[2]; [1]WinField United, River Falls, WV, [2]WinField United, Arden Hills, MN (245)

ABSTRACT

Dimetric® Charged, a combination herbicide containing a Group 5 (metribuzin) and a Group 14 (flumioxazin), is a new option for burndown and residual weed control. Field trials conducted in 2018 and 2019 show an increased knockdown and residual control of tough to control weed like Palmer amaranth (*Amaranthus palmeri*), horseweed (*Conyza canadensis*), common waterhemp (*Amaranthus tuberculatus*) and others. When combined with other POST applied herbicides and high surfactant oil concentrate (HSOC) adjuvants, Dimetric® charged provides longer lasting control.

ITALIAN RYEGRASS BURNDOWN WITH HERBICIDE COMBINATIONS INCLUDING BAS 850 H AND BAS 851 H. TL Grey*[1], LJ Newsome[2], D Findley[3]; [1]University of Georgia, Tifton, GA, [2]BASF, Tifton, GA, [3]BASF, Durham, NC (246)

ABSTRACT

Trifludimoxazin (BASF 850H) is an herbicide with unknown activity range in terms of crop and weed selectivity in the Southeastern U.S. When adding saflufenacil in combination with trifludimoxazin to form BAS 851 H, a broader spectrum of weed control can be achieved. Saflufenacil provides burndown and residual control with multiple registrations for crops including cotton, corn, small grains and some vegetables. Trifludimoxazin has been evaluated at the University of Georgia for burndown of winter annual grasses and broadleaves including Italian ryegrass, henbit, and other weeds. By tankmixing trifludimoxazin with contact herbicides, increased burndown performance was noted by improving the range and size of weeds controlled.

TIREXOR (TRIFLUDIMOXAZIN): NEXT GENERATION BURNDOWN UPDATE. D Findley*; BASF, Rolesville, NC (247)

ABSTRACT

Tirexor™ herbicide (Trifludimoxazin) [1,5-dimethyl-6-thioxo-3-(2,2,7-trifluoro-3,4-dihydro-3-oxo-4-prop-2-ynyl-2*H*-1,4-benzoxazin-6-yl)-1,3,5-triazinane-2,4-dione] is a new inhibitor of protoporphyrinogen IX oxidase (PPO or Protox). Trifludimoxazin is very active when applied PRE or POST on dicot/broadleaf weeds including *Amaranthus* spp., *Ambrosia, Chenopodium, Conyza, Lamium, Oenothera* and *Stellaria.* In addition, Trifludimoxazin can control PPO resistant *Amaranthus* biotypes which are not controlled by currently registered PPO inhibitors like fomesafen, sulfentrazone, or flumioxazin. The combination of trifludimoxazin plus saflufenacil (Voraxor™) improves the burndown effectiveness and spectrum of weeds controlled compared to either ai alone, and the combination will be an important tool for resistance management. Trifludimoxazin is expected to receive registration in key countries for use in burndown applications ahead of soybeans, corn, wheat and other crops in addition to total vegetation management.

INTRODUCTION AND OVERVIEW OF MON 301107: A NEW GLYPHOSATE FORMULATION. A Mills*[1], N Rana[2], RA Recker[3], DJ Mayonado[4], CM Mayo[5]; [1]Bayer CropScience, Collierville, TN, [2]Bayer CropScience, St Louis, MO, [3]Bayer CropScience, Smithton, IL, [4]Bayer CropScience, Hebron, MD, [5]Bayer CropScience, Gardner, KS (248)

ABSTRACT

MON 301107 is a new glyphosate formulation. Field trials conducted in 2017 and 2018 in 54 locations evaluated MON 301107 for postemergence weed control compared to commercial standards. The experimental design was a split-plot arrangement with 3-4 replications. Whole-plots consisted of different glyphosate rates and the sub-plots were various glyphosate formulations. Results from 2017-18 trials, 14 days after treatment, indicated MON 301107 at 1120 g a.e. ha^{-1} provided broadleaf control and grass control that was not statistically different than commercial standards at 1120 g a.e. ha^{-1}. Additional field trials conducted in 2019 evaluated crop safety of MON 301107 compared to Roundup PowerMAX® herbicide when used postemergence on multiple crops. The experimental design was a split-plot arrangement with 3-4 replications. Whole-plots consisted of different herbicide treatments and the sub-plots had either MON 301107 or Roundup PowerMAX as the glyphosate formulation utilized in the herbicide treatment. Glyphosate formulation was not a significant treatment factor for any of the percent injury evaluations for field corn hybrids with Roundup Ready® 2 Technology, soybean with Roundup Ready 2 Yield® Technology, or cotton with Roundup Ready® Flex Technology. These results demonstrate MON 301107 can provide non-selective foliar control of both grass and broadleaf weeds and has a comparable crop safety profile to Roundup PowerMAX.

WEED CONTROL AND CROP TOLERANCE WITH GLU-L™ A RESOLVED ISOMER OF GLUFOSINATE, IN GLUFOSINATE RESISTANT COTTON AND SOYBEAN. B Green[1], TA Hayden*[2]; [1]AgriMetis, LLC, Lutherville, MD, [2]Agrimetis, Owensboro, KY (249)

