Proceedings of the Southern Weed Science Society 75th Annual Meeting

AT&T Hotel and Conference Center
Austin, TX
January 23-27, 2022

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Regulations and Instructions for Papers and Abstracts

Regulations

1. Persons wishing to present a paper(s) at the conference must first electronically submit a title to the SWSS web site (http://www.swss.ws/) by the deadline announced in the "Call for Papers".

2. Only papers presented at the annual conference will be published in the Proceedings. An abstract or paper must be submitted electronically to the SWSS website by the deadline announced at the time of title submissions.

3. Facilities at the conference will be provided for LCD-based presentations only.

4. Terminology in presentations and publications shall generally comply with the standards accepted by the Weed Science Society of America. English or metric units of measurement may be used. The approved common names of herbicides as per the latest issue of Weed Science or trade names may be used. Chemical names will no longer be printed in the annual program. If no common name has been assigned, the code name or trade name may be used and the chemical name should be shown in parenthesis if available. Common names of weeds and crops as approved by the Weed Science Society of America should be used.

5. Where visual ratings of crop injury or weed control efficacy are reported, it is suggested that they be reported as a percentage of the nontreated check where 0 equals no weed control or crop injury and 100 equals complete weed control or crop death.

6. Each author is assured of one senior-author presentation, but multiple senior-author submissions will be accepted only as space and time are available. If you have several papers or posters you wish to present, please indicate which is highest priority by adding a note in the comments section on the title submission form

7. Papers and abstracts must be prepared in accordance with the instructions and form provided in the "Call for Papers" and on the SWSS web site. Papers not prepared in accordance with these instructions will not be included in the Proceedings.

Instructions to Authors

Instructions for title submissions, and instructions for abstracts and papers will be available in the "Call for Papers" and on the SWSS website (http://www.swss.ws/) at the time of title or abstract/paper submission.

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

Typing Instructions-Format

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

2. Content:

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

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

Each section of an abstract or paper should be clearly defined. The heading of each section should be typed in the center of the page in capital letters with double spacing before and after. Pertinent comments regarding some of these sections are listed below:

Title - All in capital letters and bold. Start at the upper lefthand corner leaving a one-inch margin from the top and all sides.

Author(s), Organizations(s), Location: - Start immediately after title. Use lower case except for initials, first letters of words, etc. Do not include titles, positions, etc. of authors.

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

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

ABSTRACT

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

Acknowledgements - Show as a footnote at the end of the abstract (not end of the page) or the bottom of the first page of papers.

Literature Citations - Number citations and list separately at the end of the text.

Table and Figures - Place these after literature citations. Single space all tables. Tables should be positioned vertically on the page. Charts and figures must be in black and white.

2022 AWARDS

Outstanding Young Weed Scientist - Academia
Michael Flessner

Dr. Michael L Flessner is an associate professor and extension weed science specialist in the School of Plant and Environmental Sciences at Virginia Tech. He received his BS from the University of Tennessee. He obtained both his masters and doctoral degrees from Auburn University where he also served as research associated.

Michael has research and extension responsibilities for weed management in corn, soybean, small grains, and other crops as well as pastures and forages across Virginia. His research efforts focus on herbicides and herbicide resistance as well as cover crops and harvest weed seed control. To date, Michael is an author of 49 peer-reviewed publications in scientific journals, over 180 abstracts presented at professional meetings, and 20 extension publications. He has been awarded over $2.9 million in competitive funds to his program. Michael has advised or co-advised 8 graduate students and currently chairs or serves on 9 student committees. Michael's students have won numerous scholarships and awards, notably enjoying success in the Society's annual weed contest.

Michael has been a member of SWSS since 2008 and served the Society in various rolls including committee service on the Weed Resistance and Technology Stewardship, Endowment Foundation, Local Arrangements, and Resolutions and Necrology committees as well as oral/poster contest judge and section chair. Michael has served on the executive committee of the Northeastern Weed Science Society (NEWSS) as Editor, in addition to other service. Michael was awarded NEWSS's Outstanding Researcher Award in 2019 and Outstanding Educator in 2022. He is also involved in WSSA, currently serving on the Weed Loss and Extension committees. Michael resides in Blacksburg, Virginia with his wife Chelsea Flessner and their two childern, Davidson and Everett.

Outstanding Young Weed Scientist - Industry
Sandeep Rana

Dr. Sandeep Rana grew up in a family of agricultural researchers and administrators on the campus of CCS Haryana Agricultural University (HAU), a public-funded agricultural university located in Hisar, Haryana, India. He was destined to become an engineer but some forward-looking conversations with his Plant Pathologist father motivated him to pursue a career in agricultural sciences instead. He still considers that to be the best career decision he has made so far. Sandeep completed his B.Sc. (Honors) in Agriculture and started with an M.S. degree in Horticultural Biotechnology at CCS HAU before coming to the USA to start his journey as a weed scientist.

In 2010, Sandeep moved to University of Arkansas to pursue his M.S. in Weed Science under the guidance of Dr. Jason K. Norsworthy. After completing the M.S. in 2013, Sandeep went ahead to earn his Ph.D. in Turfgrass Weed Science (2016) from Virginia Tech under the direction of Dr. Shawn D. Askew. He also spent a short but fruitful time at North Carolina State University working with Dr. Wesley J. Everman as a Postdoctoral Research Scholar (2017). In fall 2017, Sandeep started his professional career as an Agronomic Research Manager in Galena, MD, with Monsanto Company. With the long-term goal of contributing to cutting-edge research and production technology that address critical needs of productivity and sustainability of global agriculture, Sandeep currently serves as the North America Agronomic Research Lead for Bayer Crop Science. In this role, Sandeep provides strategic, technical, and people leadership to a team of scientists that aid in field testing, protocol development, and trial execution of new plant health and herbicide-tolerant native and biotechnology traits, crop protection products, and system improvement concepts. He works with cross-functional and multidisciplinary teams and acts as a liaison between applied agriculture and next-generation biotechnology and precision agriculture tools.

To date, Sandeep has authored and co-authored 8 peer-reviewed journal articles, a book chapter, 75 abstracts, 18 extension and outreach publications, and presented over 50 extension/outreach and scientific presentations. He thoroughly enjoys reviewing scientific articles and has reviewed nearly 80 papers across 6 journals and currently serves as an Associate Editor for 4 scientific journals - Agronomy Journal, Crop Science, Open Agriculture Journal, and Weed Technology. Sandeep holds SWSS and its members close to his heart and considers SWSS as his home society. He has not missed a meeting since his first SWSS/WSSA joint meeting in Puerto Rico in 2011. As a graduate student, Sandeep participated in all SWSS activities, with Weed Contests being his favorite, and served as the Secretary, Vice-President, and President of the SWSS GSO. He currently serves as the Chair of the SWSS Outstanding Graduate Student Award Committee and Trustee for the SWSS Endowment Board. He also regularly helps with judging student talks/posters along with chairing and moderating annual meeting sessions. Sandeep continues to learn a great deal from this society and its extremely talented members. He is always ready to give back to the society in whatever capacity he can to help make SWSS members' experiences, especially students, at least as enriching as the one he continues to have. Because of the current COVID-19 pandemic, Sandeep is happily stuck in Middletown, DE, with his beautiful wife, Trisha Sanwal Rana, and a handsome 2- year-old son, Aveer Singh Rana. Sandeep and his family will relocate to Chesterfield, MO for his current role if the world ever comes out of this COVID mess.

Previous Winners of the Outstanding Young Weed Scientist Award

Year	Name	University / Company
1980	John R. Abernathy	Texas A & M University
1981	Harold D. Coble	North Carolina State
1982	Lawrence R. Oliver	University of Arkansas
1983	Ford L. Baldwin	University of Arkansas
1984	Don S. Murray	Oklahoma State University
1985	William W. Witt	University of Kentucky
1986	Philip A. Banks	University of Georgia
1987	Kriton K. Hatzios	VPI & SU
1988	Joe E. Street	Mississippi State University
1989	C. Michael French	University of Georgia
1990	Ted Whitwell	Clemson University
1991	Alan C. York	North Carolina State
1992	E. Scott Hagood, Jr.	VPI & SU
1993	James L. Griffin	Louisiana State University
1994	David R. Shaw	Mississippi State University
1995	John C. Wilcut	North Carolina State
1996	David C. Bridges	University of Georgia
1997	L.B. McCarty	Clemson University
1998	Thomas C. Mueller	University of Tennessee
1999	Daniel B. Reynolds	Mississippi State University
2000	Fred Yelverton	North Carolina State
2001	John D. Byrd, Jr.	Mississippi State University
2002	Peter A. Dotray	Texas Tech. University
2003	Scott A. Senseman	Texas A & M University
2004	David L. Jordan	North Carolina State
2004	James C. Holloway	Syngenta
2005	Eric Prostko	University of Georgia
2005	no nomination	--
2006	Todd A. Baughman	Texas A & M University
2006	John V. Altom	Valent USA Corporation
2007	Clifford "Trey" Koger	Mississippi State University
2007	no nomination	--
2008	Stanley Culpepper	University of Georgia
2008	no nomination	--
2009	Jason K. Norsworthy	University of Arkansas
2009	no nomination	--
2010	Bob Scott	University of Arkansas
2010	no nomination	--
2011	J. Scott McElroy	Auburn University

2011	Eric Palmer	Syngenta Crop Protection
2012	Jason Bond	Mississippi State University
2012	Cody Gray	United Phosphorus Inc.
2013	Greg Armel	BASF Company
2013	Shawn Askew	Virginia Tech
2014	Jason Ferrell	University of Florida
2014	Vinod Shivrain	Syngenta
2015	Jim Brosnan	University of Tennessee
2015	no nomination	--
2016	Daniel Stephenson, IV	LSU-Ag Center
2016	Drew Ellis	Dow AgroSciences
2017	Wes Everman	North Carolina State
2017	Hunter Perry	Dow AgroSciences
2018	Ramon Leon	North Carolina State
2019	Peter Dittmar	University of Florida
2020	Kelly Backscheider	Corteva AgriSciences
2021	Muthukumar Bagavathianan	Texas A & M University
2021	Matthew Wiggins	FMC

Outstanding Educator Award
Ramon Leon

Dr. Ramon Leon is an associate professor of Weed Biology and Ecology in the Department of Crop and Soil Sciences, North Carolina State University, USA. Previously, he was an associate professor of Weed Science at the University of Florida, USA, professor of Weed Science at EARTH University in Costa Rica, and assistant professor at California Polytechnic State University, San Luis Obispo, USA. Dr. Leon obtained a Ph.D. (2005) and M.S. in Crop Production and Physiology (2003) with emphases on Weed Science and Seed Science, and a Ph.D. in Genetics (2005) from Iowa State University, and a B.S. in Agronomy (2000) from the University of Costa Rica. His research has focused on understanding changes in weed dynamics in response to management and environmental factors. He has published over 116 peer-reviewed scientific articles, 2 book chapters, and 210 abstracts. He is Editor of the Journal of Aquatic Plant Management, and Associate Editor for Weed Science, Weed Research, Agronomy Journal, Peanut Science, and previously for the journals Weed Technology and Agronomy. He has mentored seven Ph.D. and eight master's students, four postdocs, and tens of undergraduate students conducting senior projects in different aspects of weed science.

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 University
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 University
2017	Jason Norsworthy	Univesity of Arkansas
2018	Stanley Culpepper	University of Georgia
2019	Larry Steckel	University of Tennessee
2020	Stephen Enloe	University of Florida
2021	no nomination	--

Outstanding Graduate Student Award (MS)
Delaney Foster

Delaney Foster grew up in Perry, Georgia, where her parents raised beef show cattle and horses. Delaney received her B.S. degree in Agriculture at Abraham Baldwin Agricultural College in Tifton, GA in 2018. As an undergraduate student, she worked for Dr. Stanley Culpepper at the University of Georgia Tifton campus and interned with Dr. Henry McLean, field scientist with Syngenta Crop Protection. As an undergraduate, Delaney placed first at the Southern Weed Science Society Weed Contest in the summer of 2018. These experiences opened the door for Delaney to discover a career path in weed science. Delaney obtained her M.S. degree in Plant and Soil Sciences with a concentration in crop protection from Texas Tech University in Lubbock, Texas. She studied under the direction of Dr. Peter Dotray who holds a joint appointment with Texas Tech University and Texas A&M AgriLife Research and Extension Service. Her thesis was titled “Crop Response, Weed Management Systems, and Tank Mix Partners with Isoxaflutole in HPPD Tolerant Cotton”.

Delaney has proven successful in many oral and poster competitions at both regional and national society and commodity meetings, placing first at the Texas Tech 3MT Competition, the Texas Plant Protection Association poster contest, the Beltwide Cotton Conference oral paper contest (MS & PhD), and the SWSS oral paper contest (MS). She was a member of the first-place sprayer calibration team of the SWSS at the North American Weed Science Contest in 2019 while at Texas Tech. At the SWSS weeds contest in 2021, she was a member of the winning sprayer calibration team again while a part of the University of Tennessee weed team and tied for first place in the individual sprayer calibration contest.

Delaney has had the pleasure to serve as the secretary of the SWSS graduate student organization and the vice president and current president of the WSSA graduate student organization. Delaney continues her education at the University of Tennessee where she is a PhD student with Dr. Larry Steckel studying auxin-resistant Palmer amaranth in west Tennessee. She hopes to find a career in the industry upon completion of graduate school.

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
2020	Lawson Priess	University of Arkansas
2021	Nick Hurdle	University of Georgia

Outstanding Graduate Student Award (PhD)
Maria Zaccaro-Gruener

Maria was born and raised in Ribeirao Preto, Sao Paulo, Brazil. She was introduced to the importance of crop production by her parents, Ronaldo and Aracy Zaccaro, who run a plant nursery specializing in tropical plants and native fruit trees. They inspired her to pursue a B.S. degree in agronomy from the Sao Paulo State University, which was completed in 2011. Earlier that same year, she completed an internship at the Natural Products Unit (USDA) under the supervision of Dr. Franck Dayan, where she conducted bioassays to study the impact of herbicides on photosynthesis.

Maria completed an M.S. degree in Plant and Soil Sciences with a concentration in Weed Science at the Mississippi State University under the advisement of Dr. John Byrd in 2016. Her thesis work centered on evaluating herbicide options and the use of cover crops to facilitate the management of cogongrass. In the fall of 2017, she began her Ph.D. degree in Crop, Soil, and Environmental Sciences under the direction of Dr. Jason Norsworthy at the University of Arkansas. Her dissertation work focuses on 1) evaluating dicamba translocation and metabolism in soybean, 2) understanding the factors affecting volatilization of dicamba, and 3) ascertaining the contribution of dicamba volatilization to the injury that has been observed on soybean in Arkansas and other locations.

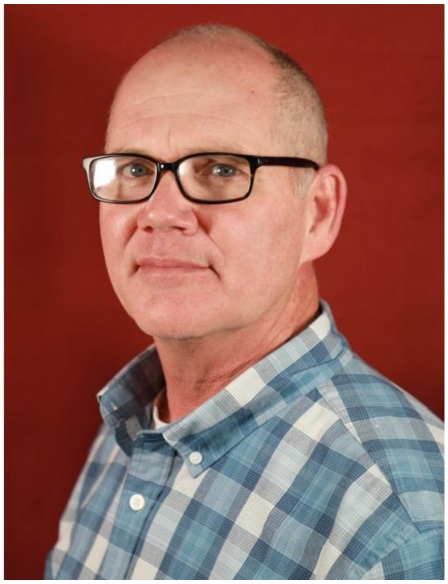
To this date, Maria has authored and co-authored 5 peer-reviewed papers, 13 extension or technical reports, and 57 abstracts from scientific presentations. Maria successfully presented her research and won awards at the Arkansas Crop Protection Association, Gamma Sigma Delta, SWSS, and WSSA. Additionally, she competed at the 2021 SWSS Weed Contest, earning tenth place overall individual. She has been actively involved in the SWSS, serving as the Endowment Committee Student Representative (2018-2020) and as the current Student Program Committee Chair for the SWSS Graduate Student Organization. She plans to stay involved in the SWSS after graduation, as she recognizes the Society's impact on the growth of students and young scientists.

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

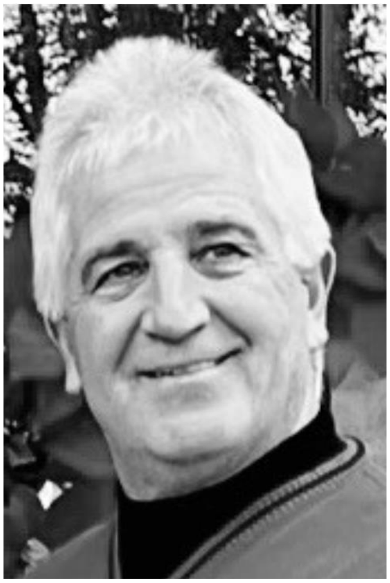
2009	Sarah Lancaster	Texas A&M University
2010	Tom Eubank	Mississippi State University
2011	Sanjeev Bangarwa	University of Arkansas
2012	Edinalvo (Edge) Camargo	Texas A&M University
2013	Kelly Barnett	University of Tennessee
2014	James McCurdy	Auburn University
2015	Sushila Chaudhari	North Carolina State 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
2020	John Brewer	Virginia Tech
2021	Sam Rustom	Louisiana State University

Fellow Award
Peter Dotray



Peter Dotray is the Rockwell Chair of Weed Science and Extension Weed Specialist with Texas Tech University, Texas A&M AgriLife Research, and Texas A&M AgriLife Extension Service - Lubbock. He received his B.S. degree from the University of Minnesota, his M.S. degree from Washington State University, and his Ph.D. from the University of Minnesota. He started his current three-way appointment in Lubbock in 1993. Peter teaches Principles of Weed Science to undergraduate and graduate students and Mode and Mechanism of Herbicide to graduate students. These courses are taught on-campus and online to students off-campus. He conducts weed control research in several crops including cotton, peanut, grain sorghum, corn, and sesame. He has secured over $5 million dollars in external research support. Peter also serves as an Extension Weed Specialist in District 2, a 20-county area home to 3.5 million acres of cotton on the Texas Southern High Plains. Peter has served as the major advisor or co-advisor of 43 graduate students, has served on 39 graduate committees, and has five graduate students in progress. He has authored or co-authored 95 journal articles, eight book chapters, 537 abstracts and proceedings, 213 technical publications and popular articles, and has given 100 presentations at professional meetings and 869 seminars and presentations at grower meetings. For the Southern Weed Science Society, Peter served as Proceedings Editor, CAST Representative, Board Member At-large, Vice President, President Elect, President, and Past President, and numerous other committees. He received the SWSS Outstanding Young Weed Scientist Award and SWSS Outstanding Educator Award. He is a Fellow of the American Peanut Research and Education Society.

Fellow Award
Henry McLean



Dr. Eric P. Prostko is a Professor and Extension Weed Specialist in the University of Georgia's (UGA) Department of Crop & Soil Sciences. He has been a faculty member at the University of Georgia since 1999. With a 100% extension appointment, Eric is responsible for the statewide weed science programs in field corn, peanut, soybean, sunflower, grain sorghum, canola, sesame, pearl millet, and winter pea. The farm gate value of these commodities in Georgia exceeds $1.5 billion dollars.

Eric has earned degrees from Delaware Valley College (BS), Rutgers University (MS), and Texas A&M University (PhD). Dr. Prostko is the author or co-author of 73 refereed journal articles, 222 scientific abstracts, and 1097 extension publications (circulars, bulletins, popular press articles, PowerPoint slides, blogs, newsletters, etc.). He has delivered 1263 educational presentations at local county crop production meetings, extension agent trainings, and other industry sponsored events. He has conducted more than 1100 field trials. Eric has been the major advisor for 3 PhD students and 2 MS students and has served on numerous other UGA graduate student committees.

Eric has been a member of the SWSS since 1994. Since that time, he has made oral or poster presentations at every meeting. As a graduate student in the SWSS, Eric was a former 1st and 2nd place winner of graduate student oral/poster contests, a member of the 1996 Texas A&M Weed Science Team who won 1st place in the SWSS Weed Contest, and was the 1st place individual in that contest. As a faculty member in the SWSS, Eric has received the Outstanding Young Weed Scientist Award (2005) and the Outstanding Educator Award (2011). He has had an exemplary service record in the SWSS including the following: regular judge of graduate student oral/poster contests; co-host of SWSS Weed Contest (2009); co-host of Endowment Enrichment Scholarship (2016); Endowment Foundation Trustee; and as chairman/member of numerous committees (Outstanding Young Weed Scientist, Fellow, Outstanding Educator, and Excellence in Regulatory Stewardship).

Dr. Prostko is also a member of the American Society of Agronomy (ASA), Weed Science Society of America (WSSA), American Peanut Research and Education Society (APRES), and the Georgia Association of County Agricultural Agents (GACAA). He has received numerous awards from these organizations including the Michael J. Bader Award of Excellence for Junior Scientist - Extension (UGA 2004), Dow AgroSciences Award for Excellence in Education (APRES 2005), Senior Specialist Award (GACAA 2010), D.W. Brooks Award for Excellence in Extension (UGA 2010), Outstanding Extension Award (WSSA 2011), Award of Excellence for Senior Scientist - Extension (UGA 2011), the Walter B. Hill Award for Distinguished Service in Public Service and Outreach (UGA 2012), the Walter B. Hill Fellow Award for Distinguished Achievement in Public Service and Outreach (UGA 2015), and APRES Fellow Award (2016).

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
2020	Greg MacDonald	University of Florida
2020	Cletus Youmans	BASF Corporation
2021	David Jordan	North Carolina State University

2021	Henry McLean	Syngenta Crop Protection

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

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

Past Presidents of the Southern Weed Science Society

1948-49	C.A. Brown	1985-86	R.E. Talbert
1949-50	E.C. Tullis	1986-87	H.M. LeBaron
1950-51	O.E. Sell	1987-88	R.L. Rogers
1951-52	G.M. Shear	1988-89	L.B. Gillham
1952-53	D.A. Hinkle	1989-90	L.R. Oliver
1953-54	W.B. Ennis, Jr.	1990-91	J.R. Bone
1954-55	W.C. Shaw	1991-92	J.M. Chandler
1955-56	G.C. Klingman	1992-93	J.L. Barrentine
1956-57	W.B. Albert	1993-94	A.D. Worsham
1957-58	E.G. Rogers	1994-95	P.A. Banks
1958-59	R. Behrens	1995-96	S.O. Duke
1959-60	V.S. Searcy	1996-97	B.D. Sims
1960-61	R.A. Darrow	1997-98	R.M. Hayes
1961-62	W.K. Porter, Jr.	1998-99	R.L. Ratliff
1962-63	J.T. Holstun, Jr.	1999-00	D.S. Murray
1963-64	R.F. Richards	2000-01	L.L. Whatley
1964-65	R.E. Frans	2001-02	J.E. Street
1965-66	D.E. Wolf	2002-03	J.W. Wells
1966-67	D.E. Davis	2003-04	W.W. Witt
1967-68	R.A. Mann	2004-05	J.S. Harden
1968-69	W.L. Lett, Jr.	2005-06	D.R. Shaw
1969-70	J.B. Baker	2006-07	J.A. Driver
1970-71	D.D. Boatright	2007-08	D.W. Monks
1971-72	J.R. Orsenigo	2008-09	A.M. Thurston
1972-73	T.J. Hernandez	2009-10	D.B. Reynolds
1973-74	A.F. Wiese	2010-11	T.J. Holt
1974-75	W.G. Westmoreland	2011-12	B.J. Brecke
1975-76	P.W. Santlemann	2012-13	T.C. Mueller
1976-77	A.J. Becon	2014-15	S.A. Senseman
1977-78	G.A. Buchanan	2015-16	B. Minton
1978-79	C.G. Parris	2016-17	P. Dotray
1979-80	M.G. Merkle	2017-18	G. Schwarzlose
1981-82	J.B. Weber	2018-19	B. Scott
1982-83	J.E. Gallagher	2019-20	James Holloway
1983-84	C.G. McWhorter	2020-21	Eric Webster
1984-85	W.S. McIntire	2021-22	Cletus Youmans

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, 2022 - January 31, 2023

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	Darrin Dodds	2022-2023
President Elect	Eric Castner	2022-2023
Vice-President	Todd Baughman	2022-2023
Secretary-Treasurer	Hunter Perry	2020-2023
Editor	Paul Tseng	2020-2023
Immediate Past President	Clete Youmans	2022-2023

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	Tom Barber	2021-2023
Member-at-Large- Industry	Andy Kendig	2021-2023
Future Member-at-Large - Academia	Michael Flessner	2022-2024
Future Member-at-Large- Industry	Pete Eure	2022-2024
Representative to WSSA	John Byrd	2020-2023

100c. EX-OFFICIO BOARD MEMBERS

Constitution and Operating Procedures	Carroll Johnson	2022-2024
SWSS Business Manager	Kelley Mazur	2021-2024
Student Representative	John Pepper	2021-2022
Newsletter Editor	Tommy Butts	2022-2024

101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

President	Gary Schwarzlose	2021-2022
Secretary	Mike Lovelace	2021-2023
	Greg MacDonald	2021-2024
	Jason Bond	2021-2025
	Sandeep Rana	2021-2026
	Lauren Lozano	2022-2027
Graduate Student Rep	Hannah Wright	2020-2022

101b. BOARD OF TRUSTEES - EX-OFFICIO

Hunter Perry	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.

Eric Webster*	2022	John Byrd	2022	Larry Steckel	2022
Peter Dittmar	2022	Sandeep Rana	2022	Drew Ellis	2022

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

102a. SWSS Fellow Award Subcommittee

John Byrd *	2022	Greg MacDonald	2023	Henry McLean	2024
Neil Rhodes	2022	Cletus Youmans	2023	David Jordan	2024

102b. Outstanding Educator Award Subcommittee

Larry Steckel *	2022	Stephen Enloe	2023	Eric Prostko	2024
Tim Grey	2022	Doug Spaunhorst	2023	Peter Dotray	2024

102c. Outstanding Young Weed Scientist Award Subcommittee

Peter Dittmar *	2022	Kelly Backscheider	2023	Greg Stapleton	2024
Jim Brosnan	2022	Todd Baughman	2023	Matthew Wiggins	2024

102d. Outstanding Graduate Student Award Subcommittee

Sandeep Rana *	2022	Matt Griffin	2023	Jim Heiser	2024
Frank Carey	2022	Kelly Backscheider	2023	Nathan Boyd	2024

102e. Excellence in Regulatory Stewardship Award Subcommittee

Drew Ellis	2022	Matt Goddard	2023	Sanjeev Bangarwa	2024
Tim Adcock	2022	Jason Norsworthy	2023	Garrett Montgomery	2024

103. COMPUTER APPLICATION COMMITTEE (STANDING)

Jim Brosnan *	2022	Shandrea Stallworth	2023	Cade Hayden	2024
Matt Goddard	2022	Gary Schwarzlose	2023	Shawn Askew	2024
				Tommy Butts	2024
Kelley Mazur – SWSS Business Manager					

104. CONSTITUTION AND OPERATING PROCEDURES COMMITTEE (STANDING)

W. Carroll Johnson *	2022-2024

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 Dodds*	2022
Eric Castner	2022
Hunter Perry	2022
Kelly Backscheider (Sustaining Mem.)	2022
Gary Schwarzlose (WSSA Rep)	2022
Phil Banks	2022
Paul Tseng (ex-officio)	2022
Kelley Mazur – SWSS Business Manager	

106. GRADUATE STUDENT ORGANIZATION

President	John Peppers	Virginia Tech
Vice President	Sarah Kezar	Texas A&M
Secretary	Devon Carroll	Univ Tennessee
Weed Resistance & Technology Comm. Rep	Taylor Randell	Univ Georgia
Endowment Committee	Hannah Wright	Univ Georgia
Social Chair/Student Program Committee	Chad Abbott	Univ Georgia
Student Program Committee	Maria Zaccaro	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 Kayla Eason		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 Rep	P. Carvalho

108. HISTORICAL COMMITTEE (STANDING)

Andy Kendig *	2022
John Byrd	2023
Tom Mueller	2024

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	2021-2022
Janice McFarland	(ad hoc) Chair of the WSSA Science Policy Comm.	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
Michael Flessner	Member-at-Large - Academia	2022-2024
Pete Eure	Member-at-Large - Industry	2022-2024

110. LOCAL ARRANGEMENTS COMMITTEE - (STANDING)

Luke Etheredge*	2022	Austin, TX (SW)
Connor Webster	2023	Baton Rouge, LA (SE)
Luke Etheredge	2024	San Antonio, TX (SW)

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

James Holloway *	2022
Eric Webster	2023
Cletus Youmans	2024
Darrin Dodds	2025

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.

Luke Etheredge (SW)	2022	Jim Brosnan (SE)	2024	S. Culpepper	2026
Andrew Price (SE)	2023	Ben McKnight (MS)	2025	M. Flessner	2027
Kelley Mazur – SWSS Business Manager					

2113. NOMINATING COMMITTEE (STANDING)
Shall be composed of the Past President as Chair.

Eric Webster	2022

114. PROGRAM COMMITTEE – 2022 MEETING (STANDING)

Darrin Dodds *	2022
Eric Castner	2023
Todd Baughman	2024

115. RESEARCH COMMITTEE (STANDING)

Eric Castner *	2022			
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. Legleiter		Tennessee	L. Steckel
Louisiana	D. Miller		Texas	P. Dotray
Mississippi	J. Byrd		Virginia	S. Askew
Missouri	K. Bradley			

117. RESOLUTIONS AND NECROLOGY COMMITTEE (STANDING)

David Black *	2022	Michael Flessner	2023	Ryan Edwards	2024

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)

Tommy Butts*	2022	
Matthew Wiggins	2023	
Pratap Devkota	2024	
Sarah Kezar	2022	Graduate Student Organization Rep. – Ex-officio member

120. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

Kelly Backscheider*	2022	Luke Etheredge	2023	Tim Adcock	2024
Andy Kendig	2022	Chris Meyer	2023	Scott Nolte	2024

Vacant	2022	Jacob Reed	2023	Michael Flessner	2024
Kelly Backscheider	2025	Ray Kelley	2025	James Holloway	2025

121. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

AL - Steve Li	2022		MO – Jim Heiser	2022
AR - Tom Barber	2022		NC – Angela Post	2022
FL - Calvin Odero	2022		OK - Todd Baughman**	2022
GA - Scott Tubbs	2022		SC - Alan Estes	2022
KY – Travis Legleiter	2022		TN – Bruce Kirksey *	2022
LA – Daniel Stephenson	2022		TX - Jacob Reed	2022
MS -Te-Ming Paul Tseng	2022		VA – Shawn Askew**	2022

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

SWSS Board of Directors Meeting Minutes

Sunday, January 23, 2022
Meeting Room 115, AT&T Hotel and Conference Center

Call to order
The meeting was called to order at 3:33 PM by Clete Youmans.
Present: James Holloway, Darrin Dodds, Tom Barber, Tommy Butts, Gary Schwarzlose, Eric Castner, John Pepper, Clete Youmans, Kelley Mazur, John Byrd, Eric Webster, Andy Kendig (virtual), Carroll Johnson (virtual), Paul Tseng, Lee VanWychen were in attendance. Shawn Askew and Hunter Perry were absent at the beginning (arrived later during the meeting due to the last-minute adjustment in the meeting time).

Darrin Dodds (Program Update)

There were 265 total presentations submitted with 119 being posters and 63 oral presentations in the graduate student contest and 83 general oral presentations for a total of 137 oral presentations. We have had 11 oral presentations withdrawn and 6 posters withdrawn. This was about a 5% reduction from the original submission number. The speaker tomorrow during the main session, Julie Borlaug, will have to present virtual at the last minute so there was some discussion about how to make adjustments with computers/speakers due to the last-minute change. All in all, we are in pretty good shape with presentation submissions and adjustments. Overall, the number of presentations is pretty similar to the number that has been presented in previous years. There will be an announcement made during the general session about accessing the mobile app and about the Covid safety policy for the SWSS meeting including the stickers (red, yellow, green) for preference on social distancing. There was also some discussion about abstracts (from Paul Tseng and Darrin Dodds) that are not submitted prior to the deadline and how to handle those and if they are allowed to submit after the meeting. It was decided that Paul can reach out once after the meeting to those that have not submitted an abstract prior to the deadline. John Byrd made the motion to accept the program chair report and Tom Barber seconded the motion. Darrin Dodds commended Luke Etheredge, Ben McKnight, and Greg Stelle as well as the local arrangements committee for their hard work.

Eric Webster (Awards Committee Report)

He announced the 2022 award winners and the number of submissions for each award. Eric Prostko and Peter Dotray were selected as Fellows. There were two nominees for the Outstanding Educator Award, and Ramon Leon, NC State University, was selected for the Honor. The Outstanding Young Weed Scientist for Industry had one nominee and the OSYWS for Academia had four nominees. Sandeep Rana, Bayer Crop Protection, and Michael Flessner, Virginia Tech, were the award winners for Industry and Academia, respectively. There were two nominations for the Outstanding Graduate Student for the MS degree and three nominations for the PhD award. Delaney Foster and Maria Zaccaro-Gruener were the Awardees for MS and PhD, respectively. There were no nominations for the Regulatory Stewardship Award. John Byrd made a motion to accept the awards committee report and Carroll Johnson seconded the motion.

Kelley Mazur (Business Manager update)

We had 290 individuals registered with 2 registration fees refunded thus far. The current number is 285 as of Sunday afternoon. There was discussion about whether or not we should refund or if we should have a cutoff date. Currently, refunds are not addressed in the MOP. John Byrd made a motion that there is no refund in registration costs after you are registered for the meeting and Eric Webster seconded the motion. It was suggested that an addition be made to the MOP. We had 100 tickets purchased for the Top Golf event on Sunday evening. There were 5 team sponsors for this event. There was discussion about whether or not additional students who hadn't registered for the Top Golf event could attend last minute. The number of spots that we currently have reserved at Top Golf is 102. I think the decision was made to allow students to attend that hadn't yet registered for the event. Corteva, BASF, and FMC are all willing to sponsor an additional team of students that aren't yet registered which covers $50 of the $75 total cost. There was discussion about potential events for Baton Rouge. There is a Top Golf there right across from the hotel.

Luke (Local Arrangements)
Rooms are not set up the way we designed them. Three folks will be here to take care as much as possible on Monday morning. All talks are in four rooms. Two of them have tiered seating and the existing AV system will be used. The other two rooms will take minor modifications. Maximum capacity of two rooms are max capacity of 75. If more than 75, we need to make adjustments. Gary needs tables. Ball room will be set up for the general session at 1:00. If computers, screens, etc. are needed, see Luke on Monday morning. Poster boards are supposed to be set up by 9:30. 32 are coming. Two extras can be used elsewhere. Darrin has push pins. The guest speaker will be virtual. The general session ball room. Whoever computer is begin used in the general session, Luke recommends using that setup for setting the meeting. Kelly will share link with others. IF anything is needed prior to the meeting, Luke, Ben and John should be contacted. One room has multiple doors….need to come up with a plan to funnel everyone through one door to avoid distraction.

Eric Castner (Finance)
Full finance report provided to BOD and discussed by Eric. Eric stressed driving revenue up. Long-term financial plan needs to be put in place to address shortfalls. Find ways to reduce expenses in addition to increasing revenue. Eric W. suggests contacting people in the industry who don't attend anymore or who's attendance is sketchy. Potentially adopt a membership-only fee of $30, $50 or similar to help meet some shortfalls. It's been brought up over the past couple of years, but didn't gain traction. Put reminders in docs like the newsletter and add a line item on the website for membership only.
Everyone agrees the recent increase to a $400 registration fee is a good place. Carroll makes motion to approve financial report. John Byrd seconds. Motion passes.

Gary S (Endowment)
Three recipients of the Endowment Enrichment Scholarship (Hannah W, Delaney F. Sarah Kezar). Lauren Lazaro joined Endowment this year. Currently alternating industry and

academia each year to keep good balance of both on the Endowment. As of now, it's not in MOP. Carrol looking into it.
Golf event began to decline in attendance, so the move to other events such as Top Golf are a welcome site by the membership and students. Around 13-15 items were donated to the silent auction…..some donated by students. Gary requested Endowment Trustees bring nominees (industry) to the meeting to be voted on for the election (industry member).
Carroll makes motion to approve. Kelly seconded. Motion approved.

Lee van Wychen (Gov't affairs)
Lee provided a report by email so the following notes are brief. Invasive plant removal program included (50M) in infrastructure bill. A significant amount of forestry money included in the infrastructure bill as well. Trying to get IR4 increased. Has not been accounting for inflation. Able to do less and less projects.
On the people side of things a few good things have happened . This past year, was the first time in years we have had weed science folks involved at the major agencies in which Lee cannot participate. They can battle in ARS meetings. Have to keep pressure on the agencies. APHIS isn't spending money on weeds. Over $300M in the plant protection program and most goes to insects.
Lee discussed surprises around the new Enlist label in regards to endangered species.
Questions were asked regarding mandates for pollinator habitat on solar farms. A fair amount of input from BOD on the topic. John Byrd and others on the BOD are skeptical of the long- and short-term success of this push.

John Byrd (WSSA update)
Report was sent out by John on Sunday.
WSSA decided to go virtual in 2022. Refunds were made for the meeting portion, but retained the membership portion. Primary focus is on general session and student presentations. Email was sent out to students for getting those presentations uploaded.

Computer application committee
Clete would like to see this group get more involved with the website. Andy K. asked about the previous topic of linking up computer applications with the Communications committee for social media management.

Sustaining Membership (Kelly B.)
Currently, $43,600 (as of Friday). We have commitments from multiple companies raising the value to approximately $48K. We will be up $7K this year. Sesaco, for example, was an add this year.

GSO (John Peppers)
Sarah Kezar will take over as GSO Chair. Graduate student luncheon had a speaker back out. A panel will be conducted in place of that. Elections will be held on Tuesday.

New Business
MOP - Page 29…corrected from Monsanto to Bayer (Excellence in Regulatory Stewardship)

Bayer commitment can begin in 2023. Gary recommends stating the award is sponsored by Bayer CropScience beginning in 2023.
A significant amount of general discussion around this topic. Carrol will handle the change.

Darrin makes motion to adjourn. John Byrd seconded. Motion passes.

SWSS Board of Directors Meeting Minutes

Sunday, January 27, 2022

Meeting Room 115, AT&T Hotel and Conference Center

Present: Darrin Dodds, Tom Barber, Tommy Butts, Todd Baughman, Michael Flessner, Eric Castner, Sarah Kezar, Clete Youmans, Kelley Mazur, John Byrd, Eric Webster, Andy Kendig (virtual), Carroll Johnson (virtual), Paul Tseng, Hunter Perry

Called to order @ 7:15 am
Todd Baughman makes motion to approve agenda and John Byrd seconded. Motion passes
Darrin and others make general comments about the meeting and everyone feels the meeting went pretty well.

Kelly – Financial overview and meeting report

303 final regisitrations, 177 regular members, 122 students. 3 students requesting full refunds (covid-related reasons). In the future, attendance will be non-refundable. Darrin mentioned the membership-only option for the future. Revenue minus credit card fees is $93K. Top Golf – 110 people paid to play. No final bill yet. Kelly planned for $41K for food and beverage. Issues experienced with room availability (messages received about no rooms, blocked or not). Going forward, have to get AV contract trimmed down (prices always quoted high) and make small changes as we go. General discussion around logistics of meeting rooms.

Luke - Local Arrangements Report

Luke recommends starting early and be proactive because items like poster boards may be hard to come by. Another comment made about AV equipment/contract.

Darrin - Program Committee Update

119 posters, 146 talks, 83 general talks. General discussion around several "hot topic" presentations and very high turnouts. In the future, may strategically move these talks to general session or place them later in the meeting to keep attendance high later in the agenda. General discussion around the Top Golf event and the excellent feedback received.
There were a few instances where talks were cancelled and some talks were bumped up….leading to time changes and talks being missed by some attendees. General discussion around ways to switch things up to break up the meeting some and increase networking (e.g. poster session changes, 3-minute thesis options, etc.). Eric C. mentioned videoing student presentations and providing links to those presentations to the students and advisors. The "3-minute thesis" idea has a lot of interest, but need to determine how to incorporate. Probably do not go all-in, but rather find a way to incorporate it into the meeting without sacrificing traditional talks.

Caroll – Constitution and Operating Procedures Update

Concern expressed over how we address the social media topic? Do we formalize social media within our committee structure? Do we create an issue over a problem that doesn't exist? Go into the summer with the topic. Do we form an ad hoc committee to discuss the topic?
Darrin makes motion to accept. Tom Barber seconds. Motion passes

Sarah – GSO update

GSO elected and established a GSO social chair. She will update Carroll with changes to update by laws.

The social chair will be responsible for creating a Twitter and Instagram account (potentially LinkedIn). There wasn't much knowledge this year among students about events. WSSA social media has been utilized recently with great success within the GSO. Sarah was asked about existing SWSS social medial and there is nothing currently available except for the SWSS historical group mentioned by John Byrd.

Kelly B. – Sustaining Membership Update

Changes being proposed

-Chariperson will be Luke Etheridge

-Letter needs to be sent with a line-item invoice to each sustaining member

-Copy of the letter may need to be added to the MOP. It may change yearly, so need to figure this out.

-Delete line item 8 in the current MOP due to outdated information. Instead of having an alphabetical listing, list sustaining members by classification (Platinum, Gold, Silver and Bronze) of annual contribution.

Platinum = >$10,000

Gold = $5,000-10,000

Silver = $2,000-5000

Bronze = <$2,000

Darrin – Weed Contest Update

Bayer in Union City has tentatively agreed to host 2023. Society has $15,000 annually to support the contest. Eric has suggested company sponsorship in "off years" to help expenses. Drew is seeking approval for the SWSS to host the 2023 Weed Olympics. If we host the 2023 Weed Olympics we would be approving a $15,000 support.

Darrin makes motion to approve 2022 Agricenter host with $15K support, hosting the 2023 Weed Olympics and funding the Olympics appropriately with the help of other societies. John Byrd seconded. Motion passes.

Shawn Askew will work on a new traveling trophy and have old winners placed on the new frame. The old trophy will enter the auction at the 2024 San Antonio meting.

Hunter – Endowment Update

$1,846 – Silent Auction revenue. Top Golf event was very successful, but was not discussed since it has been discussed several times. Waiting on nominations from Endowment Trustees for the industry seat next year.

New Business

Summer BOD meeting date proposals. Tentatively July 26-27th.

John Byrd makes motion to approve. Todd Baughman seconded. Motion carried.

Proceedings Editor Report

Report by: Paul Tseng

Proceedings Editor's Report of the 2021 Meeting

The 2021 meeting was held virtually during January 25-26, 2021. The 2021 Proceedings of the Southern Weed Science Society contained 276 pages, including 165 abstracts. By comparison, the 2020 Proceedings of the Southern Weed Science Society contained 362 pages, including 252 abstracts (Biloxi, MS); the 2019 Proceedings of the Southern Weed Science Society contained 357 pages, including 241 abstracts (Oklahoma City, OK); the 2018 Proceedings ot the Southern Weed Science Society contained 429 pages, including 293 abstracts (Atlanta, GA); 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 165 titles (119 posters and 46 oral presentations) were submitted.

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 January 2022.

Graduate Student Report

Report by: Sarah Kezar

The Student Night Out at Top Golf was a success for students and professionals to interact and show off their swing! On behalf of the Graduate Student Organization, we sincerely appreciate the Endowment Foundation and donors for making the event possible and we are looking forward to similar events in the future. The graduate student luncheon went well, and students were able to hear a panel comprised of weed science newbies and veterans in academia and industry share their experiences and advice. New business to report was the passing vote of Social Chair to be added as an officer position. This individual will be able to communicate upcoming events and news in the SWSS on social platforms such as Facebook and Twitter.

Officer elections were held thereafter, and new officers are as follows:

President- Sarah Kezar

Vice President- Mason Castner

Secretary- Navdeep Godara

Social Chair- Gresham Stephens

Graduate students will be looking forward to 2022-2023 events such as the weed contest and SWSS annual meeting.

WSSA Representative Report

Report by: John Byrd

President: Dille, Anita (2022) dieleman@ksu.edu
President-Elect: Culpepper, Stanley (2022) stanley@uga.edu
Vice-President: Moseley, Carroll (2022) carroll.moseley@syngenta.com
Past-President: Curran, William (2022) williamscurran@gmail.com
Secretary: Lazaro, Lauren (2022) llazaro@agcenter.lsu.edu
Treasurer: Elmore, Greg (2022) greg.elmore@bayer.com
Director of Publications: Willenborg, Chris (2023) chris.willenborg@usask.ca
Chair, Constitution and Operating Procedures: Lindquist, John (2023) jlindquist1@unl.edu
Member-at-Large (4-year term) Refsell, Dawn (2022) dawn.refsell@corteva.com
Member-at-Large: (4-year term) Sosnoski, Lynn (2024) lms438@cornell.edu
Graduate Student Member: Foster, Delaney (2022) dfoste37@vols.utk.edu
Executive Director of Science Policy: Van Wychen, Lee (Ex-off and non-voting) lee.vanwychen@wssa.net

Regional Representatives
Aquatic Plant Management Society: Richardson, Rob (2022) rob_richardson@ncsu.edu
Canadian Weed Science Society: Tardif, Francois (2022) ftardif@uoguelph.ca
North Central Weed Science Society: Miller, Brett (2024) brett.miller@syngenta.com
Northeastern Weed Science Society: Pyle, Steve (2023) sterschandran@mail.wvu.edu
Southern Weed Science Society: Byrd, John (2023) jbyrd@pss.msstate.edu
Western Society of Weed Science: Helm, Alan (2024) ahelm@gowanco.com

Executive Secretary (ex-off and non-voting): Gustafson, Eric eric@imigroup.org
Interactive Management, Inc Staff Vice-President and CEO: Leeper, Gary

The joint meeting with the Canadian Weed Science Society scheduled for February 20-24 at the Sheraton Vancouver Wall Center has been modified from in-person to virtual. The decision was initially discussed by the program committees of both WSSA and CWSS and based on 1) CDC recommendation Do not travel to Canada and 2) lack of travel approvals of both industry and academia members to attend an international meeting in a country discouraged by CDC. An agreement has been made with the Sheraton to plan a subsequent meeting for 2025 to avoid cancellation penalty. Registration rates have been adjusted to $300 for regular attendees and $150 for students.

Due to the altered meeting format, the agenda will focus on oral student presentations and awards, general awards ceremony, general session and special group meetings such as Women in Weed Science and Graduate Student Organization business meeting.

The virtual format used for the meeting:

Tuesday, February 22
3:00 to 5:30 pm General Session
Introduction, Asian hornet by Conrad Berube
Invasive weeds by Robert Mack

Presidential Address by Anita Dille
Awards Presentations

Wednesday, February 23
9:00 to 11:00 am MS Student oral presentations
11:15 am to 12:15 pm Women of Weed Science
12:30 to 2:00 pm PhD Student oral presentations
3:00 to 4:30 pm Canadian Weed Science Society Session 1

Thursday, February 24
9:00 to 10:00 am Champion oral presentation round
11:00 am to 12:00 pm Student Organization Business Meeting
12:30 to 2:00 pm Canadian Weed Science Society Session 2
3:00 to 3:30 pm Travel Enrichment presentations and Fellows
4:30 to 5:30 pm Business Meeting
5:30 to 6:30 Student presentations awards

Seven symposia were submitted and reviewed for the 2022 meeting: North American Kochia Action Committee: Priorities for coordinating research, communication, and outreach; Biological weed management; Endangered species act; Showcasing ARS weed science research - from the nearly retired to the newly hired; The current regulatory and legal environment for weed control products; Drones for weed control. Drones for weed control was withdrawn and Endangered species act was reformatted as a webinar January 13 afternoon. Those that were approved will be presented as additional webinars during 2022 if authors agree.

Instructions on loading materials for the oral and poster presentations was sent to WSSA President and President Elect on 01/21/22 am to provide details on the altered meeting format.

WSSA formed a Strategic Planning Committee under President Curran (2019) to update long- and short-term goals to strengthen the organization: 1. Establish WSSA as a trusted resource of information related to weed science for stakeholders, 2. Advance relationship between WSSA and affiliated organizations, 3. Develop communication partnerships with key influencers, 4. Provide forums for scientific exchange, and 5. Improve WSSA member engagement, experience, and opportunities for leadership. These have been presented to and approved by the board.

NIFA Fellow Jim Kells organized three webinars between October 2020 and January 2021: 1) Federal Funding Opportunities for Weed Scientists, 2) Grantsmanship Workshop, and 3) Federal Career Opportunities for Weed Scientists. In addition, the Weed Genomics Conference proposal was funded and will be held September 22-24, 2021, in Kansas City, MO. One additional webinar is planned for October 2021 dealing with funding opportunities from NIFA.

EPA liaison Mark VanGessel is learning his way around EPA as they are still working remotely.

WSSA is working with USDA to update common weed names to eliminate prejudice. WSSA asked for clarification on several of the rules being followed to change common names. WSSA is also working with EPA on clarification of definitions of herbicide resistance, herbicide tolerance, and herbicide susceptibility.

Future meetings:
Joint with Northeastern Weed Science Society in Arlington, VA at Crystal Gateway Marriott January 30-February 2, 2023
Joint with Southern Weed Science Society in San Antonio, TX at the Hyatt Regency January 22-25, 2024
Joint with Canadian Weed Science Society in Vancouver, Canada at the Sheraton Vancouver Wall Center, 2025.

Necrologies and Resolutions

Report by: David Black

Two necrology reports were submitted, Dr. David W. Hall and James “Jim” Robert Bone Jr.

Dr. David W. Hall, died on March 22, 2021. Son of a librarian and a biochemist, David graduated high school in Augusta, Georgia. He attended Georgia Southern College (now, University) on a tennis scholarship, majoring in Botany and minoring in Music. He also received a MS from GSU in Systematic Botany. David then spent 19 years at the University of Florida, completing his PhD in Systematic Botany with a two volume dissertation, “The Grasses of Florida,” while serving as Director of the Plant Identification and Information Services. Following his stint at the University of Florida, he became a Senior Scientist for KBN/Golder Associates, an environmental consulting firm, where he specialized in wetland identification and remediation. Since 1997, David owned and operated an environmental and forensic botany consulting firm in Gainesville, Florida.

Dr. Hall was recognized as the expert in the field of plant identification, wetland assessment delineation, threatened and endangered plants species, and forensic botany, while publishing 15 books, including: *Common Weeds and Wildflowers*; *Wildflowers of Florida and the Southeast*; *Grasses of Florida*; *Forensic Botany: A Practical Guide*; *Forensic Botany: Basics*; *Weeds of Southern Turfgrasses*; *Color Atlas of Turfgrass Weeds*; *More Color Atlas of Turfgrass Weeds*; *Florida Wetland Plants: An Identification Manual; Illustrated Plants of Florida and the Coastal Plain*; *Weeds in Florida*; and over 150 articles. While at the University of Florida, his responsibilities included plant identification and biology of plants with special emphasis on weeds and grasses.

Dr. Hall accrued numerous awards for his botanic, forensic, agricultural, and avocational activities which included several Who’s Who, Fellows, Distinguished Alumnus, plus Service, Achievement, and Hall of Fame awards. He held certifications as a Professional Wetland Scientist, and a Board Certified Forensic Examiner. He is past-president of the Florida Weed Science Society and served on many plant identification committees for the state of Florida as well as SWSS and WSSA. Dr. Hall also was past president of the Florida Tennis Association and for many years, very active in the US Tennis Association. Dr. Hall will always be remembered not only for his many plant ID talents, but also for his kindness, intelligence, professional curiosity, patience, and friendship.

WHEREAS Dr. Hall served with distinction at University of Florida and KBN/Golder Associates and,

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

James "Jim" Robert Bone Jr., 89, died on October 15th, 2021. Jim was born on April 20th, 1942 in Houston, Texas. The eldest of four children, Jim, as he was known, was a talented and accomplished high school athlete and an enthusiastic outdoorsman. He graduated from Katy High School in Katy, Texas. Following high school Jim attended Texas A&M University where he earned his Bachelor of Science degree in Range Management.

Jim had a long and highly accomplished career in service to agriculture that spanned more than 45 years. He led research and field development efforts for Chipman Chemical Company, Rhodia US, ICI Americas, Griffin LLC, and DuPont. During the later years of his career Jim served as Vice-President of Research and Development and Regulatory Affairs and then Vice-President for Sales and Marketing for Griffin LLC. Upon acquisition of Griffin by DuPont, Jim served as Manager of U.S. Field Development for DuPont. In the early years he worked in the Southeast, then in his beloved Texas, and toward the end, Jim had national and international responsibilities.

Jim Bone had a love for agriculture that showed in all that he did. He spoke positively about agriculture regardless of place or time. He had a deep love for young people. He was a strong supporter off FFA and 4-H, devoting time, effort, and money to make sure that young people developed an understanding and appreciation for agriculture. Jim's broad and deep understanding of agricultural issues led to his appointment to a three-year term as a member of the judging team for the prestigious Swisher Sweets/Sunbelt Expo Southeastern Farmer of the Year Award, an appointment that he relished as a highlight of his career.

Jim was a long-standing active member of the Southern Weed Science Society and Weed Science Society of America and recognized by receiving the Fellow / Distinguished Service Award from the SWSS in 1993 while working for Griffin.

WHEREAS Mr. Bone served with distinction at DuPont de Nemours, Inc.

WHEREAS Mr. Bone 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. James Robert Bone, Jr., and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

2022 MEETING ABSTRACT

Effects of Chaff Lining on *Amaranthus* Seed Viability. KM Patterson*[1], G LaBiche[1], NJ Arneson[2], KL Gage[3], V Kumar[4], T Legleiter[5], E Miller[3], LM Lazaro[1]; [1]LSU Ag Center, Baton Rouge, LA, [2]University of Wisconsin-Madison, Madison, WI, [3]Southern Illinois University Carbondale, Carbondale, IL, [4]Kansas State University, Hays, KS, [5]University of Kentucky, Princeton, KY (1)

Chaff lining is a harvest weed seed control tactic that confines the chaff material between stubble rows during harvest and relies on a mulch effect to prevent or reduce weed seed germination and emergence. The concentration of the chaff material places weed seeds in an environment unsuitable for germination and emergence, if left undisturbed. However, this has not been confirmed in soybean production systems. Therefore, the objective of this study was to evaluate the effectiveness of simulated chaff lining and its effects on reducing *Amaranthus* (waterhemp and Palmer amaranth) seed germination and emergence. Non-crop field studies were conducted across five states in 2021. Each plot contained two simulated chaff line treatments, with and without chaff, in lines 0.3 m wide x 6 m long with the addition of 36.7 g of either waterhemp or Palmer amaranth seed; 2.5 kg of soybean chaff was placed over seeds in one of the lines. Therefore, the study was established as a two factorial (with or without chaff line and preemergence (PRE) herbicide treatment) randomized complete block design. PRE treatments consisted of no PRE, flumioxazin, flumioxazin + metribuzin, S-metolachlor, and sulfentrazone + S-metolachlor . Seed packets with 1000 seed of either Palmer amaranth or waterhemp seed were distributed within and outside of the chaff line and collected at soybean planting, prior to the postemergence application, and at harvest to determine seed viability over time. Additionally, emergence counts were collected weekly. Germination of *Amaranthus* varied significantly by state, and therefore, germination counts were analyzed by individual state to test for differences in the effect of chaff line and herbicide treatment. Seed viability within and outside of the chaff line showed a marginal significant difference with weed species viability decreasing over time. The effect of chaff line and herbicide treatment varied by state. By 21 days after the PRE application, *Amaranthus* counts for most states were lowest in the flumioxazin, flumioxazin + metribuzin, and sulfentrazone + S-metolachlor treatments, compared to the control (no PRE) and S-metolachlor alone. The chaff line suppressed *Amaranthus* germination in Kentucky but was associated with higher germination counts in Illinois and Wisconsin, as compared to other sites. These results indicate that the use of chaff lining will not be a reliable way to suppress *Amaranthus* germination if used as a stand-alone practice. However, utilizing chaff lining in addition to other integrated weed management practices allows for a more sustainable weed management approach by using banded herbicide applications or grazing.

Soybean Harvest Index and its Impacts on Harvest Weed Seed Control. BM Hampton*[1], MP Spoth[2], ML Flessner[2], LM Lazaro[1]; [1]LSU Ag Center, Baton Rouge, LA, [2]Virginia Tech, Blacksburg, VA (2)

With the pressing concerns of herbicide resistant weeds and the continual buildup of weed seeds in the soil seedbank, alternate weed management tactics are needed to reduce weeds present at harvest. Harvest weed seed control utilizes varying techniques designed to capture and either concentrate, remove, or destroy weed seeds at harvest. HWSC efficiency can be influenced by factors such as crop yield, harvest index, and crop nutrient composition. Knowledge gap exists within these factors on soybean residue. Therefore, the objectives of the experiment were to quantify the harvest index and nutrient composition of soybean chaff and straw fractions and to understand the consequences on HWSC. Soybean chaff and straw residues and grain samples were collected in the field with conventional and plot combines across two states in 2020 and 2021. The chaff and straw fractions were separated, and fresh and dry weights were determined. Nutrient sampling was conducted on the chaff and straw fractions. Results indicated that the soybean chaff fraction resulted in about 12.6% of the harvested grain weight. Nutrient losses varied and depending on the HWSC method the replacement of nutrients contained within the chaff and straw will be necessary. Understanding the effects of nutrient loss and overall harvest index for soybean is a critical factor in furthering HWSC as a weed management tactic.

Effects of Spray Volume and Nozzle on Cotton Response to Herbicide Tank Mixtures. JC Forehand*[1], JH de Sanctis[1], CW Cahoon[1], ZR Taylor[2]; [1]North Carolina State University, Raleigh, NC, [2]North Carolina State University, Sanford, NC (3)

In cotton, acetochlor, dimethenamid-*P*, and *S*-metolachlor are routinely used POST for residual control of Palmer amaranth (*Amaranthus palmeri* S. Watson). However, these herbicides can sometimes injure cotton, which appears as necrotic speckling. Cotton response to these herbicides is influenced by several factors including tank mix partners and environmental conditions. However, the influence of spray volume and nozzle selection on cotton injury from these herbicides, in combination with other common POST herbicides, is less understood. The objectives of these studies were to determine how spray volume and nozzle influence cotton response to acetochlor, dimethenamid, and *S*-metolachlor when applied in combination with glyphosate + glufosinate. Two separate studies (Spray Volume and Nozzle) were conducted at Rocky Mount and Lewiston, NC during 2021. Cotton variety DP 2012 B3XF was planted in early May at each location. Treatment structure for both studies was a 3 by 3 factorial including 3 spray volumes (10, 15, and 25 GPA) or 3 nozzles (TTI 110015, AIXR 11002, and DG 11002) by 3 POST residual herbicides (acetochlor, dimethenamid, and *S*-metolachlor) in a randomized complete block design with 4 replications. Treatments were applied to 4-leaf cotton (POST 1) and 14 days after (DA) POST 1 (POST 2). Acetochlor, dimethenamid, and *S*-metolachlor were applied at 1263, 632, and 1404 g ai ha^{-1}, respectively. All plots, including a treated control, received glyphosate (1263 g ae ha^{-1}) plus glufosinate (883 g ai ha^{-1}) POST 1 and POST 2. Data collected included visual estimates of injury (VEI) 3 and 7 DA POST 1, and 3, 7, and 14 DA POST 2. Percent injured area (PIA) was collected 7 DA each POST application by collecting 5 representative cotton leaves from each plot which were photographed and analyzed using ImageJ (Fiji software). Cotton was harvested and weighed to determine seed cotton yield. Data were subjected to ANOVA using Agricolae package in R and treatment means separated using Fisher's Protected LSD a $P \leq 0.05$. In general, cotton responded similarly to acetochlor, dimethenamid, and *S*-metolachlor; therefore, data for main effects of spray volume and nozzle are presented pooled over Group 15 herbicides. Greater cotton injury was observed at Rocky Mount compared to Lewiston and may be the result of differing environmental conditions at application. For the Spray Volume study, at both locations, PIA 7 DA POST 1 was greatest when herbicides were applied at 10 GPA (24% at Rocky Mount and 10% at Lewiston) compared to 15 (18% at Rocky Mount and 6% at Lewiston) and 25 (16% at Rocky Mount and 5% at Lewiston) GPA. Although less, trends in VEI were similar to PIA. Greater cotton injury at lower spray volume may be explained by the higher concentration of Group 15 herbicides at these volumes; adjuvant burn would be greater at higher herbicide concentrations. For the Nozzle Study, TTI nozzles (22% at Rocky Mount and 11% at Lewiston) caused greater PIA 7 DA POST 1 than DG nozzles (17% at Rocky Mount and 7% at Lewiston). AIXR nozzles cause similar PIA to TTI nozzles at Rocky Mount (22%) and similar cotton injury to TTI nozzles and DG nozzles at Lewiston (9%). Larger droplets, which contain more herbicide and thus more adjuvant per droplet, may explain greater cotton injury caused by TTI nozzles. For both studies, no differences in cotton yield were observed across treatments. Although yield was unaffected, cotton injury from Group 15 herbicide tank mixtures was minimized at higher GPA and using nozzles that produces smaller droplets. Cotton growers can use these results to reduce the risk for foliar cotton injury resulting from herbicide tank mixtures including Group 15 herbicides.