ABSTRACT

Racemic glufosinate, a 50:50 mixture of D-glufosinate and L-glufosinate controls weeds in glufosinate tolerant soybean, cotton, corn and canola. Glu-L™ (AgriMetis LLC), an enantiomerically enriched L-glufosinate isomer, was evaluated in two formulations, F47 and F50, for weed control and crop tolerance in glufosinate tolerant cotton and soybean and compared to racemic glufosinate. The objective was to determine if the 280 g l^{-1} Glu-L™ formulations would provide equal weed control and crop tolerance at 50% of the 280 g l^{-1} racemic glufosinate product use rate. Field experiments were conducted at thirteen locations for POST-emergence weed control efficacy in soybean and six locations for soybean tolerance in 2019. Soybean efficacy trials were conducted with racemic glufosinate at 296, 592, 890, and 1190 g ai ha^{-1} and two formulations of Glu-L™, F47 and F50 each at 148, 296, 445 and 595 g ai ha^{-1}. Ammonium sulfate (AMS) was added to all treatments in midwestern locations. Efficacy trials were conducted as a randomized complete block design with four replications. Cotton POST-emergence efficacy trials were conducted at nine locations and POST-emergence tolerance trials were conducted at three locations in 2019. Cotton and soybean tolerance trials were conducted as a split plot design with five varieties as the main plot and ten herbicide treatments as the subplots. Herbicides were 280 g l^{-1} racemic glufosinate at 592, 1190 and 2380 g ai ha^{-1} and 296, 595 and 1190 g ai ha^{-1} for 280 g l^{-1} Glu-L™F47 and 280 g l^{-1} Glu-L™F50 and a nontreated check. AMS was added to all herbicide treatments and applications were made at V1 or V3 timings. Weed control across all broadleaf species was equal for racemic glufosinate and Glu-L™F50 at equivalent rates of L-glufosinate at 7 and 14 DAA. Glu-L™F-47 provided overall broadleaf control equal to racemic glufosinate and Glu-L™F50 except at the below label 148 g ai ha^{-1} rate at 14 DAA. Palmer amaranth (*Amaranthus palmeri* S. Watson), tall waterhemp (*Amaranthus tuberculatus* (Moq.) J. D. Sauer) and horseweed (*Erigeron canadensis* L.) control at 7 and 14 DAA was equal for racemic glufosinate, Glu-L™F47 and Glu-L™F50. Overall grass control was equal with racemic glufosinate and Glu-L™F50 at equivalent L-glufosinate rates. Glu-L ™F47 provided equal grass control to Glu-L™F50 and racemic glufosinate except for the below label 148 g ai ha^{-1} rate at 7 DAA. Goosegrass (*Elusine indica (L.) Gaertn*) and large crabgrass (*Digitaria sanguinalis (L.) Scop*) control was equal with racemic glufosinate, Glu-L™ F47 and Glu-L™F50. Response of cotton varieties from racemic glufosinate was 10-35% greater in Georgia, 0-8% greater in North Carolina and 2-8% greater in Texas than Glu-L™ F47 and Glu-L™ F50 at label rates of equivalent amounts of L-glufosinate. Response of soybean varieties from racemic glufosinate was 5-20% greater in South Carolina and 7-36% greater in Minnesota than from equivalent label rates of Glu-L™F47 and Glu-L™F50. Racemic glufosinate caused 0-10% greater soybean injury at the other locations. At proposed label rates of 296 and 445 g ai ha^{-1}, Glu-L™F47 and Glu-L™F50 provided grass and broadleaf control equal to 592 and 890 g ai ha^{-1} racemic glufosinate at equal L-glufosinate rates, with less or equal cotton or soybean response.

REDUCED HERBICIDE ANTAGONISM FOR GRASS WEED CONTROL THROUGH NOVEL SPRAY APPLICATION TECHNIQUES. LH Merritt, JC Ferguson*, DB Reynolds, A Brown, T Tseng; Mississippi State University, Mississippi State, MS (250)

ABSTRACT

Dicamba and 2,4-D traits have been added to soybean and cotton, allowing for over the top applications of these herbicides. Methods to avoid antagonism of glyphosate and clethodim by dicamba or 2,4-D should be utilized to achieve optimum weed control. This study was conducted at the Black Belt Experiment Station (Black Belt) and at the R.R. Foil Plant Science Research Center (R.R. Foil) in fallow fields with browntop millet (*Urochloa ramosa*), broadleaf signalgrass (*Urochloa platyphylla*) and Italian ryegrass (*Lolium perenne* ssp. *multiflorum*) pressure. A tractor mounted dual boom sprayer was modified to spray three application methods: two herbicides tanked mixed, two herbicides in separate tanks mixed in the boom line, and two herbicides in separate tanks applied through separate booms simultaneously. Two salt formulations of dicamba and two salt formulations of 2,4-D were applied with glyphosate through the three application methods to determine difference in herbicide efficacy based on salt formulation and application method. Rates for the first trial at R.R. Foil were applied at 281 and 533 g ae ha^{-1} for dicamba and 2,4-D, respectively. Rates of dicamba, and 2,4-D increased to 562 and 1065 g ae ha^{-1}, respectively in the next two trials at Black Belt and R.R. Foil. Glyphosate was applied at 434 g ae ha^{-1} and clethodim was applied at 68 g ai ha^{-1} with NIS at a rate of 0.25% v/v in all trials. Applying glyphosate with dicamba or 2,4-D resulted in the highest control when applied through separate booms. Antagonism of glyphosate and clethodim was reduced by using the separate boom application method. Antagonism of glyphosate and clethodim from dicamba and 2,4-D was observed through the tank mix and mix-in-line application method.

EVALUATING COVER CROPS AND HERBICIDE PROGRAMS FOR WEED MANAGEMENT IN COTTON. P Devkota*, R Tiwari, P Kharel, MJ Mulvaney; University of Florida, Jay, FL (251)

ABSTRACT

Cover crops are an important tool to improve soil moisture status, soil organic matter, crop health, and enhance crop performance. Another potential benefit from cover crops includes impact on weed suppression. Field research was conducted to evaluate weed suppression response from wheat, oat, rye, carinata (*Brassica* spp.), and no cover crops, and to integrate them with herbicide programs in a strip-tilled XtendFlex cotton production system. Herbicide programs consisted of PRE applied fomesafen, fluridone, or pyroxasulfone then fb POST applied dicamba for sicklepod and tropical spiderwort control. There was no effect of cover crop for sicklepod or tropical spiderwort control at 4 WAT. Sicklepod control was = 5% with PRE-applied fluridone compared to pyroxasulfone or fomesafen at 4 WAT; however no differences were observed for tropical spiderwort control. At 4 wk after dicamba application, there was no effect of cover crop on sicklepod control; however, tropical spiderwort control was = 45% with rye compared to wheat. A herbicide program consisting of PRE applied fluridone provided higher control of sicklepod and tropical spiderwort compared to the fomesafen program. Cotton injury was minimal (= 3%) from PRE applied herbicides at 4 WAT; however, injury was greater with carinata compared to rye cover crop at 4 wk after dicamba application. Cotton height was 92 cm after rye compared to 78 cm after carinata at 6 wk after dicamba application. Similarly, cotton height was 13 cm taller with fluridone compared to reflex, pyroxasulfone, or no herbicide treatment. Seed cotton yield was significantly higher with PRE applied fluridone herbicide (1,772 kg ha^{-1}) compared to fomesafen, pyroxasulfone, or no herbicide treatment (= 1,291 kg ha^{-1}). This research illustrates that combination of a rye cover crop with PRE-applied fluridone has potential for sicklepod and spiderwort control in Xtendflex cotton production systems.