Cotton Response to Multiple Sublethal Exposures of 2,4-D. AC Blythe*[1], CW Cahoon[2], L Steckel[3], GD Collins[4], W Everman[2], ZR Taylor[5], JD Joyner[6]; [1]NC State University, Raleigh, NC, [2]North Carolina State University, Raleigh, NC, [3]University of Tennessee, Jackson, TN, [4]North Carolina State University, Rocky Mount, NC, [5]North Carolina State University, Sanford, NC, [6]NC State University, Mount Olive, NC (4)

The vast majority of cotton acreage is planted to cultivars resistant 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 response to 2,4-D at multiple rates and growth stages has been well documented. Most notably, cotton response to 2,4-D is greatly reduced when plants shift from vegetative to reproductive growth. However, cotton response to multiple exposures occurring during vegetative stages has not been studied. The objective of this study is to determine cotton response to multiple exposures of 2,4-D during vegetative growth. Field research was conducted near Clayton and Rocky Mount, NC during 2019 and 2020 with an additional location near Jackson, TN in 2019. Treatment structure consisted of a two by seven factorial including two rates of 2,4-D and seven application timings. Herbicide rates included 2,4-D choline applied at 1.1 g (1/1,000X) 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. Cotton injury was visually estimated throughout the growing season and plant mapping was performed prior to defoliation. Cotton was harvested and weighed to determine seedcotton yield in October 2019 and November 2020. Results of visual ratings were as expected, 2,4-D choline at the 72 1/100X rate injured cotton greater than the 1/1,000X rate at all growth stages. At Jackson, multiple exposures of 2,4-D 1/100X rate that included an application to 10-leaf cotton reduced the number of total bolls 33 to 50% compared to the NTC. In general, percent open bolls decreased as rate and number of exposures increased. Cotton lint yield after exposures to 2,4-D 1/1,000X rate at the 2-leaf, 6-leaf, and 10-leaf growth stages individually, along with exposure at the 2- and 6-leaf growth stages yielded 1,372 to 1,586 kg ha^{-1} and was similar to the nontreated control (NTC). Cotton treated with 2,4-D 1,000X rate at 2- and 10-leaf, 6- and 10-leaf, and 2-, 6- , and 10-leaf yielded 8 to 10% less than the nontreated control. Lint yield reductions of 18 to 89% occurred after exposures of 2,4-D 1/100X rate that included an application to 6- and/or 10- leaf cotton. Furthermore, greater cotton lint yield reductions (2,4-D 1/100X rate) were observed at Jackson, in 6- and/or 10-leaf applications, and when cotton was exposed to 2,4-D multiple times compared to a single event. This research demonstrated that 2,4-D at 1/100X rate is capable of reducing cotton yield even when exposure occurs during vegetative stages. Additionally, multiple exposures at the 1/100X rate are likely to cause significant yield reductions; however, the 1/1,000X rate, did not affect cotton yield at single exposures and the 2- and 6-leaf application timing.

Effects of Spray Droplet Size on Pronamide Control of *Poa annua*. MJ Ignes*; Mississippi State University, Starkville, MS (5)

Annual bluegrass (*Poa annua* L.) is a problematic weed in turfgrass that has evolved resistance to ten different herbicide sites of action, more than any other turfgrass weed. The mitotic inhibiting herbicide pronamide has both pre- and post-emergence activity on susceptible annual bluegrass populations, but on certain resistant populations, postemergence activity is hypothetically compromised due to lack of root uptake or due to an unknown foliar resistance mechanism. Spray droplet size may affect foliar and soil deposition of pronamide, thus potentially explaining variation in population control or differential shoot and root uptake. Greenhouse experiments were conducted to quantify pronamide, flazasulfuron, and pronamide + flazasulfuron (a common tank mixture) deposition on annual bluegrass as affected by spray-droplet size. Five droplet sizes (200, 400, 600, 800, and 1000 µm) were sprayed in an enclosed spray chamber on two-to-three leaf stage annual bluegrass plants. Fluorescent tracer dye was added to each treatment solution to quantify the effects of herbicide and spray droplet size on herbicide deposition. Results from this study indicate that spray droplet size affects deposition of pronamide and flazasulfuron, applied alone and in combination, on annual bluegrass. The highest foliar deposition was produced with the 400 µm spray droplet size in pronamide treatments and with the 200 µm spray droplet size in flazasulfuron and pronamide + flazasulfuron treatments. Regression models of pronamide and pronamide + flazasulfuron treatments were similar and, therefore, the addition of flazasulfuron to pronamide in the tank mixture (pronamide + flazasulfuron treatments) did not affect herbicide deposition when compared to pronamide-alone treatments. Results suggest that the 200 to 400 µm spray droplet size is optimal for foliar deposition of pronamide. Alternatively, larger droplet sizes may facilitate better soil deposition of pronamide where root uptake is optimal. Future research will evaluate pronamide efficacy as affected by spray droplet size.

Evaluation of Herbicide Resistance in Italian Ryegrass in Kentucky. AL Herman*, T Legleiter; University of Kentucky, Princeton, KY (6)

Herbicide resistance is not a new problem for farmers in Kentucky, although herbicide resistant weed identification continues to increase. Italian ryegrass (*Lolium perenne* L *spp. multiflorum* (Lam) Hudnot) is a problematic weed in Kentucky soft red winter wheat that has historically documented as herbicide resistant in isolated locations. The level of distribution of herbicide resistance was evaluated by screening 24 populations of Italian ryegrass collected from across Kentucky against glyphosate, pinoxaden, pinoxaden+fenoxaprop, and pyroxsulam. An initial greenhouse herbicide screen comparing each suspect population to a known susceptible population at a 1- and 2- fold rates of each herbicide was initiated in 2020. Spray applications were made to Italian ryegrass plants between 1 and 4 tillers in a DeVries Generation 3 Spray Booth. Ratings were taken 14, 21 and 28 days after application as well as fresh and dry weights. In the glyphosate applied Italian ryegrass, 3 populations showed the glyphosate had 70 percent control or less compared to the susceptible population which had 88 percent control. The lowest control of glyphosate was 7 percent in a single population. Eight populations of Italian ryegrass showed 50 percent or less control with pinoxaden as compared to the susceptible population with 96 percent control. In the pinoxaden+fenoxaprop, six of the same populations that showed reduced control to pinoxaden demonstrated less than 25 percent control. Lastly, the pyroxsulam Italian ryegrass screen had 14 populations with less than 40 percent control when compared to the susceptible population which was only controlled at 51 percent. This preliminary screen confirms likely herbicide resistance in Italian ryegrass throughout Kentucky wheat fields and that some populations may be resistant to up to 4 different herbicides including glyphosate. Further dose response screens are being conducted on suspected populations that differed in control from the susceptible population in this preliminary screen.

Integrating Isoxaflutole into Cotton Weed Management. JD Joyner*[1], CW Cahoon[2], ZR Taylor[3], W Everman[2], GD Collins[4], AC Blythe[5]; [1]NC State University, Mount Olive, NC, [2]North Carolina State University, Raleigh, NC, [3]North Carolina State University, Sanford, NC, [4]North Carolina State University, Rocky Mount, NC, [5]NC State University, Raleigh, NC (7)

The commercialization of HPPD-tolerant cotton will allow for the use of a new MOA in cotton production. Isoxaflutole (IFT) is a HPPD inhibiting herbicide that can provide a new tool for managing troublesome weeds and potentially delay the development of herbicide-resistant biotypes. Field research was conducted near Clayton, Lewiston, and Rocky Mount, NC to evaluate preemergence (PRE) and postemergence (POST) efficacy of IFT. Preemergence trials compared IFT at rates of 53, 70 and 105 g ha^{-1} to cotton PRE standards and evaluated IFT at 70 g ha^{-1} in combination with standard residual herbicides. Standard treatments included acetochlor (1261 g ha^{-1}), diuron (560 g ha^{-1}), fluometuron (1121 g ha^{-1}), fluridone (168 g ha^{-1}), fomesafen (210 g ha^{-1}), and pyrithiobac (59 g ha^{-1}). In postemergence trials, IFT at 53 and 105 g ha^{-1} was compared to glyphosate (1261 g ae ha^{-1}), glufosinate (656 g ha^{-1}), pyrithiobac (101 g ha^{-1}), glyphosate + acetochlor (1261 g ha^{-1} + 1261 g ha^{-1}), and glufosinate + acetochlor (656 + 1261 g ha^{-1}). In addition, IFT at 53 and 105 g ha^{-1} was evaluated in combination with all the previously stated POST treatments. Both PRE and POST trials included a non-treated control for comparison. Visual estimates of percent weed control were collected 2, 4, and 8 weeks after application (WAA). Control by IFT varied considerably by year and location. Control of Palmer amaranth (*Amaranthus palmeri* S. Watson) 4 WAA by IFT alone or in combination with standards was greater in 2019, a year that included limited rainfall following application, compared to 2020 which received abundant rainfall. In most instances, control by IFT used in combination with standard treatments was equal to grower standard combinations of acetochlor + fomesafen and fluridone + fomesafen. Preemergence control of common ragweed (*Ambrosia artemisiifolia*) was evaluated and IFT at 105 g ha^{-1} controlled the weed $\geq$ 93% 4 WAA, while control by standard residual herbicides was less consistent (54 to 98%). In postemergence experiments, IFT never controlled Palmer amaranth > 54% 2 WAA, but in some cases did improve control when applied in combination with an effective postemergence herbicide such as glufosinate. These experiments demonstrate that combinations of IFT and cotton preemergence standards can improve control of Palmer amaranth and common ragweed. Additionally, research suggests IFT is ineffective when used postemergence but may serve as a viable postemergence residual option.

Pendimethalin for Late Season Residual Control of Texas Millet (*Urochloa texana*) in Corn. BA Dean*[1], CW Cahoon[1], EP Prostko[2], JH de Sanctis[1], ZR Taylor[3]; [1]North Carolina State University, Raleigh, NC, [2]University of Georgia, Tifton, GA, [3]North Carolina State University, Sanford, NC (8)

Acetochlor, dimethenamid, pyroxasulfone, and *S*-metolachlor (Group 15 herbicides) control most annual grasses well, except Texas millet (*Urochloa texana* (Buckley) R. Webster). In response to overuse of the Group 15 herbicides, a weed population shift from more common annual grasses, like large crabgrass (*Digitaria sanguinalis* (L.) Scop.) and goosegrass (*Eleusine indica* (L.) Gaertn.), to Texas millet is on-going. Therefore, alternative herbicides for residual Texas millet control are necessary. The objective of this research was to evaluate Texas millet control by POST herbicide programs with and without pendimethalin. Research conducted at the Central Crops Research Station near Clayton, NC during 2020 and 2021 and at the UGA Ponder Farm near Tifton, GA in 2021. All herbicides were applied postemergence (POST) to V3 to V5 corn. Treatment structure was a two by five factorial including two pendimethalin rates by five POST herbicide tank mixtures in a randomized complete block design with three or four replications. Pendimethalin rates included 0 and 1067 g ai ha^{-1}. Postemergence herbicide tank mixtures included glyphosate (1263 g ae ha^{-1}) + tembotrione (92 g ai ha^{-1}) + atrazine (2245 g ai ha^{-1}); glyphosate + atrazine; glyphosate + glufosinate (657 g ai ha^{-1}); glyphosate (1063 g ae ha^{-1}) + *S*-metolachlor (1063 g ai ha^{-1}) + mesotrione (106 g ai ha^{-1}) + atrazine; and glyphosate + topramezone (18 g ai ha^{-1}) + atrazine (281 g ai ha^{-1}). Data collected included Texas millet control 21 and 49 days after (DA) POST and corn yield. Data were subjected to ANOVA using R and treatments separated using Tukey's test at a=0.05 when appropriate. Only slight, transient corn injury was observed. Averaged over POST tank mixtures, pendimethalin improved Texas millet control 17% and 23% 21 and 49 DA POST, respectively, compared to no pendimethalin. Averaged over pendimethalin treatments, glyphosate + mesotrione + S-metolachlor + atrazine was most effective for Texas millet control and comparable to control by glyphosate + tembotrione + atrazine and glyphosate + atrazine for both evaluations. Plots receiving pendimethalin at Clayton 2020 yielded 690 kg ha^{-1} greater than plots not receiving pendimethalin; no differences in corn yield were observed at Clayton 2021 or Ty Ty 2021. In conclusion, pendimethalin applied POST improved residual control of Texas millet 21 and 49 DA POST and improved corn yield at one location. Pendimethalin is an adequate residual alternative for Texas millet control and can help limit selection pressure for Group 15-resistant weeds.

Does a Fenclorim Seed Treatment Safen Rice to a Delayed Preemergence Application of Microencapsulated Acetochlor on a Clay Soil? SC Noe*[1], JK Norsworthy[2], TH Avent[2], TC Smith[2], MM Houston[2], TR Butts[3]; [1]University of Arkansas, Fayetteville, KY, [2]University of Arkansas, Fayetteville, AR, [3]University of Arkansas System Division of Agriculture, Lonoke, AR (9)

Acetochlor is a group 15 very long-chain fatty acid elongase inhibitor commonly used for weed control in corn, soybean, and cotton. Acetochlor is not currently labeled for use in rice but has shown effective control of weeds commonly found in rice production systems, including small-seeded broadleaves and grasses. Fenclorim has been previously used as a herbicide safener in Asian rice when mixed with chloroacetamide herbicides and has shown potential for use as a seed treatment in drill-seeded rice. Injury to rice may be mitigated with the use of a microencapsulated (ME) formulation of acetochlor applied to rice having a fenclorim seed treatment and soil texture may influence the degree of safening. An experiment was conducted in Spring 2021 on a clay soil to evaluate weed control and injury to rice caused by ME acetochlor at three herbicide rates (1,260, 1,890, and 2,520 g ai ha^{-1}) with or without a fenclorim seed treatment at (2.5 g ai kg $seed^{-1}$). Crop injury and weed control were rated 28 days after crop emergence. With the fenclorim seed treatment, acetochlor at 1,860 g ha^{-1} caused only 3% injury, showing no difference from the lower rate of 1,260 g ha^{-1}. In terms of weed control, all three weeds in this study (Palmer amaranthus, Trianthema portulacastrum L., Brachiaria platyphylla) showed increased control when comparing acetochlor at 1,890 g ha^{-1} to the lower rate of 1,260 g ai ha^{-1}. These findings demonstrate that ME acetochlor at 1,890 g ha^{-1} applied to rice having a fenclorim seed treatment (2.5 g ai kg $seed^{-1}$) results in a high level of weed control on a clay soil without causing unacceptable levels of injury to rice.

Cereal Rye Residue Effects on the Germination of Troublesome Southeastern Weeds. A Kumari*[1], S Li[1], AJ Price[2]; [1]Auburn University, Auburn, AL, [2]USDA-ARS-NSDL, Auburn, AL (10)

Weed seed germination and early growth stage are critical parts of the weed life cycle affected by environmental and genetic factors. Therefore, weed control strategy should be focused on the most susceptible parts of the weed cycle to maintain sustainability and reduce the use of the chemical herbicide. Cover crops have been increasingly adopted to suppress weed germination and seedling emergence. A greenhouse experiment was conducted in Auburn University greenhouse to evaluate the germination and growth response of several key weeds in the Southeast to various levels of cereal rye residue. Seeds of palmer amaranth, sicklepod, morning glory, and crabgrass were mixed with organic garden soil and placed over the top of the tray. The soil flats were covered uniformly by four different biomass of cereal rye straw. Seed germination and seedling establishment were quantified through seedling counting and recording of dry weight. The results illustrated that morning glory was the least responsive to increasing biomass due to large seed sizes, and palmer amaranth was the most responsive due to small seed sizes. At the same time, the germination and growth rate of crabgrass and sicklepod fluctuated with different levels of biomass residue during this greenhouse study.

Impact of Drill Spacing and Nozzle Selection on Spray Coverage and Weed Control in Rice. NH Reed*[1], TR Butts[2], JK Norsworthy[1], J Hardke[3], T Barber[2], JA Bond[4], A Poncet[1], BM Davis[5], M Sumner[5]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Stuttgart, AR, [4]Mississippi State University, Stoneville, MS, [5]University of Arkansas, Lonoke, AR (11)

Weeds in the Mid-south are becoming more problematic every year. Integrated weed management strategies including cultural methods must be incorporated to better control these pests. Some strategies that are overlooked are manipulation of drill width spacing and optimization of herbicide applications specifically through nozzle type selection. As a result, the objective of this experiment was to evaluate the impact of drill spacing and nozzle selection on spray coverage and weed control in rice. A field experiment was conducted in the summer of 2021 at three locations (two in Arkansas and one in Mississippi) as a randomized complete block split-plot design. The rice was drill-seeded in four drill widths (13-cm, 19-cm, 25-cm, and 38-cm). Two herbicide applications (PRE and preflood) were made using common commercially available rice herbicides with five nozzle types [XR, AIXR, and TTI, (single-fan nozzles); TTI60 and AITTJ60 (dual-fan nozzles)]. Barnyardgrass (Echinochloa crus-galli) density was assessed at the 3-leaf rice stage. Water sensitive cards were sprayed and collected to assess spray coverage of each nozzle type. Yield data were collected and adjusted to 12.5% moisture. All data was analyzed using JMP Pro 16.0 subjected to an ANOVA table using Fisher's Projected LSD (P=0.05). Regardless of response variable or location, no interaction was observed between drill width spacing and nozzle type. At the Lonoke, AR, location, narrower drill width spacing of 13-cm, 19-cm, and 25-cm had greater weed control than a wider drill spacing of 38-cm. The smaller droplet size producing nozzles (XR, AIXR, and AITTJ60) had greater spray coverage than the larger droplet size producing nozzles (TTI and TTI60). No increase in coverage was observed from dual-fan nozzles compared to single-fan counterparts. Narrower drill spacing showed better weed control than wider drill spacing, and smaller droplet sizes had a better spray coverage than a larger droplet size.

Wildflower Emergence Following Application of Pre-emergent Herbicides. TH Duncan*, KL Broster, JD Byrd, Jr.; Mississippi State University, Mississippi State, MS (12)

Carpetgrass (*Axonopus spp.*) is a native, warm-season, perennial grass that is widespread in the Southeastern United States (USDA Plant Database). Although exhibiting desirable traits for pasture use such as tolerance of low fertility and the potential to be grazed later into fall than other forage grasses, its low forage output and low nutritional content makes it an undesirable species for some livestock producers (Liethead et al., 1971; Heath et al., 1973). Whether attempting to manage or eliminate carpetgrass in a pasture, understanding its response to commonly used pasture herbicides would be of benefit to the producer. A study was conducted in Oktibbeha Co., Mississippi in a cattle pasture with an established population of carpetgrass to observe tolerance of common carpetgrass to postemergent pasture herbicides. Eight treatments were applied in a randomized complete block design with four replications of seven treatments plus an untreated control. Treatments included: Velpar L (hexazinone) at 4.1 L ha^{-1}, Brash (2,4-D + dicamba) at 2.3 L ha^{-1}, Grazon P+D (2,4-D + picloram) at 2.3 L ha^{-}, GrazonNext (2,4-D + aminopyralid) at 1.8 and 3.5 L ha^{-1}, DuraCor (aminopyralid + florypyrauxifen-benzyl) at 0.9 L ha^{-1}, and Escort (metsulfuron methyl) at 70 g ha^{-1}. Visual carpetgrass injury ratings, as well as biomass samples, were collected 7, 14 and 28 days after treatment (DAT). Biomass samples were obtained via push mower with an attached collection bag, and grab samples were then collected, weighed, and placed in a dryer for 48 hr then reweighed to determine percent moisture. Data were then analyzed with RStudio (Version 2021.09.1), subjected to ANOVA to compare treatments, with means separated using Fisher's LSD (a = 0.05). At 14 DAT, Velpar L at 4.1 L ha^{-1} and GrazonNext at 3.5 L ha^{-1} caused the most injury to carpetgrass. At 28 DAT, Velpar at 4.1 L ha^{-1} was the most injurious, with injury caused by GrazonNext at 3.5 L ha^{-1} being comparable to Velpar, and Brash at 2.3 L ha^{-1} showing injury comparable to the GrazonNext at 3.51 L ha^{-1}. There were no observed differences in collected biomass weights or moisture content between treatments at 7, 14, or 28 DAT.

Does Coating Urea with Florpyrauxifen-benzyl Reduce Risk for Damage to Adjacent Soybean? B Cotter*[1], JK Norsworthy[1], MC Castner[1], LB Piveta[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (13)

Following commercial launch of LoyantÔ (florpyrauxifen-benzyl) in 2018, frequent off-target movement of the herbicide to adjacent soybean [*Glycine max* (L.) Merr.] fields was observed. Hence, a field experiment was conducted in 2020 and 2021, in Fayetteville, AR, to evaluate the sensitivity of soybean to low-dose rates (0 to 5.63 g ae ha^{-1}) of florpyrauxifen-benzyl as a foliar spray and coated on urea. Applications occurred at V3 stage of soybean. Soybean response to applications of florpyrauxifen-benzyl in a wide-row (91 cm) soybean system was evaluated at 7, 14, 21, and 28 days after application. Maximum soybean injury observed when florpyrauxifen-benzyl at 5.63 g ae ha^{-1} was coated on urea was 25% in 2020 and 30% in 2021. However, both years, the maximum amount of soybean injury observed from a foliar spray of florpyrauxifen-benzyl at 5.63 g ae ha^{-1} was 100% (plant death). At all timings, equivalent rates of florpyrauxifen-benzyl coated on urea was less injurious than that of foliar spray applications. No deleterious effect on yield was observed in 2020 and 2021 from any florpyrauxifen-benzyl coated on urea treatment when compared to the nontreated, but all foliar spray treatments caused a negative effect on soybean yield. Overall, by coating florpyrauxifen-benzyl on urea, soybean injury was reduced 50 to 91 percentage points in 2020 and 55 to 96 percentage points in 2021, across all rating intervals, when compared to foliar spray applications. Coating florpyrauxifen-benzyl on urea and applying it to rice will likely mitigate the risk for injury to nearby soybean that was observed following aerial spray applications of the herbicide.

Effect of Sub-lethal Rates of Glyphosate on Provisia Rice Tolerance to Quizalofop. N Godara*[1], JK Norsworthy[1], LB Piveta[1], B Cotter[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (14)

Quizalofop-resistant rice technology became commercially available for Midsouth growers in 2018 and was followed by injury to quizalofop-resistant cultivars from postemergence applications of quizalofop. Rice is grown in close association with glyphosate-resistant corn, cotton, and soybean, increasing the risk of injury to rice hectares through non-target glyphosate drift. Field experiments were conducted in 2021 at Colt and Keiser, AR, to determine if the sub-lethal rate of glyphosate interacts with sequential quizalofop application to increase the risk for injury to quizalofop-resistant rice cultivar, PVL02 over applications of quizalofop alone. Experiments were implemented as a split-plot design, with location as a whole-plot factor, and herbicide treatment (glyphosate followed by initial quizalofop application at 10, 7, 4, 0-day interval and glyphosate applied alone at 10, 7, 4, 0-day interval before initial quizalofop application) as a split-plot factor. Glyphosate was applied at 90 g ae/ha, 1/10X of labeled use rate in soybean, and sequential quizalofop applications were at the recommended use rate of 120 g ai/ha applied at the 2-leaf stage followed by the 5-leaf stage. At 28 days after treatment (DAT), glyphosate followed by initial quizalofop at 0-day interval caused 18 percentage points more injury than glyphosate applied alone at 0-day interval regardless of location. In addition, glyphosate followed by initial quizalofop at the 0-day interval had a significantly higher glyphosate concentration in leaf tissue samples than glyphosate applied alone at the 0-day interval when analyzed at 7 DAT for both locations. Furthermore, rough rice grain yield was reduced to 34% when glyphosate application was followed by quizalofop application at 0-day interval compared with glyphosate applied alone at the 0-day interval at Colt, AR. Overall, glyphosate followed by quizalofop applications exacerbates injury over sequential quizalofop application alone, and as the timing interval between sub-lethal exposure to glyphosate and quizalofop application shorten, the detrimental affect to quizalofop-resistant rice increases.

HPPD-tolerant Cotton Response and Control of *Amaranthus palmeri* in Isoxaflutole-based Systems. ME Smith*[1], PA Dotray[2], A Hixson[3]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]BASF Corporation, Lubbock, TX (15)

Amaranthus palmeri S. Wats. (Palmer amaranth, Palmer pigweed, carelessweed) is one of the top common and troublesome weeds in cotton production on the High Plains of Texas. Competition between cotton and *Amaranthus palmeri* can result in yield loss and harvest complications. New HPPD-tolerant cotton technologies from BASF will soon provide producers another option to control *Amaranthus palmeri* and other troublesome weeds. This new technology will allow producers to use isoxaflutole in their cotton weed management. In 2021, a field study was conducted at the Texas Tech New Deal Research farm to examine cotton response and *Amaranthus palmeri* control when using isoxaflutole in different cotton herbicide programs. Treatments using isoxaflutole preemergence or early-postemergence were compared to local herbicide systems. Cotton response 21 days after preemergence applications was <12% for all treatments. *Amaranthus palmeri* was controlled at least 92% 29 days after the preemergence application for all treatments that included isoxaflutole preemergence and <89% for all treatments that did not include isoxaflutole in the preemergence system. *Amaranthus palmeri* control was greater than 88% 28 days after the early-postemergence application for all treatments that included isoxaflutole in the preemergence application. Cotton lint yields were at least 1,310 pounds per acre for treatments except the untreated control.

Use of Unmanned Aerial System for Herbicide Spray Applications. V Kumar*, V Singh, D Srivastava; Virginia Tech, Painter, VA (18)

Herbicide resistant weeds and weed escapes are serious issue in agricultural production as they lead to increased weed seed bank and promote weed infestations in following years. Blanket application of herbicides using tractor mounted sprayer may not be economical to manage these weed escapes. Recent advances in precision herbicide applications and use of Unmanned Aerial System (UAS) have made it possible to control weeds with site-specific treatments. A study was conducted in 2021 at Painter, VA to evaluate spot spray applications with UAS (Precision Vision 35PX) to control weeds in soybean field. Twenty weed spots were selected at random. Additional pots and trays filled with Palmer amaranth (*Amaranthus palmeri* S. Watson) and large crabgrass (*Digitaria sanguinalis* (L.) Scop.) seedlings of two different stages were kept at those random spots. Trays had about 50 seedlings (5-10 cm tall) of each weed and three pots of 20-25 tall Palmer amaranth plants. These spots were marked and mapped with aerial imagery using DJI M300. Images were orthomosaic using Pix4Dmapper. Geo-coordinates of spots were extracted and ESRI shapefile was generated and used as an input data for UAS-based herbicide application plan. UAS sprayed each spot automatically for 1-second without pilot intervention. Weed were treated with aerial application of Liberty (glufosinate) at 2.1 m altitude, volume rate of 140 L ha^{-1}, delivering 0.22 ml of Liberty per spot (1 m^{-2}). Studies were repeated over time and space with a gap of one month. UAS sprayed herbicide with a deviation/ displacement ranged from 0 to 1-m. Fifty percent of the spots were sprayed without any displacement, 15% with 0.25-m, 15% with 0.5-m, and 20% of spots with 1-m displacement. Weed control efficiency in field area and for seedlings in trays were statistically similar at 0 and 0.25-m displacement, resulting in spraying 65% of the spots within 25-cm of target radius. The overall weed control efficiency in field was 94% (considering five major weed species) and control of Palmer amaranth and large crabgrass seedlings was more than 95% in 65% of the targeted spots. In pot study, Palmer amaranth was controlled >90% in 80% of the targeted spots. Large crabgrass control was significantly lower (80-90%) at 0.5 and 1-m displacement compared with Palmer amaranth. Results have indicated that current UAS technology can accurately spray within 1-m of target, providing 70-100% control of weeds and spot spray application at lower wind speed is expected to increase the accuracy.

Gambit Applied with Different Formulations of Propanil for Weed Control in Rice. JA Williams*[1], E Webster[2], B Greer[2], DC Walker[1], C Webster[1]; [1]LSU AgCenter, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA (19)

Gambit Applied with Different Formulations of Propanil for Weed Control in Rice JA Williams, EP Webster, WB Greer, DC Walker, LC Webster Herbicides are often applied in a mixture to broaden the weed control spectrum, manage herbicide resistance, and reduce labor costs. Herbicide mixture interactions may result in one of three responses: antagonistic, synergistic, or additive/neutral. Herbicide antagonism occurs when the observed response of two or more herbicides applied in a mixture is less than the expected response based on the herbicides applied alone. Potentially antagonistic effects on alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb.] control have been reported when a prepackaged mixture of halosulfuron plus prosulfuron (Gambit®) is mixed with propanil. Two studies were conducted at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate the interaction between a prepackaged mixture of halosulfuron plus prosulfuron mixed with different formulations of propanil. The first study utilized an emulsifiable concentrate (EC) formulation of propanil (propanil-EC) (Stam®), whereas the second study utilized a suspension concentrate (SC) formulation of propanil (propanil-SC) (SuperWham!®). For both studies, plot size was 1.5 by 3 m^{-2} with water-seeded 'RT7321 FP' rice at 47 kg ha^{-1}. A plastic ring measuring 30.5 cm in diameter was placed at the front of each plot and contained transplanted alligatorweed. Each study was a randomized complete block design with a two-factor factorial arrangement of treatments with three replications. Factor A consisted of an application of propanil at 0 or 3,363 g ai ha^{-1}. Factor B consisted of an application of either a pre-packaged mixture of halosulfuron plus prosulfuron at 0, 55, or 83 g ai ha^{-1}; halosulfuron (Permit®) at 0, 35, or 53 g ai ha^{-1}, or prosulfuron (Peak®) at 0, 20, or 30 g ai ha^{-1}. Herbicides were applied POSTFLOOD at the 1- to 2-tiller rice growth stage. All applications were applied with a crop oil concentrate at 1% v v^{-1}, except for applications containing propanil-EC. All herbicides were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1}. Visual evaluations of percent control of alligatorweed were recorded at 28 d after treatment (DAT). Data were subject to an analysis of variance using Tukey's HSD test with a p-value of 0.05. Results for the propanil-EC study show a reduction in alligatorweed control when halosulfuron plus prosulfuron was mixed with propanil-EC. Halosulfuron plus prosulfuron applied alone controlled alligatorweed 82 to 90%; however, the two rates of halosulfuron plus prosulfuron mixed with propanil-EC controlled alligatorweed 45 to 57%. Prosulfuron applied alone controlled alligatorweed 75 to 85%, but control was reduced to 38 to 45% when mixed with propanil-EC. Similar results were found in the propanil-SC study. This research indicates a potentially antagonistic reaction between the prepackaged mixture of halosulfuron plus prosulfuron, specifically the prosulfuron component, for the control of alligatorweed regardless of the propanil formulation used.

A Deep Learning Approach for Detecting Common Ragweed in Soybean Using Unmanned Aerial System. D Srivastava*[1], ML Flessner[2], V Singh[1]; [1]Virginia Tech, Painter, VA, [2]Virginia Tech, Blacksburg, VA (20)

Common Ragweed (*Ambrosia artemisiifolia*) is a troublesome weed species in Soybean (*Glycine max*) production system in the United States. Integration of Unmanned Aerial System (UAS) and deep learning technologies can help in reduction of excess usage of herbicides by enhancing site-specific herbicide applications. Execution of these site-specific treatments would require signatures of different weed species for identification purposes. Deep-learning has been considered as one of the potential methods for recognition of specific meaningful patterns, which can be helpful in differentiating weed species. The biggest challenge in building robust deep-learning models is the non-availability of quality image data to train supervised models. It is also crucial that training data must be representative of all weather conditions, such as different daylights and precipitations for generalization. The selection of highly efficient model architecture to deploy in real-world applications require experimenting with different learning algorithms. The focus of this research is to present a new architecture of convolutional neural network classification model to detect common ragweed in soybean tuned using Bayesian Optimization and comparing it to BigTransfer (also known as BiT) state-of-art transfer learning. A study was conducted in 2021 at Painter, VA, where unmanned aerial systems (UAS)-based red, green, and blue (RGB) imageries were acquired at different growth stages of soybean and common ragweed using DJI M-300 flown at an altitude of 12 meters. A set of pixels (500 x 500) from original images were extracted to feed classification models. Image data were annotated using LabelImg, LabelMe, and VGG Image annotator (VIA) applications. Experimentally, we observed that our current model outperformed the BiT model in classifying common ragweed in soybean. Our model achieved test accuracy >85% with precision >80% and recall >90% of common ragweed as compared with 50% test accuracy from the BiT model. The study results indicate that this model has the potential to be utilized for site-specific operations, leading to reduced herbicide usage, and ensuring sustainable crop production.

Sensitivity of Different Living Mulch Species to Pre-emergence Herbicides Used in Cotton. HR Taylor*[1], MV Bagavathiannan[1], D Hathcoat[2]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Research, College Station, TX (21)

In cotton, weed expressing resistance to multiple herbicide sites-of-action are a pressing issue and creating a demand for other weed control options, especially non-chemical options. One such option that could prove very beneficial for cotton producers turning towards non-chemical weed control options are living mulches. Living mulch systems provide relief from chemical control as they suppress weeds, prevent germination, and greatly reduce the competition between the weeds and cash crop. As for living mulch species, selection is essential for a farmer planting them into a cotton agroecosystem in order to achieve optimum yield/weed control. When paired with a pre-emergent herbicide, excellent weed control can be achieved without several applications per season. However, pre-emergent herbicides applied in cotton can often adversely affect the establishment of intercropped living mulch species. There exists limited information and a gap in literature available for cotton production systems that incorporate living mulches, especially in Texas. We conducted a study to observe the effect of ten soil applied herbicides commonly used in cotton, on sixteen different living mulch species. Using an injury level rating on a 0-100% scale, fluridone exhibited significant damage across all living mulch species planted. Buckwheat, cowpea, and mix 1 were the most susceptible species showing injury from a variety of herbicides. As for the most effective herbicides, pendimethalin, acetochlor, and dimethenamid-P were the least injurious to these living mulch species while providing pre-emergent weed control. Herbicides and living mulch species can be carefully selected to avoid detrimental injury from pre-emergent herbicides. If these decisions are made correctly, optimal yield without chemical control can be achieved.

Reducing Stress from Rice Foliar Herbicides with GWN10598. S Karaikal*, M Machado Noguera, IS Werle, N Roma-Burgos; University of Arkansas, Fayetteville, AR (22)

Reducing stress from foliar rice herbicides with GWN10598 S.K. Karaikal*1, M. Noguera, I. Werle1, N Roma-Burgos1 - Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. Foliar herbicides can cause visible or hidden stress to the crop, which may be reflected in yield loss. Sub-optimal environmental conditions can trigger crop injury. GWN10598 is a growth regulator that could alleviate the effects of abiotic stress on plants. Experiments were conducted in 2021 at the Southeast Research and Extension Center and in the greenhouse at Milo J. Shult Agricultural Research and Extension Center, Fayetteville, Arkansas, to determine the optimum concentration and application timing of GWN10598 with respect to florpyrauxifen-benzyl application to rice. The field experiment consisted of 33 treatments, including non-treated control. The treatments were arranged in a split-plot design with four replications. GWN10598 concentrations were sprayed at five different timings: 36 and 24 h BHT (before herbicide treatment), 26 and 36 h AHT (after herbicide treatment), and tank mix. The GWN10598 concentrations were 0.075, 0.15, 0.225, 0.3, 0.375 % v/v. The florpyrauxifen-benzyl herbicide was sprayed at 1X rate (0.026 lbs ai/A) at GWN tank mix timings. The GWN and florpyrauxifen - benzyl were sprayed separately. The GWN and herbicide were sprayed separately. GWN10598 concentrations had no effect on rice injury but the effect of GWN application timings was significant. These two factors had no interaction effect on rice injury. The highest rice injury was observed when GWN10598 was applied 36 h after florpyrauxifen. The herbicide did not cause significant injury when GWN10598 was applied earlier or later. The GWN10598 concentrations did not affect rice yield, but the application timings did. The interaction between these factors was not significant. The highest yield produced at 24 AHT. The same experiment was conducted in the greenhouse with five application timings: 4 and 12 h BHT, 24 and 48 h AHT, and tank mixed. Similar to the field test, the GWN10598 concentrations did not affect rice biomass, but the effect of application timing was significant. The interaction effect between the application timing and GWN10598 concentration was not significant. The maximum biomass was produced when GWN10598 was applied 4 h BHT and minimum biomass was produced at 48 h AHT.

Comparison of Nitrification Inhibition Potential of Johnson Grass Biotypes in Contrasting Soil Types. E Ghosh*, N Rajan, NK Subramanian, MV Bagavathiannan; Texas A&M University, College Station, TX (23)

Nitrogen is one of the most limiting plant nutrients, which is taken up by plants in the form of ammonia (NH_3) or nitrate (NO_3^-). In the soil, ammonia is actively converted to nitrate by various microorganisms. This process, known as nitrification, affects soil nitrogen retention because nitrate is less stable in the soil environment and can be rapidly lost through denitrification or leaching. These loss processes greatly reduce nitrogen availability for plant growth. Some plant species, such as *Brachiaria humidicola* (signalgrass), have evolved mechanisms to inhibit nitrification by secreting root exudates; this phenomenon is known as Biological Nitrification inhibition (BNI). BNI allows the plant species to retain greater amounts of nitrogen in the form of ammonia, which in turn improves plant growth. It has been established that sorgoleone secreted by *Sorghum bicolor* (sorghum) has BNI potential. We hypothesize that the dominance and invasiveness of *Sorghum halepense* (johnsongrass), a weedy relative of cultivated sorghum, could be attributed in part to its BNI properties. However, little has been investigated in this regard. Here, we conducted a field survey in the Southeast Texas region to determine the extent of BNI in naturally occurring *S. halepense* biotypes under cultivated field as well as roadside conditions. A total of 8 random locations were surveyed in the region, with a pair of field and nearby roadside biotype (<1 km) in each location, making a total of 16 survey sites. In each site, *S. halepense* rhizosphere soil was collected at a depth of 15 cm; soil samples were also collected in areas outside of *S. halepense* infestation for comparison. A sub-sample was analyzed in a laboratory for ammonium and nitrate contents and the ratio of ammoniacal nitrogen out of the total available nitrogen was calculated. Preliminary results indicate that *S. halepense* has strong BNI properties, but the degree of nitrification inhibition varied across the locations; it is known that BNI can be influenced by genotype as well as environment. Further, the amount of ammonium retained by roadside *S. halepense* biotypes was generally greater than that of field biotypes. More investigations are currently ongoing to understand the influence of *S. halepense* genotype and soil characteristics on the extent of BNI.

Effect of Activated Charcoal as a Crop Safener for Flumioxazin in Sweetpotato. CD Blankenship*[1], KM Jennings[2], D Monks[2], DL Jordan[2], SL Meyers[3], J Schultheis[2], D Suchoff[2]; [1]NC State University, Raleigh, NC, [2]North Carolina State University, Raleigh, NC, [3]Purdue University, West Lafayette, IN (25)

A study was conducted to determine the effect of activated charcoal as a crop safener for flumioxazin in sweetpotato (*Ipomoea batatas*) in Clinton, NC in 2021.Treatments included a five by two factorial. Factor one included no herbicide, flumioxazin pretransplant (0.1 or 0.2 kg ai ha-1), *S*-metolachlor (1.92 kg ai ha-1) pretransplant or 0 d after transplanting (DAP) and the second factor included 'Covington' sweetpotato nonrooted cuttings transplanted with or without activated charcoal (0.9 kg ha-1) mixed with the transplant water. Sweetpotato foliage was rated for visual injury and stunting at 1, 2, 4, and 8 weeks after transplanting and roots were graded by hand into canner, no. 1, and jumbo grades at harvest. Activated charcoal had no effect on no. 1 sweetpotato yield, but both the pretransplant and 0 DAP *S*-metolachlor treatments as well as the 0.2 kg ai ha-1 flumioxazin treatment resulted in reduced no. 1 sweetpotato yield by at least 24% relative to the nontreated check. There was no reduction in total yield (canner, no.1, and jumbo) from any treatment.

Weed Suppression Potential of Cereal Rye Through Alteration of Soil Nutrient Dynamics. G Camargo Silva*[1], MV Bagavathiannan[2]; [1]Texas A&M University, Department of Soil and Crop Sciences, College Station, TX, [2]Texas A&M University, College Station, TX (26)

Cover crops have become one of the major non-chemical weed control methods in recent years. The most popular cover crop species is cereal rye (*Secale cereale* L.), which apart from offering soil and water conservation benefits, has great potential for utilization in weed resistance management. Cereal rye controls weeds through several mechanisms, one of which being depletion of soil nutrients in the weed rooting zone. This project seeks to determine the importance of soil nutrient uptake in the weed suppression properties of cereal rye cover. To investigate this response, a range of cereal rye biomass gradients was established through a combination of seeding rates and termination timings. Cereal rye was planted at four seeding rates (0, 20, 40, and 80 kg ha^{-1}) and terminated at three timings (6, 4 and 2 weeks before planting cotton), totaling 12 treatments. The treatments were arranged in a split-plot design with four replications. Soil samples were collected in each plot (15-cm depth) before cereal rye planting and again immediately after termination, to determine changes in soil nutrient status as influenced by cereal rye biomass production. A total of 6 nutrients were analyzed, including N, P, K, Ca, Mg, and S. Additionally, soil pH and electrical conductivity were also measured in each plot. Cereal rye biomass was quantified in each plot at the time of termination; cereal rye was terminated using glyphosate (870 g ae ha^{-1}). Cotton was planted into the cereal rye residues with a no-till drill. Weed seedling emergence and density were documented in each plot until cotton canopy closure. Preliminary results show that higher seeding rates significantly reduce residual soil nitrogen. However, later termination timings significantly increased soil phosphorus and potassium levels. Correlation analyses provided insights into the association between the level of different soil nutrients and weed densities. Detailed investigations are currently being conducted to confirm this response and understand underlying mechanisms.

Evaluation of Living Mulch Species and Their Effect on Weed Pressure in Cotton. MJ Barth*, MV Bagavathiannan; Texas A&M University, College Station, TX (27)

Solutions to complex issues like herbicide-resistant weeds require unconventional approaches such as living mulches. Early in the growing season, cotton grows slowly and is very sensitive to competition from weeds. There is a growing need to develop non-chemical methods to suppress weeds in cotton as the number of herbicide-resistant weeds increases. An experiment was conducted at the Texas A&M University Research Farm in College Station, Texas to assess 22 living mulch species and mixes while minimizing the competitive effect on cotton. Living mulch species were planted 3 weeks after cotton emergence and received no additional weed control throughout the growing season. Living mulch ground cover, light interception, living mulch and weed biomass, and cotton yield. Several living mulch species - alfalfa, berseem clover, flax, slender creeping red fescue, tall fescue, and zucchini - did not establish. Overall, the presence of a living mulch species was found to significantly reduce weed pressure and had a significantly greater cotton yield than the weedy check. Weed suppression potential varied across living mulch species, with Japanese millet, cowpea, and soybeans being the best performers. Cotton yield was negatively impacted by some species, such as one species mix and buckwheat. Living mulches show significant promise as another "little hammer" to combat weeds, but more research is required to better understand the potential of living mulch species and their integration into weed management programs.

Interference of Palmer Amaranth (Amaranthus Palmeri) in Stevia (Stevia Rebaudiana). S Ippolito*[1], KM Jennings[2], D Monks[2], S Chaudhari[2], DL Jordan[2], LD Moore[2], CD Blankenship[3], KC Sims[4], F Chitra[2]; [1]North Carolina State University, Selma, NC, [2]North Carolina State University, Raleigh, NC, [3]NC State University, Raleigh, NC, [4]NC State University, Goldsboro, NC (28)

Stevia (*Stevia rebaudiana* Bertoni) is prized as a zero-calorie sweetener. After its relatively recent legalization as a food additive in the US, demand for stevia has increased. Prior research has shown that stevia yield and quality is reduced by competition for light under shade cloth. Therefore, a field study was conducted in Clinton, NC in 2021 to determine the effect of Palmer amaranth (*Amaranthus palmeri* S. Wats) density on stevia yield. Stevia was planted at a density of 6.5 plants m^{-1} of row on raised beds covered in white polyethylene mulch. Palmer amaranth was established at 0, 0.3, 0.7, 1, 1.3, 2, 3.3, and 6.5 plants m^{-1} of row. Yield loss was fit to a rectangular hyperbola model. Predicted yield loss to Palmer amaranth competition was 26 and 73% at .3 and 6.5 plants m^{-1}, respectively.

Sustainable Weed Control Programs in Peanut. GA Stephens*, DM Dodds, JS Calhoun, J Krutz; Mississippi State University, Mississippi State, MS (29)

Utilization of herbicides with multiple sites of action (SOAs) is one of the basic principles of herbicide resistance management. However, producers typically utilize as few herbicides as possible due to budgetary constraints. Currently, a complete herbicide program in peanut includes five to seven SOAs. Research is needed to determine if current herbicide weed control practices in peanut are adequate with respect to weed control and resistance management. Therefore, this research was conducted to evaluate the minimum number of SOAs required to maximize weed control as part of a resistance management program. The effect of up to eight SOAs on broadleaf signalgrass (*Brachiaria platyphylla)* control when herbicides were applied PRE, PRE followed by EPOST, and PRE followed by EPOST followed by LPOST in peanut were investigated at R.R. Foil Plant Science Research Center, Mississippi State, MS; the W.B. Andrews Agriculture Systems Research Farm, near Mississippi State, MS; and the Coastal Plain Branch Experiment Station, near Newton, MS. In this experiment, the minimum number of SOAs that were required to maximize broadleaf signalgrass control from 7 up to 28 days after application were one SOA applied PRE, three SOA applied by EPOST, and six SOA by LPOST. These data indicate that six herbicides/SOAs were required to maximize broadleaf signalgrass control (>99%) 28DAT. These data indicate that current practices are sufficient for broadleaf signalgrass control as well as incorporating several herbicide sites of action. The addition of more herbicides/SOAs for broadleaf signalgrass is not necessary based on these data.

Suppression of Weeds Via Cover Crops in Soybean. SA Chu*[1], G LaBiche[2], LM Lazaro[2]; [1]Louisiana State University, Baton Rouge, LA, [2]LSU Ag Center, Baton Rouge, LA (30)

Cover crops have long been thought as a vital piece of weed control in an integrated weed management (IWM) program; however, with the rise of herbicide resistant weeds, the adoption has been limited. Adoption of IWM can alleviate resistance pressure and decrease economic and environmental losses associated with herbicide resistance. Cover crops help support integrated weed management by adding carbon to soil to improve organic matter, cycling nutrients, soil structural benefits, preventing the loss of sediment and nutrients, altering soil radiation and water exchange with residue retention, and suppressing weeds and other pest populations. Cover crops fill an ecological niche and compete with weeds for resources. Additionally, they create a chemical or physical barrier that impairs weed seed germination. The ability of cover crops to compete is directly linked to the biomass accumulated and the composition. Cover crop biomass and accumulation of nutrients is driven by environmental factors, such as climate, soil, and management practices. Therefore, the goal of this experiment was to assess the impact of cover crop biomass on weed suppression and soybean (*Glycine max*) yield, with the hypotheses being an increase in cover crop biomass will increase weed suppression and crop yield. The experiment was designed to be a split plot, on the Ben Hur Central Research Station in Baton Rouge, Louisiana. Cereal rye (*Secale cereale*) was planted in October and terminated in June of the following year, with the average biomass being 53 g m^{-2}. Soybean yield did not differ between the cover crop and no cover crop treatments. End of season weed biomass was not affected by the presence of cover crop. Therefore, cover crop did not increase weed suppression or soybean yield, suggesting that cover crop impacts are highly dependent on environmental factors.

Effect of Burial Depth on Seedbank Persistence of *Poa annua* L. (Annual Bluegrass) Across Climatic Gradients. AW Osburn*[1], R Bowling[2], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M University, Dallas, TX (31)

Annual bluegrass (*Poa annua* L.) is one of the most prolific and problematic weeds in various turfgrass systems across the United States (US) and beyond. This troublesome plant severely impacts the aesthetic value of turfgrass fields and drastically increases control costs. Further, it negatively impacts turfgrass stand density and playability of many turfgrass surfaces from golf course greens to athletic fields. Annual bluegrass has exhibited high persistence in turfgrass systems, but the role of seedbank longevity in long-term persistence of this species is unknown. In the fall of 2020, ten unique populations originating from various plant hardiness zones across the US were buried in seven locations at two depths, surface and 5 cm. For each treatment, a total of 250 viable seeds were mixed in weed-free native soil of the burial site and placed in a polyethylene mesh bag, which was buried at the respective depth in three replicates. A subset of the seed for each population has been stored under room temperature for comparison. The bags are retrieved at 6-month intervals over a period of 3 years. Upon retrieval, the bags are cut open and placed on the surface of plastic trays for germination evaluation in the greenhouse. Germination is observed at weekly intervals over the course of 6 weeks. The trays are then subjected to cold treatment (4 C) for 3 weeks to facilitate dormancy breaking and then moved to the greenhouse for further germination observations. As of now, data from the first 6-month after burial (bags retrieved in Mar/April 2021) is available. Seedbank persistence was greater in seed sources obtained from northern plant hardiness zones, compared to those from the more southern regions. This is an ongoing study and results will be updated as further seed bag retrievals are evaluated. Findings shed light on the seedbank persistence of annual bluegrass across a range of environmental gradients.

Palmer Amaranth Seed Dormancy in Response to Red and Far-Red Light Exposure. SE Kezar*, MV Bagavathiannan, S Zhen; Texas A&M University, College Station, TX (32)

Seed dormancy is a critical determinant of weed species persistence in the soil seedbank, and dormancy regulation governs the proportion of germinable seedbank. Dormancy of the freshly produced seed is influenced by the genetics of the mother plant and the maternal environmental conditions in which seeds develop. Among the various environmental factors, the ratio between red (R) and far-red (FR) lights is known to alter seed dormancy in plants. In this research, we investigated seed dormancy dynamics of Palmer amaranth (*Amaranthus palmeri*), a troublesome herbicide-resistant weed in cotton production, in response to light quality differences. The treatment included eight levels of light quality: R light, FR light, R light followed by FR light, FR light followed by R light, a high R:FR ratio, low R:FR ratio, natural light, and dark condition. Each of these treatments were implemented for six different durations: 5-second pulse, 30 seconds, 1 minute, 5 minutes, 10 minutes, and 30 minutes. An aluminum-frame chamber was designed and built with mounted R and FR light bars and controls to implement the treatments. The reflectance in µmol $m^{-2}s^{-1}nm^{-1}$ was measured with a spectroradiometer to standardize light intensity within the chamber area. Two separate experiments were conducted using this setup. The first experiment was conducted in a dark room, with four replications of 50 Palmer amaranth seeds taken in Petri dishes for each treatment combination. The Petri dishes were arranged in a completely randomized design. After the treatment, the Petri dishes were moved to an incubation chamber set at 30/25 C day/night temperature regime, and a 12-hour photoperiod coinciding with the sunrise. Palmer amaranth seed germination was observed every 4 days for 21 days. The second experiment was conducted in a cotton field infested with a naturally occurring Palmer amaranth population at Texas A&M Research Farm near College Station, TX. The light chamber was moved to the field and powered using an electric generator. At the time of the experiment (Sep 2021), Palmer amaranth plants were at mid-to late-reproductive maturity; the region of inflorescences containing brown or black seeds were tagged before treatment. The treatments were implemented at dusk after sunset, and the treated inflorescences were harvested 21 days after treatment, dried, and threshed. Subsequently, a germination test was conducted in an incubation chamber with a 30/25 C day/night temperature regime and 12-hour photoperiod. Seed germination was observed every 4 days for 21 days. Preliminary results show that Palmer amaranth seed dormancy is altered by light quality, in agreement with previously published studies in other species. Findings could be used for manipulating seed dormancy and impacting seedbank dynamics of Palmer amaranth, which can serve as an additional tool in the weed management toolbox for this troublesome species.

Dicamba and Group 15 Herbicide Combinations for Palmer Amaranth Control. EC Russell*, ML Flessner, KW Bamber, WC Greene; Virginia Tech, Blacksburg, VA (33)

Palmer amaranth (*Amaranthus palmeri*) is a dioecious annual broadleaf weed whose prolific seed production and photosynthetic efficiency aid in its ability to outcompete crops. Since the introduction of dicamba-tolerant soybeans, dicamba has become a popular postemergence herbicide for Palmer amaranth control. In soybean production, group 15 herbicides (inhibitors of very long chain fatty acids) are often applied at planting to provide residual control of Palmer amaranth and other weeds. Combining a group 15 herbicide with a postemergence application of dicamba can provide residual Palmer amaranth control. However, the effect of this combination on Palmer amaranth is not fully understood. To shed some light on this question, data were consolidated from field trials conducted across Virginia from 2017 to 2021 with emphasis on dicamba combined with four different group 15 herbicides: acetochlor, *S*-metolachlor, dimethenamid-P, and pyroxasulfone. Palmer amaranth control was assessed 6 weeks after a single postemergence application and 9 weeks after a two-pass program applied at planting and again 3 weeks after planting. A single postemergence application of dicamba + acetochlor, dicamba + dimethenamid-P, and dicamba + pyroxasulfone provided >90% Palmer amaranth control at 6 weeks after application, while dicamba + *S*-metolachlor and dicamba alone had 61% and 71% control, respectively. Applying dicamba + group 15 both at planting and 3 weeks after planting provided the longest and most consistent control of Palmer amaranth with >90% Palmer amaranth control observed for all treatments 9 weeks after the preemergence application. Future research is needed with more application timings and other group 15 herbicides to determine the ideal combination for Palmer amaranth control in soybean.

Effect of Boom Height and Working Pressure on Pattern Distribution of Drift Reduction Nozzles. AA Tavares*[1], J de Oliveira[2], RB Oliveira[3], GR Kruger[4], DM Dodds[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska-Lincoln, North Platte, NE, [3]Northern Parana State University, Bandeirantes, Brazil, [4]BASF Corporation, Research Triangle Park, NC (34)

Proper sprayer configuration during pesticide applications is critical to ensure accurate pesticide application. Recurrent pesticide drift concerns motivated the development and introduction of new nozzle. The objective of this research was to compare the spray pattern from drift reduction nozzles at different boom heights and operating pressures. A patternator is an autonomous 3 m x 4 m aluminum table used to evaluate spray consistence and distribution across the boom. The table lies perpendicular to the 8-nozzle spray boom and has 80 channels to carry the collected spray solution into acrylic tubes. After collection, four supersonic devices measure the amount in each of the 80 tubes. The statistical method, coefficient of variation (CV%), is used to determine the quality of pattern of each treatment and compiles all data. The research was conducted at the Pesticide Application Technology Lab at University of Nebraska – Lincoln. Experimental design was a complete factorial with 3 drift reduction nozzles (AIXR 11003, TTI 11003, and MUG 03), 3 operating pressures (200, 400, and 600 kPa), and 4 boom heights (0.35, 0.50, 0.75, and 0.85 m). The MUG03 nozzle produced the highest variation of spray pattern across the boom. Additionally, the lowest operating pressure resulted in the highest variation found (22%) and above the threshold in all boom heights. Pooled across all operating pressures, increased boom height reduced variation for MUG 03 and AIXR 11003 nozzles. CV% increased with boom height when TTI 11003 nozzles were utilized. Even though nozzles are considered to have a 110° spray angle, each nozzle has an ideal boom height where the spray pattern distribution was more uniform. TTI 11003 had the lowest CV% (4.55%) in response to changes in boom height at 0.35 m. MUG 03 and AIXR 11003 had the lowest CV% was using boom height at 0.5 and 0.75 m, respectively. Spray nozzle selection should be a decision based in all application process not just due to droplet size.

Automating Data Annotation and Curation for a Weed Image Repository. M Kutugata*[1], PJ Ramos-Giraldo[2], M Cangiano[2], S Skovsen[3], C Reberg-Horton[2], SB Mirsky[4], MV Bagavathiannan[1]; [1]Texas A & M University, College Station, TX, [2]North Carolina State University, Raleigh, NC, [3]Aarhus University, Aarhus, Denmark, [4]USDA ARS, Beltsville, MD (35)

Advances in computer-vision based machine learning allow researchers to rapidly phenotype weeds using images collected under controlled greenhouse conditions. These techniques, however, require large amounts of labeled training data encompassing images and their corresponding regions of interest. Collecting and labeling images of weeds is time-consuming and limiting, which has severely slowed the generation of datasets necessary for utilizing artificial intelligence in agriculture, particularly in weed identification, mapping, and precision management applications. This project aims at reducing the burden of manually annotating a dataset of 727 weed images collected over a 6-week period for the 2021 OpenCV AI Competition. We did this by 1) developing a library of vegetation cut-outs, 2) generating a dataset of artificial images (using vegetation cut-outs) to train a deep learning object detection model, and 3) using detection results and simple image processing techniques to extract and classify vegetation. A total of 2,935 unique vegetation cut-outs of 7 weed species groups were created and used to generate 50,000 artificial images with bounding box and pixel-wise annotations. None of the images were manually annotated in this project, saving an estimated 22 hours per 1,000 cut-outs. Automatic annotation pipelines play an important role in developing robust datasets for trained AI models that can handle diverse scenes. The methodology devised here will be utilized in a weed image library pipeline currently being developed.

Transplant Broccoli and Collard Response to the Residual Activity of Glyphosate Applied Preplant. HE Wright*[1], TM Randell[2], JC Vance[2], A Culpepper[2]; [1]University of Georgia, Athens, GA, [2]University of Georgia, Tifton, GA (36)

Many fresh market produce crops are extremely sensitive to herbicides, which can cause detrimental injury. Glyphosate is often used before planting to control emerged weeds and is not expected to harm crop growth. However, recently published research suggests that in certain soil types, the residual activity of glyphosate can cause significant injury to sensitive produce crops. Therefore, a field experiment was conducted two times, in the fall of 2019 and 2020, near Ty Ty, GA (92% sand, 6% silt, 2% clay, 0.58% OM) to evaluate transplanted broccoli and collard response to glyphosate applied preplant. This experiment was arranged as a randomized complete block with a three-factor factorial treatment structure. The first factor, glyphosate rate, consisted of 0, 2.5, or 5.1 kg ae ha^{-1} glyphosate applied preplant. The second factor consisted of tillage (roto-tiller) after herbicide application or no tillage after application. The third factor consisted of irrigation (0.6 cm) after herbicide application or no irrigation after herbicide application. Eight hours after all treatments were applied, a mechanical hole puncher created holes for broccoli and collards to be transplanted by hand. Irrigation did not influence herbicide activity but both glyphosate rate and tillage influenced crop response. Without tillage at 28 days after treatment, glyphosate at 2.5 or 5.1 kg ae ha^{-1} injured broccoli and collards 15-79% and 30-93%, respectively. Plant widths of each crop, at that same interval, noted the aforementioned rates of glyphosate caused a reduction of 12-66% and 27-71%, respectively. Broccoli yields were reduced 35% by glyphosate at 2.5 kg ae ha^{-1} and 63% when applied at 5.1 kg ae ha^{-1}; collard yields were reduced 50% and 73% with greater impact from the higher rate. When tillage was implemented after the glyphosate application and before transplanting, visual injury, plant width growth, and yield were not influenced by the herbicide. These data suggest glyphosate rate and incorporation by tillage can influence the residual activity of glyphosate when producing fresh market broccoli and collards.