EVALUATION OF LOYANT POST-DIRECTED IN ARKANSAS COTTON. RC Doherty*[1], T Barber[2], ZT Hill[1], LM Collie[3], A Ross[4]; [1]University of Arkansas System Division of Agriculture, Monticello, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Beebe, AR, [4]University of Arkansas, Lonoke, AR (252)

ABSTRACT

Cotton (Gossypium hirsutum) herbicide systems that contain multiple modes of action and are applied timely are essential in controlling Palmer amaranth (Amaranthus palmeri) resistant to multiple herbicides. Arkansas cotton growers are in need of new and improved methods and chemistry, to manage this troublesome weed. Three trials were established in 2017, 2018, and 2019 to evaluate weed efficacy and crop response following Loyant post-directed in cotton. In 2017, the trial was established at Marianna, AR in a Loring silt loam soil and at Rohwer, AR in a Herbert silt loam soil. In 2018 and 2019 trials were established at Marianna, AR in a Loring silt loam soil and at Tillar, AR in a Herbert silt loam soil. Enlist cotton cultivar was planted in 2017 and 2018 at all locations while, in 2019 PHY 350 W3FE was established at Tillar and DP 1646 B2XF at Marianna. The trials were arranged in a randomized complete block design with four replications. All treatments received Brake FX preemerge at 1.13 lb ai/A (fluometuron 0.94lb ai/A + fluridone 0.19 lb ai/A) followed by Liberty (glufosinate) at 0.53 lb ai/A plus Dual Magnum (metolachlor) at 0.95 lb ai/A at 3-4 leaf cotton. Post-directed herbicides evaluated included Valor SX (flumioxazin) at 0.064 lbai/A, MSMA at 2.02 lb ai/A, Diuron at 1 lb ai/A, dicamba 0.5 lb ai/A, Loyant (florpyrauxifen-benzyl) at 0.0081, 0.013, and 0.026 lb ai/A , Starane Ultra (fluroxypyr) at 0.14 lb ai/A, Enlist Duo (2,4-D choline plus glyphosate) 1.96 lb ai/A, Durango (glyphosate) at 1 lb ai/A and Roundup PowerMax (glyphosate) at 1.12 lb ai/A. In 2017 and 2018 post-direct applications were applied to 10 node cotton. In 2019 post-direct applications of Loyant were applied to 8 or 10 node cotton. Visual crop injury and weed control ratings of Palmer amaranth, morningglory, and multiple grass species were recorded at 20 days after post-direct applications. Cotton was harvested and seed cotton yield was recorded.In 2017, all treatments provided 99% control of morningglory, barnyardgrass, and broadleaf signalgrass at Rohwer and Marianna. Palmer control however, was 99% at Marianna and 83 to 84% at Rohwer. No visual crop injury was caused by Loyant, or any other treatment, at either location in 2017. Cotton yield was not impacted negatively by Loyant. Dicamba caused a significant yield loss, when applied post-direct, to Enlist cotton. All other treatments were equal at the respective location. In 2018, all Loyant treatments provided 99% control of Palmer amaranth, morningglory, barnyardgrass, and Southwestern cupgrass at Tillar, while control of Palmer amaranth and barnyardgrass ranged from 88-98% at Marianna. No visual crop injury was noted with any Loyant treatment or tank-mix, at either location, in 2018. Cotton yield was not impacted negatively by any treatment at either Marianna or Tillar. All treatments provided equal cotton yields at the respective location.In 2019, crop injury at Marianna increased as the Loyant rate increased. Visual injury ranged from 2.5% with Loyant at 0.0081 lb ai/A to 11.3% with Loyant at 0.026 lb ai/A. No visual injury was noted, in any Loyant treatment, at Tillar. Weed control was not recorded at Marianna. Loyant provided 89-99, 99, and 94-99% control of Palmer amaranth, goosegrass, and morningglory respectively, at Tillar 20 days after the 10 node application. Cotton yield was reduced by 9 of the 10 Loyant treatments at Marianna, while yield was equal or greater than the weed-free check with all Loyant treatments at Tillar. The highest yield reduction was noted when Loyant was applied at 0.026 lb ai/A to 8 node Xtend cotton.

INFLUENCE OF IRRIGATION AND DELAYED ACTIVATION ON COTTON RESIDUAL HERBICIDE EFFICACY. FB Browne*, S Li, KJ Price, RD Langemeier; Auburn University, Auburn, AL (253)

ABSTRACT

Residual herbicide failures in dryland areas are frequently reported due to insufficient activation. Greenhouse studies were conducted in 2019 to evaluate the performance of cotton residual herbicides at different irrigation levels following application and investigate the influence of delayed activation on Palmer amaranth control. To test the effect of irrigation level, 10.2 by 6.4 cm pots were filled with 200g of air dried Benndale fine sandy loam soil and mixtures of 0.25 g Palmer amaranth seed + 50g of soil were spread on the surface. Water was added at 10% of total soil weight prior to herbicide treatments of acetochlor, diuron, fomesafen, fluridone, and pendimethalin at 1.26 kg, 841.39 g, 280.46 g, 231.38 g, and 1.07 kg ai ha^{-1}, respectively. Overhead irrigation was immediately applied at 0 cm, 0.64 cm, 1.27 cm, and 1.90 cm and pots were wrapped with plastic for 14 days to minimize desiccation. Irrigation was applied slowly over several hours to prevent oversaturation. Palmer amaranth germination and biomass was recorded 2 weeks after activation. Palmer amaranth germination was reduced with increased irrigation. Fomesafen, acetochlor, diuron, and fluridone provided similar Palmer amaranth control and significantly lower germination and biomass than the nontreated control at 0, 0.64, and 1.27 cm irrigation. Palmer amaranth germination in fomesafen treated pots increased as irrigation increased with 99% reductions at 0 cm irrigation and 85% reductions at 1.91 cm relative to the nontreated control. Lack of irrigation in fluridone treated pots resulted in 38%, 26%, and 13% more germination than pots activated with 0.64, 1.27, and 1.91 cm water, respectively. Acetochlor and diuron performance was similar under all irrigation levels tested. Pendimethalin provided little control of Palmer amaranth at all irrigation levels tested. In the delayed activation experiment, Benndale fine sandy loam soil was oven dried for 48 hours prior to filling pots with 200g of soil and spreading a mixture of 0.25 g Palmer amaranth seeds + 50 g of additional soil. The residual herbicides and respective rates discussed above were applied to dry soil. Following herbicide applications, 1.27 cm of irrigation was applied 0, 3, 7, or 14 days later and pots received 0.64 cm water daily to prevent desiccation. Palmer amaranth germination and biomass were recorded 2 weeks after activation. With the exception of pendimethalin, all herbicides tested maintained efficacy with activation delayed up to 14 days. Germination reductions relative to the nontreated control following 14 day delays between application and activation were 92%, 88%, 91%, 88%, and 21% for acetochlor, diuron, fomesafen, fluridone, and pendimethalin, respectively. Pendimethalin applications resulted in poor control of Palmer amaranth regardless of activation amount or timing. Activation amount and timing had little influence on herbicide efficacy in this study.