Is Palmer Amaranth in Georgia Resistant to PPO-inhibiting Herbicides Applied PRE and POST? TM Randell*[1], LC Hand[1], JC Vance[1], HE Wright[2], A Culpepper[1]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (37)

PPO-inhibiting herbicides are a critical component of numerous Georgia cropping systems, including cotton, peanut, soybean, and vegetables. In 2017, a population of Palmer amaranth (*Amaranthus palmeri* S. Watson) was identified by Extension and confirmed through initial field assessments and greenhouse bioassays, to exhibit reduced sensitivity to topically applied PPO inhibiting herbicides. Dose-response assessment studies were conducted from 2017-2021 to determine the problematic population's response to both preemergence (PRE) and postemergence (POST) applications. Seed collected from Palmer amaranth plants in a field less than 200 m away from the problematic population were included as a comparison standard, as historically, PPO herbicides have not been used on this sensitive site. In PRE dose-response studies, flumioxazin (1X=210 g ai ha^{-1}) and fomesafen (1X=57 g ai ha^{-1}) were applied to greenhouse flats filled with field soil, and planted with 135 seed from either the susceptible or problematic site. To quantify plant sensitivity, 1/27X to 3X field use rates were included for the problematic population and 1/279X to 1X rates were included for the susceptible population. Following treatment application, all herbicides were activated with overhead irrigation (0.75 cm), after which subirrigation was utilized for the remainder of the study. Both flumioxazin and fomesafen were significantly less effective controlling the population of concern. At a 1/9X field use rate, control, mortality, and biomass reduction of the susceptible population was 100%, compared to 90%, 97%, and 97% in the problematic population at a 3X rate. Calculations of i50 values for each of these response variables indicated R:S ratios of 32, 22, and 18, respectively. Similar to flumioxazin, fomesafen applied PRE noted complete control of the sensitive population at the 1X rate, but control, mortality, and biomass reduction was only 91% at a 3X rate in the problematic population. For these response variables, calculated R:S ratios were 3, 5, and 3, respectively. In POST dose-response studies, fomesafen (1X=420 g ai ha^{-1}), lactofen (1X=219 g ai ha^{-1}), and acifluorfen (1X=420 g ai ha^{-1}) were applied overtop of 8-10 cm Palmer amaranth from both populations, with 1/4X to 10X field use rates included for the problematic population, and 1/16X to 2X rates included for the susceptible population. Each herbicide was effective on the susceptible population, 1X rates provided 85% to 99% control and biomass reductions of 93% to 96%. In contrast, the problematic population was controlled only 34% to 48%, with a maximum biomass reduction of 47% at the same rate; at the 10X rate the maximum level of control observed in the problematic population was 51% to 73%. Results indicate Palmer amaranth resistant to PPO herbicides applied PRE or POST has been confirmed in Georgia and the effectiveness of these tools no longer offer a practical benefit for management of this population.

Site-Specific Treatment of Late-Season Weed Escapes in Rice Using an RTK-GPS Guided Unmanned Aerial System. B Gurjar*[1], BB Sapkota[1], I Ceperkovic[1], U Torres[1], M Kutugata[1], X Zhou[1], DE Martin[2], MV Bagavathiannan[1]; [1]Texas A&M university, College Station, TX, [2]United States Department of Agriculture, College Station, TX (38)

There is increasing demand for technological innovations in agriculture that improve efficiency and economics, while reducing the negative environmental footprint of various agricultural practices. Major progress has been made in drone technologies and image analysis methods. Weed detection in drone imagery, along with the use of semi-autonomous aerial weed control systems, are emerging as viable solutions for combating weeds, while reducing chemical inputs. In this research, a pipeline involving weed detection in drone- collected RGB imagery along with a UAS-based spray application were evaluated, targeting weed escapes in a rice field. The research was conducted at the David Winterman Rice Research and Extension Center, Eagle Lake, TX. The specific objectives of this study were to1) Identify weed patches in a rice crop using image analysis techniques, and 2) Compare the efficacy of the drone-based precision herbicide application with the conventional backpack spray application. The weed species targeted in this research were barnyardgrass, sprangletop, and hemp sesbania. Results showed that weed patches in a rice crop can be effectively detected in aerial RGB imagery. Further, the RTK-GPS based spray application was fairly accurate in targeting the previously delineated weed patches. Findings demonstrate the potential for using machine vision and unmanned aerial systems for site-specific management of weed escapes in rice. Future improvements will include real-time weed detection and spraying using an on-board data processing system.

Dislodgable 2,4-D and Dicamba Residue from Hybrid Bermudagrass Influenced by Herbicide Formulation, Rate, and Post-application Time. E Gomiero Polli*[1], MC LeCompte[1], RR Rogers[1], K Ahmed[1], E Reasor[2], T Gannon[1]; [1]North Carolina State University, Raleigh, NC, [2]PBI Gordon, Dallas, TX (40)

2,4-D and dicamba are herbicides extensively used to control broadleaf weed species in turfgrass systems. Turfgrass canopies inherently intercept a high percentage of an applied herbicide, but if the herbicide residues are retained on the upper turfgrass canopy they may be transferred from the foliar surface to human skin. These dislodgeable foliar residues are a potential concern for human exposure to herbicides from turfgrass. Therefore, the objective of this study was to investigate the influence of herbicide formulation, rate, and post-application time, and season of the year on dislodgeable 2,4-D and dicamba residue from hybrid bermudagrass (*Cynodon dactylon hybrids*). Field studies were conducted in the spring and summer seasons in 2021 at the Lake Wheeler Road Field Laboratory in Raleigh, NC. For each season, studies were organized in a 5 x 8 split-plot design including 3 repetitions and 2 runs. The whole plot represented the post-application time (1, 2, 4, and 8 days) and sub-plot the herbicide treatments. Two pre-mixed commercial formulations of 2,4-D + dicamba were applied at 860 and 1110 g ae ha^{-1} for 2,4-D and 78 and 118 g ae ha^{-1} for dicamba using a 3-nozzle boom hand-held CO2 sprayer calibrated to deliver 76 L ha^{-1}. Additional samples were collected at 0 DAT for each herbicide treatment for comparison reasons. Both formulations contained dimethylamine (DMA) salt of dicamba, but different salts of 2,4-D (DMA and ester). Samples were collected shortly after the sunrise using a modified California-style roller and a cotton sheet secured to a 70 cm x 90 cm aluminum frame. After collection, cotton sheets were placed in individual glass jars, then stored in a cooler, and transported to the laboratory where herbicide residue analyses were performed using high-performance liquid chromatography. Herbicide concentration data were subjected to analysis of variance in SAS software and treatment means were computed using Tukey's least significant procedure (a=0.05). Additionally, contrast analyses were conducted using PROC GLIMMIX to compare different formulations and rates within herbicides. The highest 2,4-D and dicamba residues were detected 1 day after application which was equivalent to 75% of residue detected at 0 DAT. This value decreased to 41, 21, and 19% at 2, 4, and 8 DAT, respectively. Additionally, 2,4-D treatments residue detection was up to 30% higher than for dicamba treatments. No difference in residue detection was observed between seasons (spring and summer), herbicides formulations, and rates. The findings of this study suggest that chances of potential human exposure to 2,4-D are higher than to dicamba. Furthermore, 8 days after application, the amount of dislodgeable residue of those herbicides is very low. Future studies will investigate the effect of fall and winter weather on dislodgeable foliar residues on these 2,4-D and dicamba formulations.

Use of Radio-labeled Herbicides to Understand Interactions Between Dicamba and Glufosinate. MC Castner*[1], JK Norsworthy[1], GL Priess[1], P Carvalho-Moore[1], J Hwang[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (41)

It is common for mixtures containing contact and systemic herbicides, such as dicamba and glufosinate, respectively, to exhibit some degree of antagonism when mixed. However, due to current label restrictions, dicamba and glufosinate cannot be mixed in XtendFlex cotton and soybean systems, meaning the herbicides must be applied sequentially. Previous field experiments concluded that dicamba followed by (fb) glufosinate at labeled rates 14 days after initial treatment was optimal for controlling Palmer amaranth. To better understand interactions between dicamba and glufosinate, an experiment was conducted with the respective ^{14}C herbicides applied separately, in mixture, and at 3- and 14-day intervals to 5- to 7-leaf Palmer amaranth. Peak dicamba absorption occurred when mixed with glufosinate (88% of total applied), whereas all other treatments were comparable and varied from 46 to 52% of the total applied ^{14}C-dicamba. Absorption of ^{14}C-glufosinate was comparable when applied alone or in any of the tested sequences with dicamba, ranging from 58 to 70% of total applied. When glufosinate was applied with or preceded dicamba, approximately 92, 83, and 63%, respectively, of the absorbed dicamba remained in the treated leaf (TL), except for dicamba alone (35%), indicating that applications of glufosinate prior to a dicamba application restrict translocation. Of the absorbed ^{14}C-glufosinate, almost all could be found in the TL, which is not surprising given the contact nature of the herbicide. To optimize Palmer amaranth control in the XtendFlex system, dicamba should be applied approximately 14 days before glufosinate, which enables maximum effectiveness of both herbicides.

Enhancing Pollinator Forage in Turfgrass with Native Weed Species in the Southeastern United States.
IG de Souza*[1], CJ Wang[2], EB De Castro[1], GM Henry[2], DW Held[3], JG Hill[1], JD McCurdy[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Georgia, Athens, GA, [3]Auburn University, Auburn, AL (43)

Urban and suburban ecosystems rely heavily upon maintained turfgrass monocultures. These systems are often non-native and input-rich. The biological and ecological value of these ecosystems may be improved through the promotion of biodiverse lawns that offer ecosystem services such as pollinator habitats. However, little is known about the contribution of weeds that proliferate in turfgrass as pollinator forage. The USDA-AFRI funded Partnership for PollinatorFriendly Lawns in the Southeastern United States project ("Refuge Lawn" for short) will study common turfgrass weeds in the southeastern U.S. and how they support pollinators. Studies include: 1) Determine bloom periodicity of native and introduced forbs common to lawn and amenity turfgrass settings in the southeastern U.S. and quantify pollinating insect visitors, 2) Characterize effects of warm-season turfgrass species selection and cultural practices on forb establishment and persistence, as well as effects upon pollinator visits, 3) Gauge stakeholder preference for pollinator habitat within maintained turfgrass systems and leverage the team's regional expertise and stakeholder connections within each respective state to create best management practices and a comprehensive Extension program that delivers research-based knowledge to various levels of turfgrass managers (including homeowners and professional practitioners) around the southeastern U.S. A plant list based on native and introduced species that have the potential to benefit pollinators in Alabama, Georgia, and Mississippi was developed. Ten sites per state will be selected for evaluating each plant species on the list by studying naturally occurring stands. Results will help determine the plants that will be tested for establishment. Interactions with stakeholders will be maintained throughout each stage of the project. Best management practice materials will be published, and field and classroom curriculum will be delivered to stakeholders.

Identification of Goosegrass (*Eleusine indica*) Populations Resistant to Foramsulfuron and Sulfentrazone. BC Johnson*, J Harris, JS McElroy; Auburn University, Auburn, AL (44)

Thirty-seven goosegrass populations suspected resistant to herbicides were submitted to the Auburn University Herbicide Resistance Lab (http://resistancelab.org) in 2020-21. Each population was treated with seven different herbicides at a standard rate to determine resistance or susceptibility. Of these, three populations were found to be resistant to Revolver (foramsulfuron) and two to Dismiss (sulfentrazone). Putative Revolver resistant goosegrass populations were from Grand National Golf Course, Opelika, AL (R-R1; R-R3), and Waiehu Golf Course, Maui County, Wailuku, HI (R-R2). Estimated Dismiss resistant goosegrass populations were from Grand National Golf Course, Opelika, AL(D-R1) and Paris Mountain Country Club, Greenville, SC (D-R2). The susceptible population for both herbicides was from the Plant Breeding Unit, Tallassee, AL (S). These suspected populations were further evaluated to confirm the level of resistance. Plants were grown from seeds and individual tillers were planted into 4-inch pots. Plants were allowed to grow into the three-leaf stage then treated with 0, 0.125, 0.25, 0.50, 1.0, 2.0, 4.0, and 6.0 times the standard rate of Dismiss (What is that rate in product and in kg ai/ha) and Revolver (What is that rate in product and in kg ai/ha). Treatments were arranged in a randomized complete block design with four replications. Treatments were applied with a CO_2-pressurized sprayer calibrated to deliver 280.5 L ha^{-1}. All treatments were applied with Induce a nonionic low foam wetter/spreader adjuvant at 0.25% v/v. Goosegrass control was visually assessed using a 0 (no control) to 100% (death of plant) scale. Control was surveyed 7, 14, 21, and 28 DAT (days after treatment). Aboveground mass was harvested and weighed in grams 28 DAT as well. Inspection of the rate response data indicated a clear delineation between a suspected Revolver or Dismiss resistant biotypes and susceptible biotypes. Suspected Revolver resistance was modeled using sigmoidal dose-response graphs. Using these models, each Revolver population R1, R2, R3 had a calculated I50 of 0.12, 0.12, 0.09, respectively, whereas the susceptible biotype had a 0.02 I50. Each Dismiss population R1, and R2 had a calculated I50 of 0.11 and 0.21 respectively, whereas the susceptible biotype had a 0.03 I50. This is the first identification of Revolver and Dismiss resistant goosegrass. Special thanks to Bruce Spesard of Bayer Environmental Sciences for sponsoring this research.

Effect of Application Timing on Rice Tolerance to Fluridone. CH Arnold*[1], JK Norsworthy[1], MC Castner[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (45)

Fluridone is utilized as a soil-applied, preemergence residual herbicide in cotton (*Gossypium hirsutum*), mainly for the control of Palmer amaranth (*Palmeri amaranthus*) and some grasses. Palmer amaranth can be extremely problematic in rice, and for that reason, the tolerance of rice to fluridone was examined. A field trial was conducted in 2021 at the Rice Research and Extension Center near Stuttgart, AR, to determine the effect of fluridone use on rice tolerance to the herbicide. Fluridone was applied at 168 g ai ha^{-1} at four application timings (preemergence, delayed preemergence, 1- to 2- leaf stage of rice, immediately after flooding). Preemergence-applied fluridone caused less than 5% injury through 21 days after treatment (DAT). A delayed preemergence application of fluridone caused 0, 1, 11, and 13% injury, respectfully at 14, 21, 28, and 35 DAT. The highest level of injury occurred fluridone was applied to 1- to 2- leaf rice, resulting in 18 to 23% injury from 14 to 35 DAT. Postflood applications resulted in no injury at all rating times. Based on these positive results, future efforts should further evaluate the utility of fluridone in rice, with preemergence and postflood application timings being the focus along with the level of weed control that can be expected with these applications. Because of the common occurrence of Palmer amaranth in furrow-irrigated rice, focus on this production system with fluridone should be a priority.

Evaluation of Annual Grass Control of Clethodim and Glyphosate Based Treatments as Affected by Water Conditioners and Auxin Herbicides. JT McCaghren*, S Li, RD Langemeier, L Pereira; Auburn University, Auburn, AL (46)

Glyphosate and/or clethodim resistant grasses are becoming more common across the southeast. In cotton and soybean glyphosate and dicamba is a common tank mix for producers which allows for a broad spectrum of weed control in dicamba resistant crops. Peanut growers are unable to use glyphosate, so instead use an ACCase herbicide such as clethodim. Previous literature has stated that antagonism can occur between glyphosate or clethodim and synthetic auxin herbicides. In peanuts, clethodim and 2,4-DB are often mixed to obtain broad spectrum control of problematic weeds. The expanded use of new dicamba resistant varieties in soybeans and cotton becoming makes antagonism between glyphosate and dicamba is a growing concern. Literature has proven that water containing ions, such as, calcium and magnesium, can produce hard water, which can antagonize glyphosate, resulting in reduced efficacy. However, with addition of water conditioners such as diammonium sulfate (AMS), dipotassium phosphate (DPP), and ammonia (NH3), antagonism may allow for hard water antagonism to be overcome. Two studies were created to 1) evaluate the antagonistic effects of glyphosate and dicamba tank mixes, as well as to evaluate the antagonistic effects of hard water when mixed with glyphosate, 2) evaluate 2,4-DB antagonism of clethodim. Both studies were conducted in summer 2021 in Henry and Elmore Counties in Alabama. In experiment one, hard water was created by mixing calcium chloride and magnesium chloride to water. Both studies included a randomized complete block design with four replications at each site. Visual ratings were recorded at 7, 14, 21, and 28 days after treatment (DAT). Also, heights, weights, and NDVI were recorded at 28 DAT. AMS was able to significantly increase control of a dicamba + glyphosate + DRA tank mix in hard water, however no other water conditioners which comply with dicamba application restrictions were able to. For experiment 2, at one site no significant antagonism to grass control was observed with 2,4-DB. In the second site, antagonism was observed, and AMS was able to overcome the antagonism.

Cotton Response to High Rates of Preemergence-Applied Acetochlor and Diuron on a Clay Soil. TC Smith*[1], JK Norsworthy[1], MM Houston[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (47)

Preemergence herbicides with residual activity are needed to control weed populations in slow-canopying cotton and reduce the pressure for herbicide resistance in cotton systems. Previous research showed that prickly sida could reduce seed cotton yields when allowed to compete with the crop throughout the season. This trial was initiated in 2021 at the Northeast Research and Extension Center in Keiser, Arkansas, to evaluate the response of cotton to preemergence applications of acetochlor and diuron alone and in combination on a silty clay soil. Results showed that all treatments caused less than 20% injury to cotton. All treatments also provided 90% or greater control on Prickly sida while high rates of diuron and the combinations of acetochlor and diuron resulted in 90% or greater control of pitted morningglory. Stand counts showed no significant loss 21 DAT for all treatments of acetochlor, duron, and the combination of the two at any rate. The combination of acetochlor and diuron at high rates increased control on pitted morningglory while injury was below 20% and deemed acceptable.

Do New Herbicide Technologies for Grain Sorghum Differ in Effectiveness on Johnsongrass Accessions.
JA Fleming*[1], JK Norsworthy[1], MV Bagavathiannan[2], V Kumar[3], MR Manuchehri[4], T Barber[5], TR Butts[5]; [1]University of Arkansas, Fayetteville, AR, [2]Texas A&M University, College Station, TX, [3]Kansas State University, Hays, KS, [4]Oklahoma State University, Stillwater, OK, [5]University of Arkansas System Division of Agriculture, Lonoke, AR (48)

Do New Herbicide Technologies for Grain Sorghum Differ in Effectiveness on Johnsongrass AccessionsDue to genetic similarities between johnsongrass and grain sorghum, few herbicides are available that will remove the troublesome weed effectively without injuring the crop. To combat this issue multiple new herbicide resistance technologies are being developed in grain sorghum to help producers' better control johnsongrass, some of which were released starting in 2021. These technologies include resistance to both ACCase-inhibitors and ALS-inhibitors. A greenhouse study was conducted in Fayetteville, AR in 2020 and 2021 to determine the effectiveness of the herbicides likely to be labeled in these technologies on accessions of johnsongrass from major sorghum-producing states. Johnsongrass seeds were collected from a total of 117 different locations within 4 states, Arkansas, Oklahoma, Texas, and Kansas. These accessions were then seeded in the greenhouse and treated with imazamox at 53 g ai ha-1, fluazifop at 210 g ai ha-1, quizalofop at 46 g ai ha-1, and nicosulfuron at 5.6 g ai ha-1. The goal was to determine which new herbicide technology would be the most effective at controlling johnsongrass to help producers make a better decision when choosing one of these technologies. Overall, the two ACCase-inhibitors, quizalofop and fluazifop, showed the highest levels of control with a percent mortality of greater than 90 percent across all accessions tested outside of one Arkansas accession. While the ALS-inhibitors nicosulfuron and imazamox both led to percent mortalities greater than 90%, both also had multiple accessions that were controlled less than 85%. Overall, the accessions from Oklahoma were controlled 100% by all herbicides tested while Arkansas showed much higher levels of variability across accessions and more potential for resistance.

Comparison of Yellow (*Setaria pumila*) and Knotroot Foxtail (*Setaria parviflora*) Response to Herbicides.
MM Joseph*, C Rutland, J Harris, JS McElroy; Auburn University, Auburn, AL (49)

Yellow and knotroot foxtail (*Setaria pumila* and *Setaria parviflora*, respectively) are problematic weeds in pastures, roadsides, and turfgrass in the Southeastern US. Yellow and knotroot foxtail are annual and perennial weeds, respectively, with few options available for effective chemical control. Yellow and knotroot foxtail can be difficult to distinguish phenotypically, thus leading to confusion about the use of herbicides. Research experiments were carried out in greenhouse and naturalized field populations to evaluate the susceptibility of yellow and knotroot foxtail to different herbicide modes of action. Only yellow foxtail was evaluated in field trials. Pinoxaden (0.6 and 1.3 kg ha^{-1}), sethoxydim (3.2 and 5.3 Kg. ha $^{-1)}$, thiencarbazone + dicamba+ iodosulfuron (0.3 kg ha$^{-1)}$, metribuzin (0.8 kg ha^{-1}), nicosulfuron + rimsulfuron (0.05 kg ha^{-1}), sulfentrazone (0.8 kg ha^{-1}), sulfentrazone + imazethapyr (1.0 kg ha^{-1}) and imazaquin (0.8 kg ha^{-1}) were applied with a non-ionic surfactant at 0.25% v v^{-1}. The experiment was repeated three times in the greenhouse as a randomized complete block design with four replications. Visual control was evaluated on a scale of 0 to 100% 7, 14 and 28 days after application (DAA) followed by final above ground biomass at 28 DAA. In the field trial, the same treatments were applied as a randomized complete block design with four replications and rated 7,14, 21, 28 DAA. Analysis of variance and Tukey HSD was performed as a mean comparison with a significance level P= 0.05. For yellow foxtail in the greenhouse, no significant control difference was observed among treatments (excluding the non-treated) and all herbicide treatments reduced above ground biomass greater than 80% at 28 DAA. Herbicide treatment differences were observed for knotroot foxtail. Pinoxaden and sethoxydim controlled knotroot foxtail less than 50% while all other treatments controlled knotroot foxtail greater than 60% at 28 DAA. Sulfentrazone controlled knotroot foxtail 90% at 28 DAA and pinoxaden controlled knotroot foxtail less than 10% at 28 DAA. In field trials for yellow foxtail, herbicide treatment differences were observed. Sulfentrazone controlled yellow foxtail 15% which was the lowest treatment while thiencarbazone+ dicamba+ iodosulfuron controlled yellow foxtail 89% at 28 DAA. In conclusion, knotroot and yellow foxtail responded differently to postemergence herbicide with knotroot foxtail being more difficult to control in general. Greenhouse rate response screens and more extensive field trials will be conducted in the coming year.

Effect of Planting Depth and a Fenclorim Seed Treatment on Rice Tolerance to Acetochlor Under Cold, Wet Conditions. TH Avent*[1], JK Norsworthy[1], TL Roberts[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (50)

Currently, acetochlor is not labeled for use in rice production in the US due to the high variability in tolerance associated with application timing, activation timing, and environmental conditions surrounding applications. The variability due to these environmental conditions can result in injury and severe stand loss. Previous research from the University of Arkansas System Division of Agriculture has demonstrated the safening ability of a fenclorim seed treatment for acetochlor applications in typical rice-growing conditions, but not under cool, saturated conditions. Therefore, two growth chamber experiments were initiated to evaluate rice tolerance with a 12-hour photoperiod, a night temperature of 12.8 C (55 F), and a 23.8 C (75 F) day. The experiment was designed as three-factor factorial: with or without fenclorim (2.5 g kg seed^{-1}), with or without acetochlor (1,050 g ai ha^{-1}) applied delayed-preemergence (DPRE), and a 0.6-cm or 2.5-cm planting depth. Rice shoots, heights, and visual estimates of injury were recorded weekly until termination and biomass collection 30 days after emergence (DAE). The fenclorim seed treatment alone at 14 DAE caused a reduction in height by delaying emergence relative to the nontreated but recovered by 21 DAE. Acetochlor alone caused injury ranging from 15 to 60%, while the fenclorim seed treatment reduced injury from acetochlor to 0 to 20%. The deeper planting depth also improved tolerance to acetochlor alone for all evaluations but did not provide commercial tolerance. Relative to the nontreated, fenclorim alone improved aboveground rice biomass while fenclorim and acetochlor were comparable to the nontreated and greater than acetochlor alone. After 14 DAE, the fenclorim seed treatment provided enhanced crop tolerance to acetochlor for all evaluations. Based on the results of this study, acetochlor applied DPRE at 1,050 g ai ha^{-1} with a fenclorim seed treatment should provide commercial tolerance.

Performance of Sweetpotato Cultivars Under *Cyperus* spp. Interference. IS Werle*[1], M Machado Noguera[1], S Karaikal[1], T Tseng[2], N Roma-Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]Mississippi State University, Mississippi State, MS (51)

Limited management tools are available to control *Cyperus* species in sweetpotato (*Ipomoea batatas* L.) production. This study evaluated the weed-suppressive ability of nine sweetpotato cultivars under yellow nutsedge (*Cyperus esculentus* L.) interference. Field experiments were conducted in 2021 in Kibler and Fayetteville, AR. The split-plot studies evaluated weed removal (weeded or not weeded) as mainplot and nine sweetpotato cultivars as subplot. Canopy height and vine length were measured at 5 and 7 weeks after transplanting (WAT). Leaf area was measured at 12 WAT. The dry shoot biomass of yellow nutsedge was measured at 12 WAT. Total marketable yield (jumbo, no. 1, and canner grades) was harvested from six plants per plot. Data were subjected to analysis of variance using JMP 16.0 (SAS Institute Inc., Cary, NC) and means were separated using Student's *t*-test. There was no cultivar by weeding interaction effect ($p>0.05$) on vine length, canopy height, and leaf area. With yellow nutsedge, canopy height was taller, leaf area was smaller, and vine length was shorter regardless of cultivar. 'Heartogold' and 'Centennial' had the tallest plant canopy in both locations. 'Morado' had the longest vines (116 cm) in Fayetteville and 'Beauregard-63' (124 cm) in Kibler. 'Heartogold' had the greatest leaf area in Fayetteville (2201.8 cm^2) and Kibler (2953.7 cm^2). All cultivars reduced yellow nutsedge shoot biomass by 2-fold in Fayetteville, while 'Heartogold' caused the most weed biomass reduction (2.6-fold) in Kibler. Weeding by cultivar interaction effect on yield was significant in both locations. Sweetpotato yield averaged 7,329 and 30,798 kg ha^{-1} with and without full-season interference with yellow nutsedge in Fayetteville. Yields were 14,429 kg ha^{-1} and 48659 kg ha^{-1} with and without full-season interference in Kibler. 'Beauregard-63' (43,537 kg ha^{-1}), 'Bayou-Belle-6' (43,361 kg ha^{-1}), 'Hatteras' (40,701 kg ha^{-1}), and 'Bayou-belle-2' (39,594 kg ha^{-1}) performed the best in Fayetteville. In Kibler, 'Beauregard-63' (78487 kg ha^{-1}) and 'Bayou-Belle-6' (70647 kg ha^{-1}) had the highest yields. These high-yielding sweetpotato cultivars can effectively suppress yellow nutsedge without reliance on chemical control.

Does Inclusion of Foliar Fertilizers to Glyphosate + Dicamba + S-metolachlor Tank Mix Increase Cotton Leaf Burn? L Pereira*, S Li, RD Langemeier, JT McCaghren; Auburn University, Auburn, AL (52)

Plant nutrients are mainly applied to soil and plant foliage for achieving maximum yields. Previous research suggested certain foliar fertilizers tank mixed with herbicides reduced crop leaf. However, certain micronutrients mixed herbicides can cause tank incompatibility and phytotoxicity. The objective of this study was to evaluate if cotton leaf burn caused by glyphosate + dicamba + S-metolachlor tank mix can be affected by reagent grade of micronutrients ($FeSO_4$, $MnSO_4$, $CuSO_4$, $MgSO_4$) as well common commercial foliar fertilizers. The experiment was conducted at Baldwin, Henry, and Elmore counties in Alabama in 2021. Herbicide application was made when the cotton was at 6 leaf stage. Treatments included different chemical compounds applied in either 8am, 11am and 2pm in the same day. Visual injury, NDVI measured with a handheld greenseeker, and plant height were recorded 3, 7, 14, and 21 days after treatment (DAT). The addition of foliar fertilizers did not significantly reduce or increase visual injury for either reagent grade micronutrients or commercial products at any rating date. Foliar fertilizer inclusion in the tank mix did not influence recovery time, and recovery was rapid for all treatments including the control with no foliar fertilizer. Similar to visual injury, inclusion of foliar fertilizers did not significantly influence plant height or NDVI values. These results indicate that cotton growers will not benefit from including foliar fertilizers in their tank mixtures for the purpose of reducing herbicide phytotoxicity or speed up crop recovery. However, tank mixing foliar nutrients with glyphosate + dicamba + S-metolachlor will not increase injury potential either.

Isolation and Identification of Allelochemicals from Root Exudates of Cotton Chromosome Substitution Lines Known to Suppress Palmer Amaranth. AL Miller*, GA Fuller, Z Yue, T Tseng; Mississippi State University, Mississippi State, MS (53)

Weedy plant species have been and continue to be an extreme issue affecting crops, including cotton. A specific weed type that is of a significant hindrance to cotton (*Gossypium hirsutum)*, in particular, is Palmer amaranth (*Amaranthus palmeri*). Palmer amaranth's ability to form herbicide resistance has created a dire need for substitute methods in controlling weed populations, besides the most common chemical control by way of herbicides. In the study administered, eleven chromosome substitution (CS) lines of the cotton plant earlier tested for weed suppressive components were utilized in the current research at hand. The CS lines chosen with expected allelopathic results based on field and greenhouse screenings were CS-23, CS-34, CS-46, CS-49, CS-50, CS-26, UA48 (conventional cultivar), and TM1 (the parent cotton line). These lines were studied using high-performance liquid chromatography (HPLC) to identify allelopathic chemicals. The CS lines were pre-germinated until two embryonic leaves and then transferred to test tubes filled with distilled water. When preparing the standard solution for HPLC analysis calibration, the following reagents were used: chlorogenic acid, caffeic acid, coumarin, trans cinnamic acid, coumaric acid, 2-hydroxycinnamic acid, vanillin, and p-hydroxybenzoic acid. Chromatogram readings for the analysis detected a peak very similar to that of chlorogenic acid in one of the CS-23 samples at 28 days after establishment (DAE). The creation of new allelopathic cotton CS varieties could be crucial to the successful battle against herbicide-resistant weeds growing among cash crops. Although much is factually known about the topic of allelopathy, more research and discovery need to be accomplished for these specific allelopathic CS lines to suitably be used in agricultural environments.