EVALUATION OF FLORPYRAUXIFEN-BENZYL CONTROL OF PALMER AMARANTH IN FURROW-IRRIGATED RICE. JW Beesinger*[1], JK Norsworthy[1], T Barber[2], MC Castner[1], GL Priess[1], RB Farr[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (254)

ABSTRACT

Furrow-irrigated rice acres have tripled in the state of Arkansas in the last 5 years. Aerobic conditions of furrow-irrigated rice present new problems when compared to the anaerobic conditions of flooded rice, a major one being the germination of Palmer amaranth (*Amaranthus palmeri*). Therefore, new management strategies need to be developed to control Palmer amaranth in furrow-irrigated rice. A field study was designed to optimize Palmer amaranth control utilizing rates and timing of applications of florpyrauxifen-benzyl. An experiment was conducted in 2019 at the Lon Mann Cotton Research Station in Marianna, Arkansas, designed to be a two-factor factorial randomized complete block. There was no interaction between rate and timing observed ($p = 0.89$). However, a significant main effect of rate ($p = 0.008$) and timing ($p < 0.0001$) was observed. Palmer amaranth control increased as rate of florpyrauxifen-benzyl increased without reaching complete control. Palmer amaranth control was greatest when florpyrauxifen-benzyl was applied to Palmer amaranth plants no taller than 45 cm in height. Failure to apply florpyrauxifen-benzyl before 45-cm tall Palmer amaranth (4 weeks after planting) resulted in a decrease in control. Delaying removal of Palmer amaranth with florpyrauxifen-benzyl at the density present in this trial also negatively impacted rice grain yield. Results from this research reveal that the use of florpyrauxifen-benzyl as a tool for Palmer amaranth control can be very effective if applied early in the growing season.

IMPLICATIONS OF DICAMBA EXPOSURE DURING RICE REPRODUCTIVE DEVELOPMENT.

MC Castner*, JK Norsworthy, L Priess, RB Farr; University of Arkansas, Fayetteville, AR (255)

ABSTRACT

Engenia and XtendiMax with VaporGrip are labeled for preemergence and postemergence control of broadleaf weeds in XtendFlex cotton and Roundup Ready 2 Xtend soybean. Despite its efficacy on problematic weeds in the Midsouth, labeled applications of Engenia and XtendiMax in both cotton and soybean have presented major concerns for off-target movement, primarily to non-dicamba-resistant soybean. Extensive research has been published regarding the effects of sublethal concentrations of dicamba at multiple growth stages in soybean; however, there is limited research investigating the impact of dicamba on reproductive rice. In order to determine the potential consequences of dicamba drift rates on reproductive rice, an experiment was conducted near Stuttgart, Arkansas in 2018 and 2019. Dicamba at rates of 1, 1/10, 1/100, and 1,1000X, with 1X being 560 g ae ha^{-1} were applied to rice at three reproductive growth stages. Treatments were arranged as a two-factor factorial, with the first factor being dicamba rate, and the second being rice growth stage. There were no significant treatment effects observed for 100-seed weight, although dicamba rate played a significant role on the relative average panicle weight with a 15 and 39% reduction at the 1/10 and 1X rate, respectively. The same trend translated to reductions in both average number of seeds per panicle and grain yield, with a decrease of approximately 14 and 35%. An interaction was observed between dicamba rate and growth stage as well, with 1/10 and 1X rates of dicamba hastening rice maturity 2 and 3 days, respectively. These results clearly show severe consequences to rice from the off-target movement of dicamba only at dicamba rates typically in excess of those associated with drift. Therefore, the threat that of off-target dicamba poses to rice is far less severe than what has been observed in soybean.

EVALUATION OF PRE AND POST HERBICIDE PROGRAMS FOR WEED CONTROL IN PEANUT (ARACHIS HYPOGEAE L.). P Kharel*[1], P Devkota[1], B Tillman[2], G MacDonald[3], R Tiwari[1]; [1]University of Florida, Jay, FL, [2]University of Florida, Marianna, FL, [3]University of Florida, Gainesville, FL (257)

ABSTRACT

Field research was conducted at Marianna, Florida, to evaluate peanut tolerance and weed control from preemergence (PRE) followed by early-postemergence (EPOST) herbicide programs. The PRE herbicides were pyroxasulfone, metolachlor, flumioxazin, pendimethalin, ethalfluralin, diclosulam, and dimethenamid. A tank-mix of paraquat plus acetochlor plus bentazon was applied at 4 wks after PRE treatment (WAT). Nontreated check and weed-free control were also included for treatment comparison. There was no difference among herbicides for peanut injury, peanut height and canopy width at 2 and 4 WAT. Palmer amaranth (*Amaranthus palmeri S. Watson*) control was lower with diclosulam (50%) compared to other herbicides (= 96%) at 4 WAT. Carpetweed (*Mollugo verticillata L.*) control was lower with metolachlor (80%) compared to pendimethalin, flumioxazin, or pyroxasulfone (=99%) at 4 WAT. At 2 wk after EPOST treatment, peanut injury was greater with PRE applied dimethenamid and pyroxasulfone compared to ethalfluralin. At 4 wk after EPOST, peanut height with pyroxasulfone was lower than weed-free control; while, there was no difference in canopy height and canopy width with other herbicide programs. Peanut injury was similar for all the herbicide programs at 4 and 8 wk after EPOST treatment. At 8 wk after EPOST treatment, Palmer amaranth control was greater (=96%) with metolachlor, flumioxazin, pendimethalin, or ethalfluralin compared to diclosulam (91%) herbicide program. There was no difference among PRE fb EPOST herbicide programs for Texas Panicum (*Panicum texanum*) control at 8 wk after EPOST treatment. Peanut yield was greater with flumioxazin (6768.6 kg ha^{-1}) compared to pyroxasulfone herbicide program (5803.3 kg ha^{-1}). The results from this study illustrate that various PRE herbicides could be incorporated in the herbicide programs for weed control in peanut production system.

RICE PERFORMANCE FOLLOWING EXPOSURE TO SUB-LETHAL CONCENTRATIONS OF COMMONLY APPLIED PRE HERBICIDES. B Lawrence*, JA Bond, BR Golden, TW Allen, HM Edwards, J McCoy; Delta Research and Extension Center, Stoneville, MS (258)

ABSTRACT

Rice production in Mississippi occurs in the northwestern portion of Mississippi within the floodplain of the Mississippi and Yazoo rivers due to the region's clay-textured soils, environment, and water availability. In 2018, rice producers harvested 56,275 ha, with production in Bolivar, Sunflower, Tunica, Quitman, and Washington counties accounting for approximately 73% of Mississippi rice ha. In these primary rice-producing counties, land area devoted to rice production makes up 6.25% of row crop hectarage. Often rice is produced within proximity of corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), and soybean [*Glycine max* (L.) Merr]. Depending on planting date, rice can be at various growth stages when preplant herbicide applications containing paraquat are be being applied to land devoted to corn, cotton, and soybean production. Research was conducted at the Mississippi State University Delta Research and Extension Center from 2015 to 2018 to (1) determine the effects of sub-lethal concentrations of paraquat, metribuzin, fomesafen, and cloransulam-methyl applied at different rice growth stages and (2) characterize rice response to a sub-lethal concentration of paraquat in combination with common POST and residual herbicide. Three studies were conducted from 2015 to 2018 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to characterize rice performance following exposure to a sub-lethal rate of paraquat, metribuzin, fomesafen, and chloransulam-methyl applied at different growth stages and to evaluate rice response to a sub-lethal rate of paraquat applied alone or in mixtures with sub-lethal rates of metribuzin or fomesafen. Experimental design for both studies was a randomized block with four replications. In the timing studies, paraquat, metribuzin, fomesafen, and chloransulam-methyl were applied at 84, 42, 39 and 3.5 g ai ha^{-1}, respectively, to spiking to one-leaf rice (VEPOST), two- to three-leaf rice (EPOST), three- to four-leaf rice (MPOST), 7 days postflood (7 DPFLD), 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 84 g ha^{-1} and Factor B being herbicide mixture and including no herbicide mixture, metribuzin at 42 g ha^{-1}, and fomesafen at 39 g ha^{-1}. Additionally, in the Residual Herbicide Study paraquat was applied alone or in mixture with Authority MTZ, Boundary, Canopy, Corvus, Cotoran, Envive, Fierce, Lexar EZ, Prefix, or Sonic at 10% of the recommended use rate in Mississippi to rice in the EPSOT growth stage. Injury data in all studies were regressed against DAT allowing for both linear and quadratic terms with coefficients depending on DAT and non-significant model terms were removed sequentially until a satisfactory model was obtained. All other data were regressed against d after emergence (DAE) allowing for both linear and quadratic terms with coefficients depending on DAE, and non-significant model terms were removed sequentially until a satisfactory model was obtained. Data collected in the timing studies consisted of injury 3 DAT and at weekly intervals to 28 DAT, yield, and d to 50% heading as a indication of rice maturity. In both mixture studies, visual estimates of rice injury were recorded 3, 7, 14, 21, and 28 d after treatment (DAT), d to 50% heading, and rough rice yield. Rough rice yields were collected at maturity. All data that did not exhibit a regression trend in the timing studies and in mixture studies were subjected to ANOVA and estimates of the least square means were used for mean separation with a = 0.05. Rice yield was negatively affected following exposure to paraquat applied any time after rice emergence. Paraquat applications to rice in early reproductive growth reduced rough rice yield and delayed maturity the greatest. Paraquat plus metribuzin injured rice 69% 28 d after treatment (DAT), which was 10 to 13% greater than following paraquat alone or paraquat plus fomesafen. Paraquat alone reduced rough rice yield 23% and was no different than paraquat plus fomesafen. However, when paraquat was applied in mixture with metribuzin rough rice yield decreased an additional 11%. Paraquat plus 10 different residual herbicides injured rice =51% 28 DAT and reduced rough rice yields =21%. These data indicate that paraquat can have negative impact on rice growth and development. Therefore, it is crucial that if environmental

conditions are conducive for off-target herbicide movement extreme caution should be exercised when applying paraquat adjacent to fields devoted to rice production.

WEED MANAGEMENT IN OKLAHOMA SOYBEAN. TA Baughman*, R Peterson; Oklahoma State University, Ardmore, OK (259)

ABSTRACT

Weeds are a major production concern for soybean producers throughout the state of Oklahoma. Herbicide resistance has reduced the effectiveness of several herbicide families for many Oklahoma growers. Therefore, other weed management systems and combinations of multiple mode-of-action herbicide programs must be evaluated to determine systems that are both efficacious and economical. Trials were established during the 2019 growing seasons at the Oklahoma State University's Mingo Valley Research Station near Bixby, OK. Soybean were planted on June 13, 2019 at a rate of 8 seed/foot. Soybean technologies evaluated included Enlist (2,4-D tolerance), GT27 (HPPD tolerance), Liberty-Link (glufosinate tolerance), and Xtend (dicamba tolerance). Preemergence and postemergence programs were evaluated with each of the technologies. PRE applications were made immediately after planting, while POST applications ranged from 18 to 47 days after planting. Plots were evaluated for visual injury and were harvested for yield. One trial was established evaluating the GT27 technology. Isoxaflutole was applied PRE in combination with various other herbicides. Soybean injury was less than 5% except with Zidua PRO applied alone or Authority First, Verdict, or Zidua PRO in combination with isoxaflutole. Palmer amaranth and large crabgrass control was at least 95% with all treatments except with Verdict applied alone or in combination with isoxaflutole prior to POST treatment application. Large crabgrass control was less than 95% with Authority First. The addition of isoxaflutole to Authority First increased large crabgrass control from 76% to 95% control. After POST applications of Liberty + Roundup weed control was greater than 95% with all treatments except Verdict applied alone PRE. Treatments looking at residual herbicide applied either PRE or POST was conducted with each of the three technologies: Enlist, Liberty-Link, and Xtend. PRE (residual only) applications were made immediately after planting while POST1 (residual + POST) treatments were made 18 days after planting. All treatments were followed up with a treatment 47 days after planting. Soybean injury was 5% or less except with treatments that did not receive a PRE treatments. Most of this injury was in the form of stunting due to competition from the weeds not controlled prior to the POST applications. Weed control (Palmer amaranth, large crabgrass, ivyleaf morningglory) late season was at least 95% with all treatments in the Enlist system except when Cinch was applied POST. Morningglory control was less than 95% with Reflex POST in the Enlist system. Morningglory control was less than 95% with all residual treatments applied POST in the Liberty-Link system. Weed control late season was at least 98% with all treatments in the Xtend system. Yields were similar between the same PRE and POST residual treatments with the Enlist system except Cinch applied POST. This was likely due to the lower weed control with this treatment. No difference in yield was observed between PRE and POST treatments in the Liberty-Link system. Yields were lower with the PRE treatments of Cinch, Warrant, and Reflex compared to those same treatments applied POST in the Xtend system. Yields were greater than 61 bu/A with all POST residual treatments while only Warrant Ultra applied PRE had yields above 61 bu/A. This did not appear to be due to injury and may have been due to the lack of morningglory control mid-season.