Response of Palmer Amaranth Accessions to Selected Herbicides. M Williams*, MW Marshall; Clemson University, Blackville, SC (54)

The introduction of glyphosate tolerant soybean varieties resulted in lower input costs and simplicity of weed control for growers. Nearly 100% of soybean acres in production today have glyphosate and/or other stacked trait tolerances. In less than a decade, glyphosate resistance was detected in Palmer amaranth. In addition, Palmer amaranth resistance to glufosinate, dicamba, and PPO-inhibitors herbicides was confirmed recently. A survey of Palmer amaranth was conducted in South Carolina shortly after resistance was confirmed to glyphosate and ALS-inhibitors in 2009-10; however, a screening of Palmer amaranth populations in the state was initiated in 2020 and continued in 2021 to determine the level of resistance (if any) in the state to foundation herbicides used in corn, cotton, and soybean production for Palmer amaranth control. Palmer amaranth female seedheads were collected from across the main crop producing regions of South Carolina in fall of 2021. Seedheads were oven dried, threshed, and mature seed was separated from the chaff using sizing sieves. The preemergence (PRE) herbicides evaluated in this study was atrazine at 0,1.1, and 2.2 kg/ha; s-metolachlor at 0,1.06, 2.13 kg/ha; and isoxaflutole at 0, 0.11, 0.22 kg/ha. The postemergence (POST) herbicides were glyphosate at 0, 0.84, 1.68 kg/ha, glufosinate at 0, 0.66, 1.72 kg/ha; fomesafen at 0, 0.28, 0.56 kg/ha; 2,4-D choline at 0, 1.06, 2.12 kg/ha; dicamba at 0, 0.56, 1.12 kg/ha, and thifensulfuron at 0, 0.0045, and 0.009 kg/ha. The herbicide rates above correspond to the 0, 1X, and 2X of the normal field use rate. Field soil was collected and steamed before placing in the flats for preemergence study. The soil in this study was a Fuquay sandy loam with 88% sand, 10% silt, and 2% clay content. Seed were planted in the flats by population and then treated with the PRE herbicides. The herbicides were watered in 12 hours later. For the postemergence study, seed were similarly planted in flats by population containing a commercial potting mix. After the Palmer amaranth populations reached the 2-leaf growth stage, the flats were treated with the POST herbicides. An untreated flat was included for each herbicide as a check. At 14 days after application, the preemergence and postemergence flats were evaluated for any Palmer amaranth survivors. A population was marked with a plus (+) if any survived and a negative (-) if all were controlled (POST) or did not emerge (PRE). As expected, all populations were resistant up to the 2X of glyphosate and thifensulfuron. These two modes-of-actions were previously confirmed in 2009-2010. We observed Palmer amaranth survivors in the PRE study at the 1X rate of atrazine and isoxaflutole from Laurens County. In addition, 8 populations survived the 1X rate of s-metolachlor. In the Edgefield population, survivors were found in the 2X rate of s-metolachlor. Apart from the Edgefield County population, the rest of the populations tested were controlled at the 2X rate of atrazine, s-metolachlor, and isoxaflutole. The remaining POST herbicides, glufosinate, fomesafen, 2,4-D choline, and dicamba effectively controlled all populations in this study at the 1X rate. In summary, there is suspected Palmer amaranth resistance in South Carolina to atrazine, s-metolachlor, and isoxaflutole. Future research includes continue the survey and evaluate these suspected populations resistance factor over a broader rate range.

Peanut Response to Paraquat in the Southwest Growing Region. ZR Treadway*[1], JL Dudak[1], TA Baughman[1], PA Dotray[2], WJ Grichar[3]; [1]Oklahoma State University, Ardmore, OK, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Texas A&M AgriLife Research, Yoakum, TX (55)

Weed pressure in peanut [Arachis hypogea (L.)] is a valid concern for producers and is detrimental from germination to harvest. Weeds compete for the same nutrients, water, and sunlight as peanut, often leading to stunted plant growth. Weed pressure at harvest can lower both digging and combining efficiency. Excessive weed densities can cause yield losses upwards of 40%. Timely weed control is key to maximum peanut yield. Paraquat is one of the herbicide options available to producers to control troublesome weeds. Paraquat is labeled for application within 28 days after groundcrack. Later application may result in unacceptable crop response. Trials were conducted in 2021 near Fort Cobb, OK; and Lubbock and Yoakum, TX; to evaluate the response of peanut to paraquat applications at varied times throughout the growing season. Treatments included paraquat (Gramoxone 3.0 SL) applied at either 0.28 kg ai ha-1 (1X) or 0.57 kg ai ha-1 (2X) alone or in combination with s-metolachlor (Dual Magnum) at either 1.42 kg ai ha-1 (1X) or 2.84 kg ai ha-1 (2X). All treatments were applied with non-ionic surfactant (Induce) at 0.25% v/v, 14 days after cracking (DAC), 28 DAC, or 14 DAC followed by 28 DAC. Treatments were arranged in a randomized complete block design with either three or four replications. Plots were maintained weed-free throughout the season. Stand reduction never exceeded 4% with any treatment at any location throughout the growing season. The only treatment applied 14 DAC that injured peanut less than 10% (42 DAC) was paraquat alone (1X) at both Fort Cobb and Lubbock. The only 28 DAC treatment at Fort Cobb that injured peanut over 10% was paraquat (2X). Injury was 20% or more with all 28 DAC treatments at Lubbock except paraquat + s-metolachlor (1X). Applications made at both 14 and 28 DAC injured peanut 11-20% at Fort Cobb and 40-70% at Lubbock. Most injury consisted of necrosis and stunting at these locations. Injury at Fort Cobb (56 DAC) did not exceed 10% for treatments applied at 14 or 28 DAC. All treatments exceeded that at Lubbock (15-40%), except for paraquat (1X) applied 14 DAC. When two applications were made injury was 9% (paraquat - 1X) to 25% (paraquat + s-metolachlor - 2X) at Fort Cobb and 33% (paraquat - 1X) to 72% (paraquat + metolachlor - 2X) at Lubbock. Only 28 DAC timings were applied at Yoakum due to early season weather. Injury was 15% or greater (42 DAC0 and 20% or greater (56 DAC) with all 28 DAC treatments. Yields at Fort Cobb were not significantly different among treatments, apart from paraquat applied at a 2X rate alone and in combination with s-metolachlor, both yielding lower than the weed free check. Yields at Lubbock were not significantly different among treatments. These studies indicate that while substantial injury can be observed with paraquat this does not necessarily translate to a yield loss.

Post-Emergence Glufosinate Tank Mix Applications in Liberty-Link Soybeans. JL Dudak*, ZR Treadway, TA Baughman; Oklahoma State University, Ardmore, OK (56)

United States soybean producers are estimated to plant over 87 millon acres in 2022. As the number of resistant weed populations increase, soybean producers will strive to find alternative options. Glufosinate (Liberty) tolerant soybeans were introduced to the market in 2009, however, their adoption has been limited in Oklahoma. This study was conducted to evaluate the phytotoxicity and efficacy of Liberty alone and in combination with s-metolachlor (Moccasin) and ammonium sulfate (AMS) on crop response and weed control. Studies were conducted at the OSU Mingo Valley Research Station near Bixby, Oklahoma over three growing seasons. Liberty-Link tolerant soybean were planted in May or June of each year in 30-inch rows. Data were subjected to ANOVA, and treatments separated using Fisher's LSD ($\alpha = 0.05$). Treatments include: glufosinate (656 g ai ha-1), applied alone as an POST1 (14 DAP) followed by POST2 (28 DAP) or POST2 followed by POST3 (42 DAP) timing. Liberty was also applied in combination with s-metolachlor (1120 g ai ha-1) and/or ammonium sulfate (2.24 kg ha-1) at these same timings. All treatments included Induce (0.25% v/v). Soybean injury was <10% with all treatments across all years. In 2019, Palmer amaranth control was >98% with all treatments. Liberty + Moccasin (with and without AMS) POST1 + POST2 were the only treatments that provided 100% control of Palmer amaranth in 2020. In 2021, treatments with POST1 + POST2 (89-93%) applications resulted in greater control than the POST2 + POST3 (55-66%) treatments. Large crabgrass control was >95% in 2019 and 2020 with all treatments. In 2021, all POST1 + POST2 treatments controlled large crabgrass 78-85%, while the POST2 + POST3 treatments resulted in 10% control. All treatments including POST1 + POST2, in 2019, and all treatments in 2020 and 2021 controlled morningglory >99%. Liberty alone and in combination with Moccasin and/or AMS applied POST1 and POST2 yielded higher than the herbicide treatment trial average in 2 of the 3 years. Those same treatments applied POST2 + POST3 yielded below the trial average in 2 of the 3 years. This research indicated the importance of application timing for successful weed control in a Liberty-Link soybean system. Additionally, while not tested in these studies it illustrates how important a residual preemergence herbicide can potentially play in that success.

Preemergence Control of Purple Nutsedge with Pyrimisulfan. E Begitschke*, KA Tucker, CJ Wang, GM Henry; University of Georgia, Athens, GA (57)

Purple nutsedge (*Cyperus rotundus* L.) is one of the most problematic turfgrass weeds due to a high growth rate, aggressive rhizomes, and prolific tuber production. Field research with pyrimisulfan (Vexis), a relatively new acetolactate synthase inhibiting herbicide, yielded substantial reductions in purple nutsedge shoot, rhizome, and tuber production when applied postemergence; however, little is known about its effects on purple nutsedge morphology when applied preemergence. Therefore, research was conducted to evaluate preemergence applications of pyrimisulfan on purple nutsedge in a controlled environment. Purple nutsedge was established in the Athens Turfgrass Research and Education Center greenhouse complex in Athens, GA in 2021 by planting 7 tubers pot^{-1} to a depth of 2.5 cm within a soil profile consisting of a sandy clay loam. Initial herbicide treatments were applied immediately following planting on 14 July, 2021 and consisted of granular (Vexis) and liquid (EH1663) pyrimisulfan (49 and 52.5 g ai ha^{-1}, respectively) along with combinations of EH1663 and dithiopyr (Dimension) at 560 g ai ha^{-1}. A non-treated control was included for comparison. All sequential applications were made on 3 September, 2021 [7 weeks after initial treatment (WAIT)]. A single application of Vexis reduced shoot dry mass by 89% when compared to the non-treated check 12 WAIT, while single applications of EH1663 and EH1663 + dithiopyr reduced shoot dry weights by = 99%. These responses coincided with 83, 93, and 93% reductions in tuber production in pots that received a single application of Vexis, EH1663, and EH1663 + dithiopyr, respectively. Similar trends were observed with sequential applications, with all treatments reducing shoot dry mass by = 92% and tuber production by = 90% compared to the non-treated check 12 WAIT. Additionally, a single application of Vexis reduced tuber viability by 23%, while sequential applications of Vexis reduced tuber viability by 41% 12 WAIT. Single and sequential applications of EH1663 and EH1663 + dithiopyr both reduced tuber viability by = 87%. Future research should focus on the combination of pyrimisulfan plus other preemergence herbicides for the control of purple nutsedge.

Addition of Glutathione *S*-Transferases Inhibitors to Glufosinate as an Alternative Winter Burndown of *Lolium* Ssp. P Carvalho-Moore*, JK Norsworthy, M Zaccaro-Gruener, MC Castner, MM Houston, LB Piveta; University of Arkansas, Fayetteville, AR (59)

With the rise of glyphosate resistance and concerns with future availability of paraquat, few options are available to control *Lolium* spp. Glufosinate may be a good burndown option to control this weed. However, the effectiveness of this herbicide is negatively affected under certain environmental conditions, such as colder temperatures and low light. Approaches to overcome the inconsistency in the activity of glufosinate have been pursued, including the addition of metabolic inhibitors. The objective of this study was to assess if the addition of glutathione *S*-transferase (GST) inhibitors to glufosinate would increase *Lolium* ssp. control in a winter burndown. A field experiment was conducted at the Milo J. Shult Agricultural Research & Extension Center in Fayetteville, Arkansas, in 2021. The GST-inhibitors added were 4-chloro-7-nitrobenzofurazan (NBD-Cl), diethyl maleate, baicalin, curcumin, and ellagic acid. All GST-inhibitors were sprayed at 60 g ai ha^{-1} with glufosinate (655 g ai ha^{-1}) and nonionic surfactant (0.25% v/v). A nontreated and glufosinate without GST-inhibitors were included for comparison. Treatments with glyphosate (1120 g ae ha^{-1}) or paraquat (560 g ai ha^{-1}) were added as standard burndown controls. The experiment was arranged as a randomized complete block design with four replications. All treatments were sprayed at dusk. *Lolium* control (%) and biomass (g) were assessed at 21 days after treatment. Data were subjected to analysis of variance using Proc GLIMMIX in SAS (v9.4), and means were separated using Fisher's protected LSD (alpha=0.05) if significant. A paraquat or glyphosate application resulted in the highest control levels, 96 and 93%, respectively. The *Lolium* population sprayed in this trial was susceptible to glyphosate differently from what is encountered around the state. The mixture of baicalin and glufosinate increased control (by 16% percentage points) and reduced biomass (by 36% percentage points) compared to glufosinate alone. *Lolium* control was improved by the addition of GST-inhibitor baicalin to glufosinate, showing that GST-inhibitors have the potential to overcome the environmental limitations imposed to this herbicide. Through use of GST-inhibitors like baicalin, glufosinate applications may become a more reliable weed control option in winter burndown programs.

Persistence of Dicamba and 2,4-D in Xtend and Enlist Soybean. M Zaccaro-Gruener*[1], JK Norsworthy[1], LB Piveta[1], A Mauromoustakos[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (60)

Extensive adoption of 2,4-D- and dicamba-resistant soybean has increased the use of these herbicides during the summer months. Warm conditions can exacerbate issues of off-target movement of herbicides. During investigations, state pesticide regulation authorities are using plant tissue sampling and herbicide residue analysis to determine whether fields were directly sprayed with a herbicide of its detection is a result of primary or secondary movement. Two field experiments were conducted in 2020 and 2021, at the Milo J. Shult Agricultural Research and Extension Center, in Fayetteville, AR. The purpose of this research was to determine if analytical tests of herbicide residue on soybean plants treated with dicamba or 2,4-D could be used to distinguish between rates applied and how the residue levels decay over time. Additionally, the aim was to evaluate the impact of soybean technology (trait) on the detection and decay of herbicide residue. Four-row plots were established with two rows of Xtend and Enlist soybean, and herbicide applications were made to the center two rows at the V4 growth stage. Dicamba (XtendiMax) was applied at 560 (1X rate), 56 (0.1X), 5.6 (0.01X) and 0.056 g ae ha^{-1} (0.001X). 2,4-D (Enlist One) was applied at 1065 (1X rate), 1.065 (0.1X), 10.65 (0.01X), and 1.065 g ae ha^{-1} (0.001X). Plant samples were collected randomly from each technology in each plot starting the day of application (day 0) until 31 days after treatment (DAT). Results showed that residue levels were not detectable when treated with 0.1X, 0.01X, and 0.001X of both herbicides beyond the day of application (0 DAT), regardless of variety. Generally, only residues from 1X treatment rates were consistently detected for both herbicides, with residue detection on both the resistant and sensitive soybean diminishing rapidly following application. Interestingly, residues from the 1X rate of dicamba were detected at a slightly higher concentration in Enlist than in Xtend soybean at the same collection date, which is likely a function of dicamba degradation inside the plant. Likewise, 2,4-D residues from the 1X rate were detected at a slightly greater concentration in Xtend than in Enlist soybean. The current method of herbicide residue analysis in soybean tissue samples could be used to evaluate sources of dicamba or 2,4-D, but primarily to distinguish between a direct application from other forms of exposure.

Response of Cotton Chromosome Substitution Lines to Sublethal Doses of 2,4-D. JC Argenta*[1], W Matte[1], LM Perez[2], T Tseng[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (61)

The development of 2,4-D-resistant crop cultivars will potentially have a significant influence on weed management. However, the off-site movement of this chemical to adjacent non-target crops and other plants is a concern in many areas worldwide, especially where sensitive non-transgenic cotton is grown. The availability of non-transgenic cultivars tolerant to 2,4-D drift will protect the yield and quality of these plants. This project uses chromosome substitution (CS) lines initially confirmed to be tolerant to field rate (1X) of 2,4-D. The objective of this research is to identify the tolerance level of selected cotton chromosomal substitution lines to 2,4-D through a dose-response study conducted in the greenhouse. The experiment was laid in a completely randomized design where six different cotton chromosomal substitution lines/varieties (CS-B15sh, CS-B16-15, CS-B04, CS-T22sh, TM-1, and UA 48), at 2-3 leaf stage, were sprayed with five different rates of 2,4-D (0, 56, 280, 560, and 840 g ae ha^{-1}). Plant injury and height were recorded at 14, 21, and 28 days after treatment (DAT), while shoot biomass was obtained at 28 DAT. From the regression models obtained for the dose-response curves, the necessary dose was estimated to cause 50% injury (GR_{50}). This value was used to differentiate the different cotton lines in response to 2,4-D. The results showed that CS-B04 line presented the lowest injury values among the other CS lines, being most evident at the lowest doses of 2,4-D applied. No difference was observed among the CS lines when the herbicide rate was equal or greater than 560 g ae ha^{-1} for most evaluations. Plant height was mainly affected by the increase in herbicide doses, with no interaction between doses and different cotton lines. The DR_{50} values showed that the amount of herbicide rate necessary to cause 50% injury and/or reduction in growth and biomass variables is higher in CS-B04, followed by lines CS-B15sh and CS-B16-15. This indicates a greater tolerance of the CS-B04 line when compared to the other lines, especially when compared to the 2,4-D susceptible lines CS-T22sh, TM-1, and UA 48. The results obtained indicate that CS-B04 cotton line can be a genetic resource for cotton breeds for developing 2,4-D drift tolerant cultivars.

Effect of Soil Wetting Agents on Soil-Applied Herbicide Sorption and Efficacy. JA Patterson*, JS Calhoun, DM Dodds, J Krutz, D Spencer; Mississippi State University, Mississippi State, MS (63)

Herbicide-soil interactions influence residual weed control. Surfactants, specifically wetting agents or water optimizers, increase water holding capacity in the root zone of plants; however, little is known about how these products affect residual herbicide sorption and efficacy. The effects of surfactants including Stretta™, Tolero™, Aquisync™, and Aquicare™ on *S*-metolachlor and fluometuron sorption and residual barnyardgrass control were evaluated at the R.R. Foil Plant Science Research Center near Mississippi State, MS on a Mantachie loam, Catalpa silty clay loam, and Marietta fine sandy loam. All soil type and soil surfactant combinations, except Stretta™ applied to a Catalpa silty clay loam, decreased *S*-metolachlor sorption compared to the herbicide applied alone. Conversely, all evaluated surfactants except Aquicare™, regardless of soil type, provided comparable levels of fluometuron sorption to soil. No evaluated surfactant influenced fluometuron efficacy on barnyardgrass control. However, at 21 days after treatment, all evaluated surfactants increased barnyardgrass control (98-99%) with *S*-metolachlor compared to the herbicide applied alone (94%). Although minor differences were observed with barnyardgrass control following *S*-metolachlor application, adequate barnyardgrass control was attained with all combinations of herbicides and surfactants. These data indicate that wetting agent soil surfactants will likely not significantly influence efficacy of these herbicides under field conditions.

New Technologies in Water-Seeded Rice Production. C Webster*[1], B Greer[2], E Webster[2], DC Walker[1], JA Williams[1]; [1]LSU AgCenter, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA (64)

New Technologies in Water-Seeded Rice ProductionLC Webster, WB Greer, EP Webster, DC Walker, JA Williams Water-seeding was the predominant rice planting method in Louisiana prior to the release of imidazolinone resistant (IR) cultivars (*Oryza sativa* L.) in 2002. Since the release of IR-rice, growers in Louisiana have shifted to a predominantly drill-seeded production system. Although drill-seeding is the predominant planting method, 17% of rice planted in Louisiana in 2020 was water-seeded. Due to the popularity of drill-seeded rice in recent years, research is lacking on the use of new technologies in water-seeded rice production. Two separate field studies were conducted in 2021 and replicated across two soil types and planting dates at the LSU Agricultural Center H. Rouse Caffey Rice Research Station near Crowley, LA. Field studies were conducted to evaluate the early season use of florpyrauxifen-benzyl and a prepackaged mixture of halosulfuron plus prosulfuron in water-seeded rice production. Each study was a randomized complete block with an augmented two-factor factorial arrangement of treatments with three replications. Factor A for both studies consisted of herbicides applied to the soil surface 48-hours prior to the seeding flooding and seeding (SURFACE), directly onto the pregerminated seed 24-hours following seeding and immediately after removal of the seeding flood (SEED), and at pegging (PEG). Factor B for the first study consisted of florpyrauxifen applied at 15 or 29 g ai ha^{-1}. Factor B for the second study consisted of a prepackaged mixture of halosulfuron plus prosulfuron at 55 or 83 g ai ha^{-1}. All SEED and PEG applications were applied with a methylated seed oil at 0.5% v v^{-1}. A nontreated was added to each study for comparison.Visual evaluations for crop injury and weed control were recorded at 14, 21, and 28 d after treatment (DAT), where 0 = no control and 100 = plant death. Weed control ratings in the florpyrauxifen study were recorded for barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.] and Indian jointvetch (*Aeschynomene indica* L.). Weed control ratings in the prepackaged mixture of halosulfuron plus prosulfuron study were recorded for Indian jointvetch and Texasweed [*Caperonia palustris* (L.) St. Hil.]. Results for both the florpyrauxifen and halosulfuron plus prosulfuron studies suggest that these new herbicide technologies have a fit in water-seeded rice production for early season applications. However, applications immediately following aerial seeding and the removal of the seeding flood should be avoided especially at higher rates. Rice injury was 19% from florpyrauxifen applied directly to pregeminated seed at the SEED timing averaged across rates of 15 and 29 g ha^{-1}. Rice injury from halosulfuron plus prosulfuron at 83 g ha^{-1} was 28% when applied at the SEED timing. Because halosulfuron plus prosulfuron has little to no activity on grass weed species, these results suggest that florpyrauxifen may be a better POST application in water-seeded rice production; however, the presence of different weed species may drive herbicide decisions. Due to the residual activity from halosulfuron plus prosulfuron compared with florpyrauxifen at the SURFACE timings, halosulfuron plus prosulfuron may be a more effective PRE residual option.

Confirmation of a Five-way Herbicide-resistant Waterhemp (Amaranthus Tuberculatus) Population in North Carolina. EA Jones*, RJ Andres, DJ Contreras, CW Cahoon, JC Dunne, KM Jennings, RG Leon, W Everman; North Carolina State University, Raleigh, NC (65)

Waterhemp plants were collected from a soybean field in Surry County, North Carolina (NC) in the fall of 2018; the first year the field had been infested with the species. Since waterhemp is not native to NC, the waterhemp population was thought to be introduced via farm machinery purchased from the Midwest United States where multiple herbicide-resistant populations are common. Dose-response assays were conducted using herbicides from the groups 2 (imazethapyr), 4 (2,4-D; dicamba), 5 (atrazine), 9 (glyphosate), 10 (glufosinate), 14 (fomesafen), and 27 (mesotrione). Herbicides were sprayed at a commonly used or maximum labeled rate ranging from 1x to 4x. Survivors from the Surry County NC waterhemp population were observed when treated with imazethapyr, atrazine, glyphosate, fomesafen, and mesotrione across all rates. No survivors form the Surry County NC waterhemp population were observed when treated with 2,4-D, dicamba, and glufosinate Sanger sequencing showed the Surry County NC population exhibited the ?Gly_{210} mutation in the PPX2 enzyme. Single nucleotide polymorphism sequencing exhibited the Surry County NC population exhibited a Trp_{574}Leu mutation in the ALS enzyme. The results of the dose-response and molecular assays provide evidence that the Surry County IA had evolved resistance to five unique herbicide groups before being introduced to North Carolina.

Fecundity Reductions of Palmer Amaranth Surviving Glufosinate Treatments in Cotton. EA Jones*, DJ Contreras, CW Cahoon, KM Jennings, RG Leon, W Everman; North Carolina State University, Raleigh, NC (66)

Experiments were conducted at two locations (Clayton and Rocky Mount, NC) to determine the fecundity reductions of Palmer amaranth surviving glufosinate treatments compared to non-treated Palmer amaranth in weed-free cotton (IC) and fallow (NC). Glufosinate (590 g ai ha^{-1}) was applied at three different timings: early postemergence (5 cm), postemergence (7-10 cm) weeds, and late postemergence (>10 cm). Marked-surviving female plants were collected at the end of the season and fecundity was estimated via the mass of the collected seed. No plants survived the early postemergence treatments at either locations. Plants surviving the postemergence and late postemergence treatment remained fecund. Seed size was generally not different across treatments for the exception that NC Palmer amaranth seeds were smaller at Clayton and Palmer amaranth surviving the late postemergence treatment seeds were larger at Rocky Mount. On average, NC Palmer amaranth were the most fecund followed by IC Palmer amaranth, Palmer amaranth surviving postemergence and late postemergence glufosinate treatments. Fecundity reductions were 96% (postemergence) and 82% (late postemergence) at Clayton and 96% (postemergence) and 95% (late postemergence) at Rocky Mount compared to NC Palmer amaranth. Fecundity reductions were 90% (postemergence) and 51% (late postemergence) at Clayton and 83% (postemergence) and 74% (late postemergence) at Rocky Mount compared to IC Palmer amaranth. The results of the experiment provide evidence that Palmer amaranth surviving glufosinate treatments exhibit similar fecundity reductions compared to non-treated Palmer amaranth. Offspring will be produced that will need to be controlled in the subsequent growing season.

Effect of Cover Crop Types, Termination Method and Herbicide Program on Weed Management in Cotton. YR Upadhyaya*[1], P Devkota[2], MJ Mulvaney[3], W Hammond[1], H Bayabil[1]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL, [3]Mississippi State University, Mississippi State, MS (67)

Weed management is critical for the growth and yield of a crop. An experiment was conducted at the West Florida Research and Education Center, Jay, Florida in 2020 to study the effect of cover crops on weed management. A randomized complete block split-plot design was used. The main plot factor were four cover crop types (crimson clover, cereal rye, rye/clover mix, and no cover fallow), sub-plot factors were termination methods (rolled vs. standing) and sub-sub-plot factors were herbicide treatments (PRE herbicide, and no herbicide). The one-meter square area in between the middle two rows was used for the weed data collection. Two common weeds namely, Texas panicum, Tropical Spiderwort were focused on the study. The weed density was recorded at two and four weeks after planting cotton, and the weed biomass was harvested before the POST emergence herbicide application. Cover crops alone provided Texas panicum and Tropical spiderwort control like dual magnum herbicide application. There were no statistically significant differences between rolled and standing termination methods. Cover crops can enhance weed control for cotton.

Longevity of Residual Palmer Amaranth Control with Preemergence-applied Cotton Herbicides. L Adams*[1], T Barber[2], JK Norsworthy[3], A Ross[4], RC Doherty[5]; [1]University of Arkansas, Greenwood, MS, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Fayetteville, AR, [4]University of Arkansas Cooperative Extension Service, Ward, AR, [5]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR (68)

Cotton growers in the mid-southern U.S. region must successfully control Palmer amaranth (*Amaranthus palmeri*) populations due to its ability to cause significant yield reductions. As a result, growers must apply residual herbicides containing multiple modes of action (MOA) for the best control of Palmer amaranth. The objective of this research was to evaluate the longevity of Palmer amaranth control using multiple modes of action herbicides applied prior to cotton emergence. Experiments were conducted in 2021, on-farm in Tillar, Arkansas and at the Lonn Mann Cotton Research Station in Marianna, Arkansas to evaluate the longevity of residual Palmer amaranth control with preemergence-applied cotton herbicides. A total of 11 treatments containing one to three different modes of action were applied at planting. Herbicides and rates included fluridone (alone/tank mix) at 252/168 g ai/ha, prometryn at 840 g ai/ha, fluometuron at 840 g ai/ha, acetochlor at 840 g ai/ha, and dicamba at 560 g ai/ha. Visual Palmer amaranth control ratings were taken 4 and 6 weeks after treatment (WAT). Results indicate that treatments containing 2 or 3 MOA provided the greatest control of Palmer amaranth 4 and 6 WAT. At 4 WAT, herbicide treatments containing 2 and 3 MOA increased control by 12 and 17 percentage points respectively when compared to 1 MOA. At 6 WAT, 2 MOA herbicide treatments increased control by 8 percentage points when compared to 1 MOA. Treatment combinations containing fluridone herbicide provided the best control at 6 WAT. Therefore, Palmer amaranth can successfully be controlled up to 6 WAT containing multiple MOA herbicides. Additionally, multiple MOA herbicides with residual activity will provide lengthy Palmer amaranth control while also reducing risk of yield loss in cotton production systems.

Weed Management Options for Vegetable Plasticulture Production in Southwest Florida. R Tiwari*[1], N Boyd[2], S Daroub[3], R Kanissery[1]; [1]University of Florida/Institute of Food and Agricultural Sciences-Southwest Florida Research and Education Center, Immokalee, FL, [2]University of Florida/Institute of Food and Agricultural Sciences-Gulf Coast Research and Education Center, Wimauma, FL, [3]University of Florida/Institute of Food and Agricultural Sciences-Everglades Research and Education Center, Everglades, FL (70)

Hydration Reservoir Durability After Exposure to Undiluted Herbicide. KL Broster*[1], H Quick[1], DP Russell[2], JD Byrd, Jr.[1]; [1]Mississippi State University, Mississippi State, MS, [2]Auburn University, Madison, AL (71)

Individual plant treatment methods, like hack-and-squirt, are a selective control option for undesirable species, and is cost effective for producers with minimal injury to desirable species. Current herbicide application methods in hack-and-quirt include the use of disposable syringes and spray bottles, both with different downfalls in accuracy of application. A recent design by Byrd (2018), would use hydration reservoirs to carry undiluted herbicide, and a line-fill vaccinator with adjustable syringe for more accurate application, in a cost-effective manner for producers. A study at the R.R. Foil Plant Science Research Center was conducted to evaluate the storage of undiluted herbicides in CamelBak® hydration reservoirs, while stored in an unheated, uncooled metal building. Separate reservoirs were filled with 473 ml of isopropylamine salt of imazapyr, isopropylamine and dimethylamine salts of glyphosate, triethylamine and choline salts, butoxyethyl ester, and acid of triclopyr, and potassium salt of aminocyclopyrachlor. Reservoirs were hung over 1.2L Rubbermaid® (Rubbermaid, 1402 Adams Farm Pkwy Greensboro, North Carolina, U.S.) plastic storage container, with four replications of each herbicide. Visual evaluations of reservoir integrity occurred each month for six months, then at 12 months, and 24 months after storage (MAS). Acid of triclopyr leaked from the reservoir within 1 MAS. At 24 MAS, only the acid and butoxyethyl ester of triclopyr leaked from the CamelBak® reservoirs into the Rubbermaid® storage containers. These reservoirs can be a useful method to store many of the undiluted herbicide used for hack and squirt applications with minimal concern of shelf life deterioration of herbicide diluted with water.