INFLUENCE NITROGEN AND POTASSIUM FERTILIZATION ON SOYBEAN EXPOSED TO A LOW-DOSE OF DICAMBA AT MULTIPLE GROWTH STAGES. OW France*, JK Norsworthy, MM Zaccaro, MC Castner; University of Arkansas, Fayetteville, AR (260)

ABSTRACT

While providing an option for weed control, the increase in dicamba use in recent years has posed several new threats to non-dicamba soybean farmers in the form of physical drift and volatility. Soybean is extremely sensitive to dicamba, even at very low rates, such as when volatility or physical drift occur. The objective of this study was to determine if addition of the nutrients nitrogen (N) and potassium (K) would hasten soybean recovery from, or mitigate negative yield response to, low-dose dicamba injury. A field trial was established at the Arkansas Agricultural Research and Extension Center in Fayetteville, Arkansas in 2019. This trial was set up as a two-factor factorial with growth stage at application (R1 or R3, or both) applied at 1/150X rate of dicamba as factor A and fertilization type as factor B. Injury data were collected using two scales, including a typical visible injury rating and the Behrens and Leuschen dicamba injury scale. At 4 weeks after the R1 application (3 weeks after the R3 application), fertilizer type had an effect on injury according to the visible injury and Behrens and Leuschen scales. Based on visible injury, plots receiving both N and K had lower injury compared to plots receiving neither N nor K as well as those receiving N alone. For the Behrens and Leuschen scale, plots receiving only K had lower injury than plots receiving neither N nor K as well as all other treatments. For visible injury ratings taken 2, 3, 4, 5, and 6 weeks after the R1 dicamba application plots receiving both N and K had the numerically lowest injury, although it was not always significant. For the Behrens and Leuschen scale, ratings taken at 2, 3, and 4 weeks after the R1 application plots receiving K alone had the numerically lowest injury, although not always significant. At 5 and 6 weeks after the R1 application, plots receiving N and K had the lowest injury. Nontreated plots with soybean receiving N and K consistently produced the highest amount of plant biomass while the opposite was true for treated plots. Only yield across growth stage at application was significant with no significance for yield across fertilizer treatment.

HERBICIDE PROGRAM AND ROW SPACING EFFECT ON PPO-RESISTANT PALMER AMARANTH AND WATERHEMP. MS Wiggins*[1], D Copeland[2], N Hustedde[3]; [1]FMC, Friendship, TN, [2]FMC, Dayton, OH, [3]FMC, Celestine, IN (261)

ABSTRACT

Multiple-resistant Palmer amaranth (*Amaranthus palmeri* S.Watson) and waterhemp (*Amaranthus tuberculatus* (Moq.) J.D. Sauer) infest most row-crop production acres in the U.S. Successful management of the aforementioned weeds species requires an integrated approach. The use of residual herbicides with multiple, effective sites of action, applied at planting and during the season is very common for waterhemp and Palmer amaranth management programs. Cultural practices, such as narrowed row spacing, can also be utilized to aid in suppression waterhemp and Palmer amaranth. In 2019, research was conducted in Tennessee and Indiana to evaluate the effect of row spacing and the number of herbicide sites of action applied PRE on Palmer amaranth and waterhemp control. In Jackson, TN, row spacing did not affect Palmer amaranth control 28 DAA. Greatest Palmer amaranth control was provided by sulfentrazone + pyroxasulfone (95%) 28 DAA. Control of Palmer amaranth was similar between treatments: sulfentrazone alone (72%), pyroxasulfone + fluthiacet-methyl (65%), and *S*-metolachlor + metribuzin (70%). The lowest control of Palmer amaranth was observed 28 DAA where *S*-metolachlor (44%) and metribuzin (24%) were applied alone. Row spacing did not impact waterhemp control 28 DAA at Champaign, IL location. Similar waterhemp control was observed with metribuzin alone (81%), metribuzin + *S*-metolachor (93 %), pyroxasulfone + fluthiacet-methyl (81 %), and sulfentrazone + pyroxasulfone (97%) 28 DAA. Similar control was observed between metribuzin alone, pyroxasulfone + fluthiacet-methyl, and sulfentrazone alone (69%). However, waterhemp control observed with sulfentrazone alone was significantly less than metribuzin + *S*-metolachor and sulfentrazone + pyroxasulfone. The poorest waterhemp control was observed 28 DAA with *S*-metolachlor applied alone (48%). In Year 1 of this study, row spacing did not impact Palmer amaranth or waterhemp control. This was likely due to confounding factors such as rainfall accumulation and delayed plantings experienced across the U.S. in 2019. Extensive reports of additive control of *Amaranthus* spp. have been reported where cultural weed control practices are deployed. In this study, effective control of Palmer amaranth and waterhemp was observed for PRE-treatments that comprised two, herbicide sites of action, regardless of row spacing.

DIFFERENTIAL SUSCEPTIBILITY OF PALMER AMARANTH ACCESSIONS TO GROUP 3 AND 15 HERBICIDES. FG Torralva*, LB Piveta, JK Norsworthy; University of Arkansas, Fayetteville, AR (262)

ABSTRACT

Main crop production systems in midsouthern United States includes cotton, soybean, rice, and corn. Palmer amaranth (*Amaranthus palmeri* S. Wats.) has prevailed as a noxious weed in most of these crops and has evolved resistance to different herbicide sites of action. Resistance of some accessions to preemergence herbicides such as *S*-metolachlor have been reported by our group. In addition, failure of trifluralin and other dinitroaniline herbicides have been observed in greenhouse trials. Thus, the objective of this research was to determine the susceptibility of Palmer amaranth accessions collected across Arkansas to *S*-metolachlor (1064 g ai ha^{-1}) and trifluralin (1120 g ai ha^{-1}). Results have showed distinctly different levels of susceptibility across accessions. Mortality values ranged from 79 to 100 and 13 to 100% with *S*-metolachlor (average mortality 96%) and trifluralin (average mortality 87%), respectively. From 121 accessions treated with *S*-metolachlor, 86 (71%) showed a mortality level = 95%. In the case of trifluralin, only 49 (41%) out of 119 accessions displayed a mortality level = 95%. Furthermore, approximately 5% of accessions assayed with trifluralin exhibited a mortality £ 50%. This survey points out sites with low-susceptibility accessions and establishes the need for effective-applied alternatives for controlling Palmer amaranth.

IMPACT OF DROPLET SIZE AND CARRIER VOLUME ON SOYBEAN (GLYCINE MAX) HARVEST AID EFFICACY. SD Hall*[1], DM Dodds[1], G Kruger[2], JT Irby[1], JP McNeal[1], LX Franca[1], JJ Williams[1], BJ Norris[1], WJ Rutland[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska - Lincoln, North Platte, NE (263)

ABSTRACT

An experiment was conducted in 2019 to evaluate the effect of carrier volume and spray droplet size have on the efficacy of soybean (*Glycine max*) harvest aids. This experiment was conducted in Starkville and Brooksville, Mississippi. Eight row (7.7m x 12.2m) plots were planted with ASGRO 46X6 soybeans at a seeding rate of 321,237 seed ha^{-1}. Harvest aid applications were made when 65% mature pods were present with a Capstan® Pinpoint Pulse-Width Modulation (PWM) sprayer on a high-clearance Bowman MudMaster® at a ground speed of 14.5 kilometers $hour^{-1}$. The experiment utilized two carrier volumes (47 and 187 L ha^{-1}) and three droplet sizes (200, 500, and 800µm). Harvest aids included paraquat (Gramoxone® SL 2.0) at 3.88 kg ai ha^{-1} saflufenacil (Sharpen®) at 0.04 kg ai ha^{-1} and sodium chlorate (Defol 5®) at 2.85 kg ai ha^{-1}. Visual ratings were taken at 3,7,10, and 14 days after application and included percent defoliation, desiccation, and green leaves. All the ratings were based off the untreated check in each replication. The center two rows were harvested with a combine specialized for small plot research and grain moisture checked for each plot. The experimental design was a randomized complete block that included 4 replications. These data were subjected to analysis of variance using the PROC MIXED procedure in SAS v9.4. Means were separated using Fisher's Protected LSD with an alpha value of 0.05. Green leaves at 10 days after application were impacted by an interaction between carrier volume and harvest aid. Saflufenacil at the lower carrier volume produced 25% green leaves left on the plant. At 14 days after application, the application of saflufenacil resulted in 11% green leaves. These percentages were statically greater than were from other treatments but did not translate into yield reduction. However, soybeans to which saflufenacil was applied higher grain moisture percentage. However, observed percent grain moisture was still under the desired moisture level above which a reduction in price would be received from the elevator.

SYNERGIZED AMETRYN - A NEW USE FOR AN OLD TRIAZINE FOR RESISTANT WEED AND GRASS CONTROL IN CORN. LL Walker*; Walker Cotton Technical Services, Flintville, TN (264)

ABSTRACT

The innovator of this new herbicide program for corn began this work in '08. It recognizes Dr. Dean Reicher's, Weed Scientist, University of IL, paper of atrazine's enhancement of mesotrione in improving herbicide performance post applied.This presentation shows the attributes of ametryn + isoxaflutole and other HPPD combinations and its efficacy on Hippuris vulgaris, Sorghum halpense, Amaranthus retroflexus and A. hybridus, Lolium perenne multiflorum plus five other weed and grass species that has shown herbicide resistance to at least one herbicide group. Synergized ametryn is compared to atrazine + glyphosate, atrazine + S-metolachlor + mesotrione, saflufenacil + pyroxasulfone, saflufenacil + S-metolachlor, plus others. This presentation also shows the importance of precision application and its place for synergized ametryn in 21st century modern agriculture.Vision - Not necessarily Seeing things as they are - But Seeing Things as they can be.

THE BICYCLOPYRONE WEED CONTROL ADVANTAGE IN A NEW PREMIX PRODUCT CONCEPT FOR CORN. S Cully[1], H McLean*[2], GD Vail[3], RD Lins[4], TH Beckett[3]; [1]Syngenta Crop Protection, Marion, IL, [2]Syngenta Crop Protection, Perry, GA, [3]Syngenta Crop Protection, Greensboro, NC, [4]Syngenta Crop Protection, LLC, Rochester, MN (265)

ABSTRACT

Acuron® GT is a new herbicide coming soon from Syngenta for weed control in glyphosate tolerant field corn. Acuron GT will contain S-metolachlor, mesotrione, bicyclopyrone and glyphosate for postemergence application with knockdown and residual control of grasses and broadleaves. In 2019, field trials were conducted to evaluate Acuron GT for weed control and crop tolerance. Results show that Acuron GT effectively controls many difficult weeds and provides improved residual control and consistency compared to other commercial standards. Acuron GT is not registered for sale or use in the US and is not being offered for sale.

MANAGEMENT OF VOLUNTEER CORN WITH FUSILADE DX PLUS DICAMBA TANK MIXES.

M Hay*[1], ET Parker[2], P Eure[3]; [1]Syngenta, Vero Beach, FL, [2]Syngenta Crop Protection, Vero Beach, FL, [3]Syngenta Crop Protection, Greensboro, NC (266)

ABSTRACT

Volunteer corn can significantly reduce soybean yield if left uncontrolled. Soybean yield loss caused by volunteer corn is dependent on the density and duration of interference. Management of volunteer corn in soybean includes reducing corn grain losses at harvest, tillage, cultivation, and chemical control. Use of Group 1 herbicides in soybeans to control glyphosate tolerant volunteer corn is common. Commercialization of dicamba tolerant soybean (*Glycine max* L. (Merr.)) increased the frequency of dicamba and Group 1 herbicide tank mixtures for control of glyphosate tolerant volunteer corn (*Zea mays* L.). Previous research documented the antagonism of monocot control when dicamba is added to Group 1 herbicides. Therefore, the objectives of this research were to (1) Evaluate Fusilade® DX (fluazifop-P-butyl) herbicide volunteer corn control with and without dicamba (2) Discuss factors that influence volunteer corn control when using Fusilade DX + dicamba tank mixtures. This research concluded that Fusilade DX is an effective tool for managing volunteer corn in soybeans when tank mixed with and without dicamba. Volunteer corn management may also be influenced by corn height, tank mix partners, and adjuvants.