Allelopathic Sweet Potato Varieties for Palmer Amaranth Growth Reduction. V Varsha*[1], IS Werle[2], MW Shankle[3], SL Meyers[4], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Arkansas, Fayetteville, AR, [3]Mississippi State University, Pontotoc, MS, [4]Purdue University, West Lafayette, IN (72)

The present study was conducted with 17 varieties of sweet potato to evaluate the allelopathic effect of sweet potato on the growth of Palmer amaranth (*Amaranthus palmeri*). The study was conducted in the Department of Plant and Soil Sciences greenhouse at Mississippi State University, MS, under controlled conditions. The experiment was carried out in a stair-step setup, and data was collected for plant height at regular intervals. Palmer amaranth showed a significant height reduction in the presence of sweet potato varieties Centennial, Evangeline, and Hatteras. Reduction in Palmer amaranth's height was 32 and 20% in the presence of Centennial variety after two and four weeks, respectively, compared to Palmer amaranth control. In the presence of variety Evangeline, the Palmer amaranth height reduction was 27% after two weeks which gradually increased to 28 and 36% after four and five weeks, respectively. The Hatteras variety drastically reduced Palmer amaranth height from the 2nd to 4th week (3 to 85%, respectively). In the case of variety Morado, the Palmer amaranth plants germinated very late, *i.e.*, four weeks later compared to all other varieties; and even after that, the growth was very slow. Results of the ANOVA for weekly plant height showed that the variation among the sweet potato varieties is significant with a CD value of 1.73, thus suggesting different sweet potato varieties having different effects on Palmer amaranth growth. The present findings show that sweet potato varieties Centennial, Evangeline, Hatteras, and Morado suppressed the growth of Palmer amaranth and can be considered for further allelopathic studies to identify the cause and pathway responsible for weed growth suppression.

Characterization of Spatial Herbicide Injury Patterns in Cotton Using an Unmanned Aerial System. U Torres*[1], BB Sapkota[1], BM McKnight[1], SA Nolte[2], G Morgan[3], PA Dotray[4], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Extension, College Station, TX, [3]Cotton Incorporated, Cary, NC, [4]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX (74)

Herbicide-induced crop stress from off-target movement is an emerging concern in cotton production. Injury caused by off-target herbicide exposure can negatively impact cotton yield and profitability. The extent of herbicide-induced crop injury depends on a number of factors, including crop sensitivity, herbicide chemistry, and dose. Unmanned Aerial Vehicles (UAVs) equipped with multispectral imaging sensors may have the potential to aid in detecting the spatial extent and severity of off-target herbicide movement. Vegetation indices, which are spectral band equations designed to enhance the vegetation properties of remotely sensed data, can provide an effective method for determining crop health status from aerial imagery. An experiment was conducted during summer 2021 at the Texas A&M Research Farm in College Station, TX to detect and characterize cotton response to herbicide exposure using UAV-based multispectral imagery. Cotton injury from eight herbicides (nicosulfuron, 2,4-D, dicamba, atrazine, isoxaflutole, glyphosate, glufosinate, and paraquat) at three rates (high, moderate, and low) were evaluated, along with a non-treated control. Herbicide treatments were applied with a CO_2 pressurized backpack sprayer to conventional cotton at the first square growth stage. Aerial images were acquired at 2 weeks after treatment. A DJI Matrice 600 Pro® UAV equipped with a MicaSense RedEdge™ multispectral imaging sensor was flown at an altitude of 20 meters, resulting in imagery with 1.4 cm pixel^{-1} spatial resolution. A number of vegetation indices were applied to the multispectral imagery and differences between treatments were assessed after removing the soil background, which was accomplished by creating a supervised classification system and applying a binary mask to the imagery. Treatment differences were elucidated by the Normalized Difference Vegetation Index, Green Normalized Difference Vegetation Index, Secondary Modified Soil Adjusted Vegetation Index, and the Renormalized Difference Vegetation Index. Injury from isoxaflutole, dicamba, and 2,4-D showed the greatest injury levels in the aerial imagery. Further, cotton injury from dicamba had the lowest near-infrared reflectance. Results demonstrate that UAV-based multispectral imagery can be effectively used for assessing herbicide-induced crop injury under field conditions.

Effects of Burndown Applications Before Cover Crop Planting on Cover Crop Biomass and Weed Suppression. C Sias*, ML Flessner, KW Bamber, EC Russell, WC Greene, MP Spoth; Virginia Tech, Blacksburg, VA (75)

Successful cover crop (CC) establishment in the fall is important to maximize total CC production, which is critical for achieving multiple objectives of CCs . Competition from winter weeds may reduce CC establishment and delay development. The application of a burndown herbicide such as paraquat at the time of CC planting in the fall may help reduce winter weed pressure and therefore help establish a more successful CC. An experiment was conducted to test this hypothesis by evaluating a no CC check, cereal rye (*Secale cereale* L.) (68 kg ha^{-1}), hairy vetch (*Vicia villosa* Roth) (17 kg ha^{-1}), crimson clover (*Trifolium incarnatum* L.) (17 kg ha^{-1}), and cereal rye + hairy vetch (46 kg ha^{-1} + 11 kg ha^{-1}) drilled with and without a burndown of paraquat at 0.85 kg ha^{-1} at planting (mid-October to Mid-November). A randomized complete block design using a five by two factorial was used at ten individual locations between 2019-2021. Visible weed suppression ratings were collected in mid-march and total CC biomass was collected in early April. Data were analyzed using SAS and Fisher's protected LSD using ($P < 0.05$). Differences were observed between locations and whether the CC followed a corn or soybean for weed species present and CC biomass accumulated. More CC biomass was accumulated following corn than soybean, regardless of burndown application or weed competition. Winter weeds such as purple deadnettle (*Lamium purpureum* L.) and mouse ear chickweed (*Cerastium fontanum*) are better controlled by paraquat at planting, although interactions with timing (following corn or soybean) influenced control for some weeds. This information is useful for producers to achieve various cover cropping objectives while managing increasing costs of herbicide and labor.

Weed Management Programs for Peanut in South Texas. JA McGinty*[1], WJ Grichar[2]; [1]Texas A&M AgriLife Extension Service, Corpus Christi, TX, [2]Texas A&M AgriLife Research, Yoakum, TX (76)

Palmer amaranth (*Amaranthus palmeri* S. Wats.) represents a significant threat to peanut (*Arachis hypogaea* L.) production in South Texas. To investigate herbicide programs for season-long management of this pest, a field trial was conducted in 2021 in a peanut field near Pearsall, TX. The trial included fifteen treatments and was arranged as a randomized complete block design with three replications. Treatments included preemergence (PRE) applications of pendimethalin at 1.06 kg ha^{-1} either alone or in combination with flumioxazin (71.5 g ha^{-1}), *S*-metolachlor (1.42 kg ha^{-1}), imazethapyr (25.2 g ha^{-1}), pyroxasulfone + carfentrazone (65.4 + 4.7 g ha^{-1}), dimethenamid-P (0.63 kg ha^{-1}), or acetochlor (1.26 kg ha^{-1}). These were followed by either at-cracking applications of paraquat + pyroxasulfone (0.28 + 0.12 kg ha^{-1}), early postemergence (EPOST) applications of either pyroxasulfone + carfentrazone + 2,4-DB (65.4 + 4.7 g ha^{-1} + 0.45 kg ha^{-1}) or imazapic + 2,4-DB (70.0 g ha^{-1} + 0.45 kg ha^{-1}), or mid postemergence (MPOST) applications of *S*-metolachlor + 2,4-DB (1.42 + 0.45 kg ha^{-1}). Thirteen days after PRE applications were made, control of Palmer amaranth was highest with tank mixtures of pendimethalin with either flumioxazin, *S*-metolachlor, flumioxazin + *S*-metolachlor, pyroxasulfone + carfentrazone, or dimethenamid-P (99-100% control), versus that of pendimethalin + acetochlor (90%), pendimethalin + imazethapyr (60%), or pendimethalin alone (67 to 78%). Fourteen days after EPOST applications were made, control of Palmer amaranth was greatest with pendimethalin + flumioxazin PRE (91%), pendimethalin + dimethenamid-P (91%), pendimethalin + *S*-metolachlor PRE (92%), and pendimethalin + flumioxazin + *S*-metolachlor PRE (96 to 97). By four weeks after all applications were made, the greatest control of Palmer amaranth was observed with pendimethalin + *S*-metolachlor PRE (80%), pendimethalin PRE followed by pyroxasulfone + carfentrazone + 2,4-DB EPOST (81%), pendimethalin PRE followed by imazapic + 2,4-DB EPOST (84%), pendimethalin + flumioxazin PRE (88%), pendimethalin + flumioxazin + *S*-metolachlor PRE (96%), pendimethalin + *S*-metolachlor PRE followed by *S*-metolachlor + 2,4-DB MPOST (98%), and pendimethalin + flumioxazin + S-metolachlor PRE followed by *S*-metolachlor + 2,4-DB MPOST (98%).

Double Crop Soybean Yield Loss from Herbicides in Groups 14 and 15. ML Flessner*, KW Bamber; Virginia Tech, Blacksburg, VA (77)

Previous research indicates that herbicides in groups 14 and 15 do not reduce full season soybean yield, despite foliar injury. Double crop soybeans are planted after wheat harvest and have a limited number of days until a killing frost to make yield. Injury to double crop soybean may be more detrimental to yield than in full season soybean as foliar injury may further restrict the ability to capture sunlight and make yield. Since limited data exists, the objective of this research was to evaluate soybean injury and yield from herbicides in groups 14, 15, and tank-mixtures thereof in double crop soybean. Field studies were conducted in Blacksburg, Virginia in 2020 and Blackstone, Virginia in 2021. Double crop soybeans were planted after wheat harvest. Treatments were applied at the R1 soybean growth stage. Glyphosate was applied as needed to maintain weed-free trials. Data collected included visible foliar soybean injury on a 0 (no control) to 100% (complete necrosis) scale 7 days after application and soybean yield was collected at harvest and adjusted to 13.0% moisture. Data were analyzed in JMP Pro 13 with ANOVA followed by means separation using Fisher's Protected LSD ($p < 0.05$). Soybean injury was slightly greater in 2020 (average of 36%) than 2021 (average of 28%). Soybean yield was greater in 2021 (average of 49.3 bu/A or 3100 kg/ha) than 2020 (average of 31.0 bu/A or 1950 kg/ha). Group 15 herbicides resulted in the least soybean injury (<10%). Fomesafen containing treatments were more injurious than group 15 herbicides (20-35%), but less injurious than lactofen containing treatments, which resulted in the most soybean injury (55-65%). Foliar necrosis was exacerbated when tank-mixing group 14 and 15 herbicides compared to group 15 herbicides alone. Likely due to the shortened growing season, soybeans were not able to recover and yield was reduced. Group 15 herbicides and fomesafen alone resulted in the greatest soybean yield (2830-3140 kg/ha) and were similar to the nontreated (3020 kg/ha). Fomesafen + group 15 herbicides resulted in slightly less yield (2520-2830 kg/ha) than the nontreated but similar to fomesafen alone (2830 kg/ha). Lactofen containing treatments resulted in the least yield (1890-2200 kg/ha). Tank-mixing group 15 herbicides with other postemergent herbicides is often recommended. This research supports this recommendation as soybean injury and yield were not made worse when tank-mixed compared to fomesafen or lactofen alone, respectively. Growers intending to apply these tank-mixtures should use fomesafen rather than lactofen. Future research should evaluate other herbicides such as acifluorfen and dimethenamid as well as evaluating outcomes in a weedy setting, as this research was conducted in a weed-free setting focusing on soybean response.

Is a Target Site Mutation Responsible for Resistance to Glufosinate in Palmer Amaranth (*Amaranthus palmeri*)? F Gonzalez Torralva*[1], JK Norsworthy[1], P Carvalho-Moore[1], LB Piveta[1], GL Priess[1], T Barber[2], TR Butts[2], JS McElroy[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]Auburn University, Auburn, AL (78)

Glufosinate ammonium (glufosinate) is a glutamine synthetase (*GS*) -inhibiting herbicide which has been used for controlling a diverse number of weed species in different cropping systems. Some Palmer amaranth (*Amaranthus palmeri* S. Watson) accessions collected in eastern Arkansas with resistance to glufosinate have been confirmed. The aim of this research was to determine if target site mutations in the *GS* gene of those Palmer amaranth accessions are present. *GS* gene of susceptible and resistant Palmer amaranth accessions was sequenced following standard procedures. Comparison of nucleotide sequences and their predicted protein among susceptible and resistant accessions have demonstrated that those accessions do not have an altered target site as have been reported in other glufosinate-resistant weed species. The results of this research suggest that the resistant accessions most likely have a resistance mechanism other than target site mutations that contributes to lack of effective control with glufosinate.

Impact of Weed Management Practices on Palmer Amaranth Emergence and Population in XtendFlex and Enlist Soybean. LB Piveta*[1], JK Norsworthy[1], TC Smith[1], MM Houston[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (79)

Palmer amaranth (PA) is the most troublesome weed of soybean throughout the Midsouth. With resistance to seven herbicide sites of action, a multifaceted approach is needed to effectively manage this weed. A long-term study was initiated in Newport, AR, during the spring of 2020 to evaluate the influence of herbicide programs, rye cover crop (beginning fall of 2020), and harvest weed seed control (HWSC) (beginning fall of 2020) on Palmer amaranth. The programs evaluated consisted of a preemergence herbicide followed by two postemergence application in Enlist and XtendFlex soybean, where 2,4-D and dicamba were utilized in the appropriate technology, and lastly, and a postemergence-only program was evaluated in the XtendFlex system. Herbicide programs in Enlist and XtendFlex soybean that included residual herbicides limited PA emergence and provided season-long control based on no weeds present at harvest. The postemergence-only program reduced PA densities with applications of dicamba + glyphosate (560 + 1263 g ae ha^{-1}) followed by glufosinate + glyphosate (656 g ai ha^{-1} + 1263 g ae ha^{-1}), but escapes were still present at harvest (0.26 PA per m^2). Use of a cereal rye cover crop or HWSC the preceding year reduced PA density in the postemergence-only program when the first application was made in 2021, but the benefit of the cover crop or HWSC tactic was not evident when preemergence herbicides were applied. The continued collection of data from this trial will be beneficial in assisting farmers in determining the contribution and value of a cereal rye cover and use of a HWSC tactic on long-term management of Palmer amaranth within herbicide programs being used in the Midsouth.

Lessons Learned from Annual Auxin Trainings in North Carolina. ZR Taylor*[1], CW Cahoon[2], W Everman[2], DL Jordan[2], AC York[3]; [1]North Carolina State University, Sanford, NC, [2]North Carolina State University, Raleigh, NC, [3]North Carolina State University, Liberty, NC (80)

Auxin tolerant crops and labelled products were introduced to the market for the 2017 growing season. Depending on trait package, these crops are either tolerant to dicamba or 2,4-D products. Due to widespread herbicide-resistant weeds in North Carolina, high adoption rates of this new technology was anticipated. However, non-tolerant crops are highly susceptible to low rates of these products, so issues with off-target movement due to physical drift and volatility were also expected. In an effort to limit these incidents, North Carolina adopted 24(c) special local needs labels for these products, requiring annual training by NC State University extension specialist on their proper use. All attendees at these trainings have been offered a survey since 2018. These surveys have helped extension track the adoption of this technology, as well as the attitude growers have towards both the technology and training requirements. We were also able to track off-target movement complaints by attendees, and see if training efforts were having the desired effect of reducing these incidents. After four years of surveys, we can see that adoption of the technology has been increasing each year among growers in attendance. While reports of off-target movement to sensitive varieties of soybean and cotton crops has been variable, we have observed a steady decline in reports of off-target movement to tobacco, North Carolina's highest value crop. Growers have been overwhelmingly supportive of the training requirements, with 83, 88, 91, and 92 percent of attendees reporting the training is worth their time in 2018, 2019, 2020, and 2021, respectively. The support we have gathered from growers, as well as decreasing reports of off-target movement, show that the auxin training program in North Carolina has been successful.

Will Certain Adjuvants Improve Pendimethalin and *S*-Metolachlor Activity? WJ Grichar*[1], JA McGinty[2]; [1]Texas A&M AgriLife Research, Yoakum, TX, [2]Texas A&M AgriLife Extension Service, Corpus Christi, TX (81)

WILL CERTAIN ADJUVANTS IMPROVE PENDIMETHALIN OR *S*-METOLACHLOR ACTIVITY? W. J. Grichar and J. A. McGinty; Texas A&M AgriLife Research and Extension Center, 10345 State Hwy 44, Corpus Christi, TX ABSTRACT Field studies were conducted during the 2021 growing season near Yoakum (29.2765º N, 97.1238º W) in south-central Texas and near Corpus Christi (27.7817º N, 97.5737º W) long the upper Texas Gulf Coast to determine weed efficacy when using an adjuvant in combination with commonly used soil applied herbicides. Pendimethalin at 0.53 or 1.06 kg ha^{-1} and *S*-metolachlor at 0.72 or 1.42 kg ha^{-1} were applied preemergence after corn (*Zea mays* L.) or peanut (*Arachis hypogaea* L.) planting at Yoakum and under a non-crop situation at Corpus Christi. These herbicides were applied either alone or in combination with Grounded at 2.3 L ha^{-1} or Spectrum at 0.6 L ha^{-1}. An untreated check was included at each location for comparison. Weed efficacy evaluations were taken 7 and 15 weeks after herbicide treatment (WAT) in the corn study, 26 and 54 days after herbicide treatment (DAT) in the peanut study, and 14 and 42 DAT in the non-cropland study. A lack of early-season rainfall, which slowed weed emergence and growth, prevented an earlier evaluation in the corn study. In corn when evaluated 7 WAT, Texas millet [*Urochloa texana* (Buckl.)], Palmer amaranth (*Amaranthus palmeri* S. Wats), and smellmelon (*Cucumis melo* L.) control improved as the rate of either pendimethalin or S-metolachlor increased. With Palmer amaranth, the addition of Grounded to pendimethalin at 1.06 kg ha^{-1} reduced control when compared with pendimethalin at the same rate either alone or with the addition of Spectrum. Smellmelon control with pendimethalin at 0.53 kg ha^{-1} improved with the addition of Grounded over pendimethalin alone. When evaluated 15 WAT, only Texas millet was present in consistent enough populations to evaluate and no differences in control was noted with/without an adjuvant with either pendimethalin or *S*-metolachlor. In peanut when evaluated 26 and 54 DAT, Texas millet or smellmelon control was not influenced with the use of either Grounded or Spectrum. Control of Texas millet and smellmelon was reduced drastically from the first to the second evaluation with the exception of smellmelon control with pendimethalin at 1.06 kg ha^{-1} and *S*-metolachlor at 0.72 kg ha^{-1} with Grounded which still showed 78 and 80% control, respectively. In the non-cropland study, when evaluated 14 DAT, both Texas millet and Palmer amaranth control was $\geq$ 97% with all combinations of pendimethalin or *S*-metolachlor with/without an adjuvant. At the 42 DAT evaluation, again no differences in weed control were noted between the herbicide without an adjuvant and with the addition of Grounded or Spectrum. However, Texas millet control improved as the rate of pendimethalin or *S*-metolachlor increased while Palmer amaranth control improved as the rate of pendimethalin increased. Also, Palmer amaranth control with both rates of S-metolachlor with/without an adjuvant was > 90%. In summary, in none of the trials did the addition of either Grounded or Spectrum to either herbicide consistently improve weed efficacy. Also the length of herbicide persistence was not increased with these adjuvants.

Metabolism-based Resistance of Palmer Amaranth (*Amaranthus palmeri* S. Wats) to *S*-Metolachlor. J Hwang*[1], JK Norsworthy[1], P Carvalho-Moore[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (82)

Previously, a Palmer amaranth (*Amaranthus palmeri* S. Wats) biotype from Arkansas was confirmed resistant to *S*-metolachlor. In the present study, the inhibitory effect of malathion (a known cytochrome P450 inhibitor) and 4-chloro-7-nitrobenzofurazan [NBD-Cl (a known glutathione *S*-transferase inhibitor)] on growth and herbicide metabolism of susceptible (S) and resistant (R) Palmer amaranth biotypes following the *S*-metolachlor treatment were investigated to reveal which metabolic pathway can contribute to the herbicide resistance. In R Palmer amaranth, the addition of NBD-Cl (50 nM) to *S*-metolachlor (2 µM) caused 20% greater reduction in root lengths compared to the herbicide alone treatment; however, when malathion (50 µM) was added to the herbicide, no reduction occurred. Over the entire study period, production of identified metabolites such as metolachlor-oxanilic acid (2.0-4.7 times) and metolachlor-ethanesulfonic acid (4.0-12.1 times) was greater in the R biotype than in the S biotype. Additionally, the presence of unidentified metabolites (UM-1 and UM-2) increasing consistently over time was verified on the analyzed chromatograms, and their production was 1.2-2.9 times greater in the R biotype. Conclusively, *S*-metolachlor resistance of the tested Palmer amaranth was associated with the activity of GST enzymes, and metabolites analyzed in this study could be the resultants produced following the GST-mediated metabolism. In a further study, analysis of genes encoding enzymes related to the elongation of very-long-chain fatty acids is needed to investigate the involvement of target-site resistance in the evolution of *S*-metolachlor resistance in Palmer amaranth.

Palmer Amaranth Control with PRE Herbicides Alone or in Combination with Dicamba. CR White*[1], W Keeling[1], PA Dotray[2], JM Bell[3], K Heflin[3]; [1]Texas A&M AgriLife Research, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Texas A&M AgriLife, Amarillo, TX (83)

Dicamba-tolerant cotton varieties have been widely planted across the Texas High Plains. Using soil active, preemergent herbicides at planting is an important part of integrated weed management systems, especially when managing glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats). Dicamba is effective as a postemergence herbicide and could have value when combined with traditional preemergence (PRE) herbicides. Three trials were conducting in 2021 at Lubbock, Halfway, and Bushland, Texas to compare standard PRE treatments alone or in combination with dicamba. Applications were made using a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1} with TurboTeeJet 11002 nozzles. Palmer amaranth control 21 days after planting (DAP) was >70% using all PRE herbicides alone and was similar across all treatments at both Lubbock and Bushland. At Halfway, Caparol alone was less effective than the other three herbicides. At 35 DAP, similar control was achieved at both Lubbock and Bushland, while Cotoran had the greatest control at Halfway. When tank-mixing XtendiMax herbicide with PRE herbicides, control was not improved at 21 or 35 DAP at Lubbock or Bushland. At Halfway, tank-mixing dicamba with Caparol improved control of Palmer amaranth when compared to Caparol alone. These results indicate that XtendiMax is an extremely effective postemergence herbicide for Palmer amaranth control, but no consistent improvement in control was observed when tank-mixed with traditional PRE herbicides in cotton.

Impact of Application Timing of Dual Magnum, Outlook, and Warrant on Weed Management and Crop Tolerance in Two-Pass Programs with Enlist One and Liberty. D Miller*, M Mize; LSU AgCenter, St Joseph, LA (84)

A field study was conducted on a Commerce silt loam soil at the LSU AgCenter Northeast Research Station near St. Joseph, La. A factorial arrangement of treatments included residual herbicide (s-metolachlor as Dual Magnum @ 1.7 lb ai/A; acetochlor as Warrant @ 1.125 lb ai/A; or dimethenamid-P as Outlook @ 0.656 lb ai/A) and residual herbicide timing (residual herbicide PRE only; residual herbicide PRE followed by Enlist One plus Liberty (combo) EPOST (V1-V2); residual herbicide PRE followed by followed by combo LPOST (V4-V5); residual herbicide plus combo EPOST; residual herbicide plus combo LPOST; residual herbicide plus combo EPOST followed by residual herbicide plus combo LPOST. Enlist One as 2,4-D choline and glufosinate as Liberty were applied at 0.95 lb ae/A and 0.4 lb ai/A, respectively. Soybean (*Glycine max* (L.) Merr.) P49T62E was planted on May 25. EPOST and LPOST application were June 11 and June 22, respectively. Rainfall totals were 0.91, 6.32, 8.9, and 7.8 inches for late May, June, July, and August, respectively. Parameters measured included visual % weed control 28 d after LPOST application, soybean height prior to harvest, and yield. Interaction of residual herbicide and timing was noted with barnyardgrass (*Echinochloa crus-galli* (L.) P. Beauv.) control. With the exception of Warrant applied in combination with the combo EPOST (38 vs 80 and 89% control), all residual herbicides resulted in equivalent control regardless of timing. When residual herbicide was not included, two applications of the combo EPOST fb LPOST were required to provide greater than 63% control (90 vs 0 to 63%). When residual herbicide was included, PRE or EPOST timing was needed to maximize control. An interaction of residual herbicide and timing was noted with browntop millet (*Urochloa ramosa (L.)*) control. When applied PRE only (75 and 64 vs 42%) and PRE fb the combo EPOST (100 and 93 vs 74%), Dual Magnum and Warrant resulted in greater control in comparison to Outlook. Control was similar among residual herbicides for all other timings. When residual herbicide was not included, control was maximized with the combo applied at the LPOST timing (80 and 85 vs 0 to 67%). When residual herbicide was included, control was maximized with Dual Magnum and Warrant applied at any timing expect PRE only with no follow-up POST herbicide application. With Outlook, control was only maximized when applied PRE fb the combo LPOST. An interaction of residual herbicide and timing was noted with goosegrass (*Eleusine indica (L.) Gaertn.*) control. All residual herbicides resulted in equivalent control regardless of timing. When residual herbicide was not included, two applications of the combo EPOST fb LPOST were required to provide greater than 78% control (99 vs 0 to 78%). When residual herbicide was included, control was maximized at all timings with Dual Magnum. With Warrant and Outlook, control was maximized with all timings except when applied with the combo LPOST. An interaction of residual herbicide and timing was noted with yellow nutsedge (*Cyperus esculentus L.*) control. Control was similar for Dual Magnum and Warrant regardless of timing (92 to 100%). Control was lower with Outlook in comparison to both when applied PRE only (87%) and PRE fb the combo LPOST (74%). In addition, control with Outlook was lower in comparison to Dual Magnum when both were applied EPOST fb LPOST with the combo (83 vs 95%). When residual herbicide was not included, control was maximized with all timings. When residual herbicide was included, control was maximized at all timings with Dual Magnum and Warrant. With Outlook, PRE only and inclusion with the combo applied LPOST or EPOST and LPOST were the timings that did not maximize control (74 to 87%). A significant residual herbicide timing effect was noted with hemp sesbania (*Sesbania exaltata (Raf.) Rydb. ex A.W. Hill*) control. Averaged across residual herbicides, with the exception of the PRE only timing (36%), control was equal among all timings (87 to 98%). Broadleaf signalgrass (*Urochloa platyphylla (Munro ex C. Wright)*), pitted (*Ipomoea lacunosa L.*) and entireleaf mornninglory (*Ipomoea hederacea Jacq.*), carpetweed (*Mollugo verticillata L.*), sicklepod (*Senna obtusifolia (L.)*), and redroot pigweed (*Amaranthus retroflexus L.*) were controlled at least 96, 99, 100, 94, and 88%, respectively, and equally by all treatments. Visual soybean injury was not observed with any herbicide application. A significant residual herbicide timing was noted for soybean height prior to harvest. Averaged across residual herbicides, height was maximized with at all timings except LPOST only with the combo and the

EPOST/LPOST sequential treatment (58 and 65 vs 67 to 73 cm). Significant residual herbicide and timing effects were noted with soybean yield. Averaged across residual herbicides, yield was maximized with PRE timing fb the combo EPOST (42 bu/A) or LPOST (43 bu/A) and applied in combination with the combo sequentially EPOST and LPOST (42 bu/A). Other timings resulted in lower yield ranging from 23 to 37 bu/A. Averaged across timings, residual herbicides resulted in equal yield of 37 to 39 bu/A and greater than the 27 bu/A observed where no PRE herbicide was applied.