PRE- AND POST-EMERGENCE HERBICIDE TOLERANCE OF INDUSTRIAL HEMP GROWN FOR GRAIN. SJ Michael*, ML Flessner, KW Bamber, JH Fike; Virginia Tech, Blacksburg, VA (267)

ABSTRACT

Industrial hemp (*Cannabis sativa*) has been increasing in popularity recently following deregulation in the 2018 farm bill. Hemp can be grown for grain, oil, or fiber production but little is known about its tolerance to various herbicides. Two studies were conducted to test tolerance to pre- and post-emergence herbicides. Both studies were randomized complete block design with four replications and conducted in both Blacksburg and Blackstone, VA. 'Joey' hemp was drilled on 16.5 cm row spacings at 34 kg ha^{-1} on June 3 and May 21, 2019, respectively, with pre-emergence herbicides applied the same day at each location. Pre-emergence (PRE) herbicide treatments included: pendimethalin (1.6 kg ha^{-1}), ethalfluralin (1.05 kg ha^{-1}), *S*-metolachlor (1.6 kg ha^{-1}), acetochlor (1.26 kg ha^{-1}), chlorimuron-ethyl (0.035 kg ha^{-1}), flumetsulam (0.056 kg ha^{-1}), fomesafen (0.42 kg ha^{-1}), sulfentrazone (0.28 kg ha^{-1}), flumioxazin (0.089 kg ha^{-1}), metribuzin (0.278 kg ha^{-1}), linuron (1.4 kg ha^{-1}), and diuron (1.12 kg ha^{-1}). Post-emergence (POST) herbicides were applied on June 28 and June 17, 2019 in Blacksburg and Blackstone, VA when hemp was 45 and 65 cm tall, respectively. POST herbicide treatments included: sethoxydim (0.136 kg ha^{-1}), clethodim (0.102 kg ha^{-1}), quizalofop-p-ethyl (0.077 kg ha^{-1}), bromoxynil (0.28 kg ha^{-1}), carfentrazone-ethyl (0.026 kg ha^{-1}), fomesafen (0.42 kg ha^{-1}), acifluorfen (0.42 kg ha^{-1}), clopyralid (0.139 kg ae ha^{-1}), fluroxypyr (0.157 kg ae ha^{-1}), quinclorac (0.42 kg ae ha^{-1}), and thifensulfuron-methyl (0.004 kg ha^{-1}). Visible injury ratings for PRE herbicides were taken at 30 days and 57+ days after application and 10 days and 15+ days after application for POST herbicides. Grain yield data were recorded at harvest. Stand count was taken for PRE herbicides on August 30, 2019. Visible injury and yield data were subjected to ANOVA and subsequently means separation using Fisher's protected $LSD_{0.05}$. Stand count data were subjected to a Dunnett's test. Of all PRE herbicides, ethalfluralin (<1%), pendimethalin (<12%), and acetochlor (<26%) were the least injurious treatments in Blacksburg 30 DAA. Ethalfluralin (<5%) was the only PRE herbicide with relative crop safety at Blackstone 30 DAA. Ethalfluralin, pendimethalin, acetochlor, *S*-metolachlor, and linuron all maintained less than 20% visible injury at Blacksburg 57+ DAA. Ethalfluralin, pendimethalin, and *S*-metolachlor did not reduce stand relative to the nontreated. Ethalfluralin, pendimethalin, *S*-metolachlor, and sulfentrazone did not reduce yield relative to the nontreated check at both locations. POST herbicides quizalofop-p-ethyl, bromoxynil, sethoxydim, clethodim, (all <3%), clopyralid (<10%), and quinclorac (<15%) were the least injurious at both locations 10 DAA. Quizalofop-p-ethyl, bromoxynil, sethoxydim, clethodim, and clopyralid were the least injurious (<10%) 15+ DAA at both locations. POST herbicides bromoxynil, sethoxydim, clethodim, clopyralid, acifluorfen, carfentrazone-ethyl, and fomesafen did not reduce yield relative to the nontreated check at both locations. Several herbicides resulted in commercially acceptable (<20%) injury to hemp and have potential to be used for weed control. However, some injury was observed and warrants further study across time and space. Additionally, future research should evaluate other herbicides.

DICAMBA RESEARCH UPDATE. LE Steckel[1], TC Mueller*[2]; [1]University of Tennessee, Jackson, TN, [2]University of Tennessee, Knoxville, TN (268)

ABSTRACT

This report details data from field and lab studies from 2017, 2018 and 2019. The field studies utilized high-volume air samplers located inside the treated area. The samplers were operated over a time course of 0 to 36 hours after treatment. Dicamba emissions were greater during the afternoon hours compared to nighttime. A three-year field study of DGA dicamba applied to various surfaces showed more dicamba coming from green plants than tilled soil than dead plants. Relative responses of the three years were consistent, but the overall magnitude of dicamba measurement varied by a factor of 20X. The measured temperature and relative humidity of the three surfaces were similar, so another explanation will be needed. This surface effect is important, since most of the reported field studies of dicamba emission are under bare ground conditions, and as such could be understating actual dicamba concentrations. A comparison of DGA, DGA +Vapor Grip (VG), and BAPMA salts of dicamba; all treatments including the potassium salt of glyphosate; showed that the DGA tended to have slightly higher emissions, but the three treatments had similar overall dicamba emissions. Lab studies indicated that the addition of glyphosate to DGA+VG greatly increased dicamba emissions. Dicamba emissions were also directly related to temperature, with little volatility at 15 C, but more dicamba as the temperature increased. The addition of glyphosate to dicamba mixtures reduced final pH substantially, often below label recommendation of 5.0. This was true for both BAPMA and DGA+VG over a wide range of starting water pHs. The addition of AMS had only a minor effect on pH, indicating that total cationic loading was an important factor in the subsequent dicamba volatility. BAPMA and DGA+VG spray mixture pH was not affected by potential tank mix partners of clethodim, glufosinate, acetochlor, S-metolachlor and bifenthrin.

Survey of Herbicide-Resistant Weeds in the South

Please refer to **www.herbicideresistance.org** for up-to-date information on herbicide resistant weeds in the Southern region.

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