Impact of Application Timing of Dual Magnum, Outlook, and Warrant on Weed Management and Crop Tolerance in Two-Pass Programs with Enlist Duo. D Miller*, M Mize; LSU AgCenter, St Joseph, LA (85)

A field study was conducted on a Commerce silt loam soil at the LSU AgCenter Northeast Research Station near St. Joseph, La. A factorial arrangement of treatments included residual herbicide (s-metolachlor as Dual Magnum @ 1.7 lb ai/A; acetochlor as Warrant @ 1.125 lb ai/A; or dimethenamid-P as Outlook @ 0.656 lb ai/A) and residual herbicide timing (residual herbicide PRE only; residual herbicide PRE followed by Enlist Duo EPOST (V1-V2); residual herbicide PRE followed by Enlist Duo LPOST (V4-V5); residual herbicide plus Enlist Duo EPOST; residual herbicide plus Enlist Duo LPOST; residual herbicide plus Enlist Duo EPOST followed by residual herbicide plus Enlist Duo LPOST. Glyphosate plus 2,4-D choline as Enlist Duo applied at 1.94 lb ae/A. Soybean (*Glycine max* (L.) Merr.) P49T62E was planted on May 25. EPOST and LPOST application were June 11 and June 22, respectively. Rainfall totals were 0.91, 6.32, 8.9, and 7.8 inches for late May, June, July, and August, respectively. Parameters measured included visual % weed control 28 d after LPOST application, soybean height prior to harvest, and yield. An interaction of residual herbicide and timing was noted with barnyardgrass (*Echinochloa crus-galli* (L.) P. Beauv.) control. All residual herbicides resulted in equivalent control regardless of timing. When residual herbicide was not included, control ranged from 65 to 83%. When residual herbicide was included, control was maximized at any timing with Dual Magnum and Warrant. With Outlook, PRE only was the only timing that did not maximize control. An interaction of residual herbicide and timing was noted with broadleaf signalgrass control (*Urochloa platyphylla (Munro ex C. Wright)*). For the PRE only timing, Outlook provided 99% control which was greater than the 75 and 42% observed with Dual Magnum and Warrant, respectively. All residual herbicides resulted in equivalent control at other timings. When residual herbicide was not included, control was maximized at all timings (89 to 100%). When residual herbicide was included, control was maximized at any timing with Outlook (88 to 100%). With Dual Magnum (75 vs 98 to 100%) and Warrant (42 vs 86 to 100%), PRE only was the only timing that did not maximize control. An interaction of residual herbicide and timing was noted with browntop millet (*Urochloa ramosa (L.)*) control. When applied PRE only (41 and 81 vs 94%), Dual Magnum and Warrant resulted in greater control in comparison to Outlook. When applied PRE fb Enlist Duo EPOST, Dual Magnum provided 98% control, which was equal to that with Warrant (90%) and greater than Outlook (75%). Control was similar among residual herbicides for all other timings. When residual herbicide was not included, control was maximized with Enlist Duo applied at the LPOST timing (89 and 88 vs 0 to 50%). When residual herbicide was included, control was maximized at any timing with Warrant. With Dual Magnum, control was maximized at all timings except PRE only (81%) and in combination with Enlist Duo EPOST (82%). With Outlook, control was maximized with all timings except PRE only (40%) and PRE fb Enlist Duo EPOST (75%). An interaction of residual herbicide and timing was noted with yellow nutsedge (*Cyperus esculentus L.*) control. Control was similar for all residual herbicides at all timings except PRE fb Enlist Duo EPOST where Dual Magnum (100%) and Warrant (96%) resulted in greater control than Outlook (70%). When residual herbicide was not included, control was maximized with all timings except PRE fb Enlist Duo EPOST. When residual herbicide was included, control was maximized at all timings with Dual Magnum and Warrant. With Outlook, PRE fb Enlist Duo was the only timing that did not maximize control (70 vs 87 to 100%). An interaction of residual herbicide and timing was noted for sicklepod (*Senna obtusifolia (L.)*) control. With the exception of the PRE fb EPOST timing where Warrant provided 100% control which was equal to that with Dual Magnum (92%) and greater than Outlook (80%), all residual herbicides resulted in equivalent control regardless of timing. When residual herbicide was not included, control was maximized at all timings (87 to 100%). When residual herbicide was included, control was equal among all timings with Dual Magnum and Warrant. With Outlook, control was maximized with all timings except PRE fb Enlist Duo EPOST (87 to 100% vs 80%). Significant residual herbicide and timing effects were noted for hemp sesbania (*Sesbania exaltata (Raf.) Rydb. ex A.W. Hill*) control. Averaged across timings, residual herbicides resulted in equivalent control ranging from 79 to 81% and greater than with no residual herbicide (67%). Averaged across residual herbicides, control was greatest with all treatments including a LPOST herbicide application 92 to 94% vs 31 to 77%). Pitted (*Ipomoea lacunosa L.*) and entireleaf morningglory (*Ipomoea hederacea Jacq.*), carpetweed (*Mollugo verticillata L.*), goosegrass (*Eleusine indica (L.) Gaertn.*), and redroot pigweed (*Amaranthus retroflexus L.*) were controlled at least 99, 100, 88, and 96%, respectively, and equally by all treatments. Visual soybean injury was not observed with any herbicide application. Soybean height prior to harvest was unaffected by residual herbicide or application timing. A significant residual herbicide timing effect was noted with soybean yield. Averaged across residual herbicides, yield was maximized with all timings except PRE only (65% lower).

Impact of Dual Magnum, Outlook, and Warrant on Crop Injury and Yield from Reduced Rates of Enlist One in Xtend Soybean. D Miller*, M Mize; LSU AgCenter, St Joseph, LA (86)

A field study was conducted at the LSU AgCenter Northeast Research Station near St. Joseph, La. A factorial arrangement of treatments included 2,4-D choline as Enlist One reduced rate (1/10 or 1/100x of 0.95 lb ae/A use rate), residual herbicide (none; s-metolachlor as Dual Magnum @ 1.7 lb ai/A; acetochlor as Warrant @ 1.125 lb ai/A; or dimethenamid-P as Outlook @ 0.656 lb ai/A), and soybean (*Glycine max* (L.) Merr.) growth stage at application (V2-V3 or V6-V7). Glyphosate as Roundup Powermax at 1 lb ai/A plus dicamba as Xtendimax at 0.5 lb ae/A was included with all herbicide applications. Soybean 47XFO soybean was planted on May 7. Early and late growth stage applications were May 25 and June 18, respectively. Rainfall totals were 0.91, 6.32, 8.9, and 7.8 inches for late May, June, July, and August, respectively. Parameters measured included visual % soybean injury 7, 14, and 28 d after application, soybean height prior to harvest, and yield. Significant reduced Enlist One rate, residual herbicide, and growth stage effects were observed for soybean injury 7 DAT. Averaged across residual herbicides and growth stage, soybean injury was greater at the highest Enlist One reduced rate applied (39 vs. 20%). Averaged across reduced Enlist One rate and growth stage, Dual Magnum was the only residual herbicide (40%) that resulted in greater soybean injury than Roundup Powermax plus Xtendimax alone (26%). Averaged across reduced Enlist One rate and residual herbicide, soybean injury was greatest at the earlier growth stage (33 vs. 26%). Significant reduced Enlist One rate and residual herbicide effects were observed for soybean injury 14 DAT. Averaged across residual herbicide and growth stage, soybean injury was greater at the highest Enlist One reduced rate (32 vs 16%). Averaged across reduced Enlist One rate, Dual Magnum was the only residual herbicide (29%) that resulted in greater soybean injury than Roundup Powermax plus Xtendimax alone (22%). Significant reduced Enlist One rate and growth stage effects were observed for soybean injury 28 DAT. Averaged across residual herbicide and growth stage, soybean injury was greatest at the highest Enlist One reduced rate (16 vs 6%). Averaged across reduced Enlist One rate and residual herbicide, soybean injury was greatest at the later growth stage (17 vs 4%). Significant reduced Enlist rate effect and residual herbicide by growth stage interaction were noted for soybean height prior to harvest. Averaged across residual herbicide and growth stages, soybean height was 6% lower for the highest reduced Enlist One rate. Averaged across reduced Enlist One rate, within the V2-V3 growth stage residual herbicide addition did not reduce soybean height compared to Roundup Powermax plus Xtendimax applied alone. Within the V6-V7 growth stage, Warrant was the only residual herbicide that resulted in reduced soybean height compared to Roundup Powermax plus Xtendimax (4%). Averaged across reduced Enlist One rate, within each residual herbicide only for Warrant was a difference observed among growth stages with the later growth stage application reducing heights 5%. A significant reduced Enlist One rate by growth stage interaction was observed for soybean yield. Averaged across residual herbicides, within the V2-V3 growth stage yield was 21% lower at the highest reduced Enlist One rate. Within the V6-V7 growth stage, yield was equal between rates (62 and 66 bu/A). Averaged across residual herbicides, within the highest reduced Enlist One rate, yield was 11% lower at the V2-V3 growth stage. Within the lowest reduced Enlist One rate, yield was similar regardless of growth stage at application (70 and 66 bu/A).

Elucidation of the Impact of Soil Nutrient Gradients on Weed Seedling Emergence and Growth. V Kankarla*, MV Bagavathiannan; Texas A & M University, College Station, TX (87)

Weeds account for an annual economic loss of more than $100 billion U.S dollars globally (Appleby et al. 2000). Soil nutrients play a significant role in crop and weed growth. They affect seedling germination, emergence, growth, development, distribution, persistence, and crop weed competitiveness (Bajwa et al. 2014). Soil nutrient availability especially during the early growth stages of crops and weeds can impact competition among them through differential effects on their growth. A greenhouse experiment is designed to understand how different soil nutrient gradient status would regulate crop weed population dynamics and their competitive interactions. Two replicated experiments are run for 45 days each with two crop species (corn and cotton), two weed species (Johnson grass and Palmer), and eight levels of nutrient gradients (recommended rate of NPK as check, no fertilizer as check, 75% of recommended N (full P and K), 50% of recommended N (full P and K), 25% of recommended N (full P and K), 75% of recommended P (full N and K), 50% of recommended P (full N and K) and 25% of recommended P (full N and K)) in sandy soils using sub-irrigation at Borlaug Center for Southern Crop Improvement, Texas A & M University. Plant height measurements and weed suppression visual rating on a scale of 0 to 100% will be taken at 25 and ~50 days after transplanting (termination). At the end of the experiment (after harvest) crop and weed shoot, root biomass, and root volume will be recorded to suggest practical weed management solutions.

Peanut Response to Reviton™ (Tiafenacil). EP Prostko*, C Abbott; University of Georgia, Tifton, GA (89)

Reviton™ (tiafenacil) is a new, non-selective, burndown herbicide labeled for use in various crops. Tiafenacil is a member of the N-phenyl-imide family and a PPO-inhibitor (WSSA MOA #14). Current label restrictions prohibit peanut planting for 120 to 180 days after application depending upon rate. Little information is known about the response of peanut to preemergence (PRE) or postemergence (POST) applications. Therefore, the objective of this research was to determine the effects of Reviton™ applied PRE or POST on peanut growth and yield. An irrigated, small-plot field trial was conducted in 2021 at the UGA Ponder Research Farm near Ty Ty, Georgia. The soil type at this location was a Tifton sand (0.91% OM, 94% sand, 0% silt, 6% clay, 6.0 pH, and 3.6 CEC). Twin-row 'GA-06G' peanuts were planted on May 3, 2021. Herbicide treatments included Reviton™ 2.83SC applied PRE @ 2 oz/A or POST (30 DAP, R1 stage) @ 1.0 oz/A or 2.0 oz/A. POST applications included Induce @ 0.25 v/v. Treatments were arranged in a randomized complete block design with 3 replications. PRE treatments were activated by a 1.15" rainfall event the day of application. Herbicides were applied with a CO_2-powered backpack sprayer calibrated to deliver 15 GPA (38 PSI, 3.5 mph, 11002AIXR nozzles). The plot area was maintained weed-free using a combination of labeled herbicides and hand-weeding. Data collected included peanut injury (leaf necrosis/stunting), canopy height/width, and yield. All data were subjected to ANOVA and means separated using Tukey's HSD (P = 0.10). PRE applications of Reviton™ had no effect on peanut leaf necrosis, visual stunting, and canopy height/width. POST applications Reviton™ caused significant leaf necrosis (60-75%), visual stunting (35-60%), and canopy height/width reductions (11-23%). Reviton™ had no effect on peanut yield (P = 0.2037). Since this is only 1 year of data, additional research is needed to confirm peanut tolerance to PRE and POST applications of Reviton™.

Influence of an Early-season Application of Non-selective Plus Group 15 Herbicides on 2,4-D Tolerant Cotton Growth and Yield. DO Stephenson*, DB Franks, PD Newton; LSU Ag Center, Alexandria, LA (90)

Regardless of the herbicide-tolerant technology utilized in cotton production, residual herbicides are necessary for management of herbicide-resistant weeds. However, many producers are relying on POST applications of Group 15 herbicides in leu of PRE herbicides for early-season residual control. Research was conducted in 2021 at the LSU AgCenter Dean Lee Research and Extension Center near Alexandria, LA to evaluate cotton injury, growth, and yield following an application of two Group 15 herbicides co-applied with various non-selective herbicides to 1-leaf cotton. Group 15 herbicides were acetochlor, *S*-metolachlor, and no Group 15. Non-selective herbicides evaluated were glyphosate, glufosinate, 2,4-choline, glyphosate:2,4-D choline, glufosinate plus 2,4-D choline, or no non-selective. All herbicides were evaluated at labeled use rates. All treatments injured cotton 3, 7, and 14 d after treatment (DAT), but no visible injury was observed 28 and 42 DAT. Injury was predominately necrosis and leaf malformation. Averaged across Group 15 herbicides, glufosinate alone or co-applied with 2,4-D choline injured cotton 40%, which was greater than glyphosate. Regardless of non-selective herbicide, acetochlor and *S*-metolachlor injured cotton 35 and 36%, respectively, 3 DAT. A similar trend in visible injury was observed 7 DAT with treatments containing glufosinate injuring cotton greater than glyphosate. Acetochlor, *S*-metolachlor, and no Group 15 herbicide injured cotton 34, 29, and 13%, respectively, 7 DAT. At 14 DAT, only glufosinate co-applied with either Group 15 herbicide injured cotton greater than 10%. Injury data is support by cotton heights collected throughout the season. Treatments containing glufosinate or glyphosate:2,4-D choline reduced cotton height greater than glyphosate or no non-selective treatments with heights reduced 15 to 40 mm. Also, height was reduced following both Group 15 herbicides at all evaluation dates. Although early-season injury and height reduction was observed following these treatments, no differences in cotton lint yield were detected. Research will be repeated in 2022.

Transplant Method Influences Herbicide Injury in Broccoli and Collard. A Culpepper*[1], JC Vance[1], TM Randell[1], HE Wright[2]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (91)

Leafy greens and cole crops account for a farm gate value exceeding $120 million in Georgia. Production is complex with both seeds and transplants being planted into mulched or non-mulched systems. Achieving weed control in these systems is extremely complex, especially with the recent rapid spread of wild radish. Broccoli, collards, and wild radish are all members of the Brassicaceae family; thus, effectively controlling wild radish in these crops requires farmers to implement new management strategies. The objective of this experiment was to determine if the method of transplanting into non-mulched systems could improve crop safety to Goal 2XL herbicide (oxyflourofen) applied preplant, thereby increasing wild radish control by being able to safely apply higher herbicide use rates. An experiment was conducted 3 times during 2020 and 2021 at the University of Georgia's Ponder Farm. Tillage was used to remove all weeds prior to planting and to prepare a planting bed. Emerald Crown broccoli and Top Bunch collards were transplanted on a spacing of 12 inches down the row and 20 inches across the bed on 6 foot centers. Goal 2XL was applied at 8, 16, 24, 32, and 48 oz/A followed by overhead irrigation of 0.35 inches. Three days after herbicide application and irrigation, crops were transplanted into soils with 85 to 88% sand with < 0.7% OM. The two methods of transplanting included 1) the standard hole punching technique accompanied by hand planting and 2) using a mechanical carrousel transplanter from Mechanical Transplanter Co. Control of wild radish was not influenced by transplant method, with Goal 2 XL at 8, 16, 24, 32, and 48 oz/A providing 39, 53, 66, 89, and 95% control, respectively, at 27 days after treatment (DAT). In contrast planting method did influence crop injury response. Injury of broccoli and collard transplanted using the traditional hole punch method was 0-4, 4-8, 7-11, 16-20, and 23-24% by Goal 2XL at the aforementioned rates, respectively. In contrast to the traditional hole punch method that pushes soil from the treated surface into the hole to surround the transplant root ball, the mechanical transplanter creates a furrow and places the transplant below the soil surface treated with the herbicide. With the mechanical planting method, Goal 2 XL at the aforementioned rates injured the crops only 0-2, 1-3, 2-5, 3-9, and 7-10%, respectively. Transplant method did not influence crop heights at 21 DAT but as the rate of Goal 2XL increased crop heights were reduced up to 11%; no influence on crop heights was noted by 35 DAT. Although the mechanical transplanter reduced the level of damage of both broccoli and collard from Goal 2XL, neither planting method nor Goal 2 XL rate influenced yield of either crop.

Evaluation of Residual Herbicides for Broad-Spectrum Weed Control in Mississippi Corn. JW Reister*[1], T Bararpour[1], DA Bell[2]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Leland, MS (92)

Palmer amaranth (*Amaranthus palmeri*) control has become a challenge because of its high propensity to evolve herbicide resistance, resulting in reduced herbicide options in infested crops such as corn, soybean, and cotton. A field study was conducted in 2021 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate the residual activity of AAtrex, Dual II magnum, Sencor, Lexar, Callisto, Prowl, Outlook, Zidua, Corvus, ImpactZ, Capreno, Warrant, and Acuron, on glyphosate-resistant Palmer amaranth. Corn (P 1870 YHR) was planted on May 25 and emerged on May 31. The experiment was conducted as a randomized complete block design with 18 herbicide treatments and four replications. Plot size was 4 (40 inch) rows 13.3-ft wide by 20-ft long with 10-ft alleys between replications. Glyphosate-resistant Palmer amaranth seeds were broadcasted in the entire experiment site to make sure for uniform Palmer amaranth distribution per plot. Visual estimates of glyphosate-resistant Palmer amaranth emergence/control were recorded at prescribed intervals after peremergence herbicide applications on May 25. The following herbicide treatments were used: 1) Dual II Magnum (*S*-metolachlor) at 1.3 pt/A; 2) AAtrex (atrazine) at 2 qt/A; 3) Dual II Magnum + AAtrex at 1.5 qt/A; 4) Outlook (dimethenamid-p) at 14 oz/A; 5) Outlook + AAtrex at 1.5 qt/A; 6) Callisto (mesotrione) at 6.5 oz/A; 7) Callisto + AAtrex at 1.5 qt/A; 8) Callisto + AAtrex at 1.5 qt/A + Dual II Magnum; 9) Sencor (metribuzin) at 0.5 lb ai/A; 10) Sencor + Dual II Magnum; 11) Corvus (isoxoflutole + thiencarbazone) at 5.6 oz/A; 12) ImpactZ (topramezone + atrazine) at 8 oz/A; 13) Prowl (pendimethalin) at 3 pt/A; 14) Lexar (*S*-metolachlor + mesotrione + atrazine) at 3 qt/A; 15) Capreno (thiencarbazone + tembotrione) at 3 oz/A; 16) Zidua SC (pyroxasulfone) at 4.5 oz/A; 17) Warrant (acetochlor) at 3 pt/A; 18) Acuron (*S*-metolachlor + atrazine + bicyclopyrone + mesotrione) at 2.5 qt/A. A nontreated check was included in the study. There was no corn injury. Glyphosate-resistant Palmer amaranth control was 66, 93, 98, 56, 94, 78, 96, 100, 80, 89, 86, 71, 58, 100, 74, 69, 51, and 90% control for herbicide treatment 1 through 18 by four-weeks after application (WAA), respectively. Only two residual herbicide treatment of Callisto + AAtrex + Dual II Magnum (Trt. 8) and Lexar (Trt. 14) provided the best (98%) and longer residual activity of glyphosate-resistant Palmer amaranth control by 7 WAA. Entireleaf morningglory (*Ipomoea hederacea* Jacq. var. *integriuscula*) was difficult to control. Only Outlook + Aatrex (Trt. 5), Callisto + AAtrex + Dual II Magnum (Trt. 8), Lexar (Trt. 14), and Acuron (Trt. 18) herbicide treatments provided >96% control of morningglory by 7 WAA. All herbicide treatments provided >95% control of prickly sida (*Sida spinosa*) 4 WAA and 90 to 100% by 7 WAA. Overall, all herbicide treatments (except Trt. 1) provided 95 to 100% hemp sesbania (*Sesbania herbacea*) control 4 WAA. By 7 WAA, only herbicide treatment 2, 3, 5, 7, 8, 10, 12, 14, and 18 provided 99 to 100% control of hemp sesbania.

Optimum Cover Crop Termination Timing in Corn Weed Control System. A Ross*[1], T Barber[2], LM Collie[3], RC Doherty[4], ZT Hill[5]; [1]University of Arkansas Cooperative Extension Service, Ward, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Lonoke, AR, [4]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [5]University of Arkansas Cooperative Extension Service, Monticello, AR (93)

Optimum Cover Crop Termination Timing in Corn Weed Control System A.W. Ross[1], L.T. Barber[1], R.C, Doherty[2], Z.T. Hill[2], L.M. Collie[1] [1]University of Arkansas Research and Extension Service Lonoke AR [2]University of Arkansas Research and Extension Service, Monticello AR Abstract Cover crops have become increasingly popular in the midsouth, 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. In 2021 a research study was conducted at the Lon Mann Cotton Research Station in Marianna, AR to determine the optimum time to terminate a cover crop, while also achieving sufficient weed control and optimum corn yield. A common cover crop blend including cereal rye, Austrian winter pea, vetch, clover and radish was planted in November 2020. Corn was planted in April 2021, utilizing Pioneer 1197 YHR variety planted at 32,000 seeds to the acre. The test was designed as a randomized complete block with seven cover crop termination timings: 14 and 7 days prior to planting (DPP), at planting (AP), and 7, 14, 21, and 28 days after planting (DAP). A conventional tillage treatment was added for comparison and was treated with the standard program used for termination. All termination treatments consisted of glyphosate (Roundup Powermax 3) applied at 40 oz/A plus *S*-metolachlor (Dual II Magnum) at 1.3 pt/A and atrazine (Aatrex) at 1 qt/A. A standard POST application was made at V4 corn stage across all treatments utilizing a premix of *S*-metolachlor, glyphosate, and mesotrione (Halex GT) at 2 qt/A plus Atrazine at 1 qt/A. A visual weed control assessment was taken 4 weeks after planting. There was no significant difference in Palmer amaranth or barnyardgrass control when cover crop was terminated 7 DPP, at planting, and 7,14,21, and 28 DAP. Palmer amaranth was 78-90% controlled while barnyardgrass was 81-91% controlled. The 14 DPP termination timing only provided 50% control of Palmer amaranth and 47% control of barnyard grass, while the conventional tillage treatment provided the least (37%) control of both Palmer amaranth and barnyardgrass. Control of Palmer amaranth and barnyardgrass was increased to 94-99% for all termination timings following the V4 POST application and no significant differences were observed from 7-21 days following the application. Corn yields were highest (160-181 bu/A) for 14 DPP, and 7 DPP termination timings, and the conventional tillage treatment. Yields from plots where cover crop was terminated at-planting, 7,14, and 28 DAP ranged from 144-128 bu/A. Cover crops terminated at 21 DAP resulted in the lowest yield of the study, only 97 bu/A. These data suggest that terminating cover crops 7 DPP will result in improved weed control while maintaining optimum corn yields.

Comparing the Accuracy of Available Weather Resources for Pesticide Applicators Across Multiple States. SA Nolte*[1], ZS Howard[2], NJ Arneson[3], N Arsenijevic[3], M Bish[4], KW Bradley[4], IB Cuvaca[5], KL Gage[6], JT Ikley[7], WG Johnson[8], LM Lazaro[9], S Lancaster[10], T Legleiter[11], M Loux[12], E Miller[6], BG Young[13], R Werle[3], M Zimmer[8]; [1]Texas A&M AgriLife Extension, College Station, TX, [2]Texas A & M University, College Station, TX, [3]University of Wisconsin-Madison, Madison, WI, [4]University of Missouri, Columbia, MO, [5]University of Nebraska-Lincoln, Lincoln, NE, [6]Southern Illinois University Carbondale, Carbondale, IL, [7]North Dakota State University, Fargo, ND, [8]Purdue University, West Lafayette, IN, [9]LSU Ag Center, Baton Rouge, LA, [10]Kansas State University, Manhattan, KS, [11]University of Kentucky, Princeton, KY, [12]The Ohio State University, Columbus, OH, [13]Purdue University, Brookston, IN (94)

Growth Stage and Varietal Sensitivity of White Clover to Florpyrauxifen-benzyl-containing Herbicides.
WC Greene*, ML Flessner; Virginia Tech, Blacksburg, VA (95)

Florpyrauxifen-benzyl + 2,4-D is a new herbicide for pastures and hayfields that is expected for commercial release in 2022. Florpyrauxifen-benzyl + 2,4-D is reported to preserve established white clover (*Trifolium repens*. L.) while controlling broadleaf weed species. Two greenhouse trials were conducted in Blacksburg, Virginia in order to evaluate white clover sensitivity as affected by growth stage and white clover variety. Growth stages evaluated were vegetative (3-4 trifoliate) and flowering. White clover varieties evaluated included 'Patriot', 'Ladino', 'Durana', and 'Alice'. Herbicides evaluated for growth stage sensitivity included 1) florpyrauxifen-benzyl + 2,4-D (9 + 560 g ha^{-1}), (2) florpyrauxifen-benzyl + 2,4-D (18 + 1,120 g ha^{-1}), (3) florpyrauxifen-benzyl (9 g ha^{-1}), (4) florpyrauxifen-benzyl (18 g ha^{-1}), (5) 2,4-D (560 g ha^{-1}), (6) 2,4-D (1,120 g ha^{-1}), and (7) dicamba + 2,4-D (560 + 1,120 g ha^{-1}). For the varietal sensitivity trial, herbicides evaluated included 1) florpyrauxifen-benzyl + 2,4-D (9 + 560 g ai ha^{-1}), (2) florpyrauxifen-benzyl + 2,4-D (18 + 1,120 g ha^{-1}), (3) 2,4-D (560 g ha^{-1}), (4) 2,4-D (1,120 g ha^{-1}), and (5) dicamba + 2,4-D (560 + 1,120 g ha^{-1}). Six weeks following herbicide application, plant height as well as above ground biomass was collected. All data were expressed as a percentage of the nontreated control and subject to ANOVA using Fisher's protected LSD ($p \leq 0.05$). Results from the growth stage study showed that flowering clover was more susceptible than vegetative, although differences in biomass were not significant across all herbicide treatments. Treatments which did not reduce biomass compared to the nontreated control included: florpyrauxifen-benzyl (18 g ha^{-1}) to vegetative and flowering clover, 2,4-D (560 g ha^{-1}) to vegetative and flowering clover, and 2,4-D (1,120 g ha^{-1}) to vegetative clover. White clover variety did not have an effect on white clover biomass, six weeks following herbicide treatment, therefore results were pooled across variety. All herbicides decreased above-ground biomass compared to the nontreated control. Dicamba + 2,4-D and florpyrauxifen-benzyl + 2,4-D (18 + 1,120 g ha^{-1}) resulted in the greatest decrease in white clover biomass, while both rates of 2,4-D (560 g ha^{-1} and 1,120 g ha^{-1}) resulted in the least reduction in biomass. These results suggest that white clover growth stage can influence the level of herbicide injury, while white clover variety does not have an effect on white clover injury following applications of florpyrauxifen-benzyl- containing herbicides. Although florpyrauxifen-benzyl + 2,4-D did significantly reduce white clover biomass, white clover was not completely killed, demonstrating a level of tolerance to florpyrauxifen-benzyl + 2,4-D, suggesting that white clover may recover following herbicide application.

Evaluation of Corn Herbicide for Johnsongrass Control. DA Bell*[1], T Bararpour[2], JW Reister[2]; [1]Mississippi State University, Leland, MS, [2]Mississippi State University, Stoneville, MS (96)

Johnsongrass *(Sorghum halepen)* has been a problematic weed for years because of its competitive nature of growth. Often growing to 6-8 feet tall, it can severely lower yields in corn, cotton, soybeans, and other crops. A field study was conducted in 2020 at the Delta Research and Extension Center in Stoneville, Mississippi to evaluate the effectiveness of various herbicides on Johnsongrass control. There was not any crop in this study (non-crop situation). The experiment was conducted as a randomized complete block design with 11 herbicide treatments and four replications in a natural johnsongrass population. Plot size was 13.3-ft wide (four rows) by 20-ft long with 10-ft alleys between replications. The following herbicide treatments were used: 1) Select Max (clethodim) at 12.8 oz/a + COC (Agri-Dex) at 1% v/v; 2) Assure II (quizalofop) at 9.2 oz/a + COC; 3) Fusilade (fluazifop) at 12 oz/a + COC; 4) Clincher (cyhalofop) at 15 oz/a; 5) Ricestar (fenoxaprop) 24.3 oz/a; 6) Axial (pinoxaden) at 16.2 oz/a; 7) Liberty (glufosinate) at 32 oz/a; 8) Roundup PowerMax (glyphosate) at 32 oz/a; 9) Select Max + Roundup PowerMax + COC; 10) Select Max + Liberty + COC; and 11) Select Max + Liberty + Roundup PowerMax + COC. A nontreated check was included in the study. All postemergence applications were made on 8- to 10-inch tall johnsongrass. Four weeks after postemergence applications (WAA), all johnsongrass were mowed down for regrowth evaluation. Johnsongrass control was 90, 92, 91, 95, and 95% for treatments 7, 8, 9, 10, and 11 at 1 WAA, but treatments 2 through 7 resulted in 70, 68, 57, 13, 45, and 8% johnsongrass control, respectively. Two WAA, johnsongrass control from application of treatments 1, 2, 3, and 5 improved to 84, 85, 82, and 78%, respectively. Johnsongrass control was 88 and 87, 87 and 89, 82 and 82, 22 and 33, 82 and 80, 8 and 8, 97 and 95, 100 and 100, 98 and 98, 100 and 100, 100 and 100 from the application of treatment 1 through 11, respectively. Johnsongrass regrowth evaluation was made 3-weeks after the test area was mowed down. There was johnsongrass regrowth from every herbicide application except from Roundup PowerMax (treatment 8). Roundup PowerMax alone application was the only treatment that provided 100% johnsongrass control with no-regrowth.

Effect of Cotton Herbicide Programmes on Weed Species Populations Over Time. FH Oreja*, M Inman, DL Jordan, RG Leon; North Carolina State University, Raleigh, NC (97)

The adoption of dicamba-resistant cotton allows using this herbicide to control and reduce weed populations in the long-run. However, the repetitive use of dicamba to control herbicide-resistant Palmer amaranth (*Amaranthus palmeri*) increases the risk of changing weed community structure and lower the number of species. The objective of this work was to determine the population trajectories of weed species over 8 years with herbicide programs that included glyphosate, dicamba, and residual herbicides. In 2011, a cotton experiment was established and during the first four years, treatments included postemergence applications of glyphosate, with or without dicamba, and with or without pre-emergence herbicides. Glyphosate plus dicamba was applied to the entire test area for the final 4 years of the study. Soil core samples were taken every spring, before planting, to estimate seedbank weed community. Population trajectories exhibited different patterns depending on the weed species and herbicide programs. Density of Palmer amaranth increased during the first 4 years, except in those treatments with dicamba applied every year, which decreased linearly. During the final 4 years, when dicamba was added to all treatments, density decreased. Modifications in Palmer amaranth population density affected some species depending on herbicide program. Thus, when herbicide programs favored *A. palmeri* population growth, this reduced the population of other weed species and vice versa. This was the case for large crabgrass (*Digitaria sanguinalis*), carpetweed (*Mollugo verticillata*), annual sedge (*Cyperus compressus*) and false daisy (*Eclipta prostrata*). Goosegrass (*Eleusine indica*) was not affected by *A. palmeri* population levels and, even in some herbicide programs, increased its density. This study further demonstrates the prolific growth and reproductive ability of Palmer amaranth when exposed to poor control strategies and how this species can affect the community assembly interacting with herbicide programs.

Response of Peanut Cultivars to Postemergence Herbicides. P Devkota*[1], N Singh[1], BL Tillman[2]; [1]University of Florida, Jay, FL, [2]University of Florida/IFAS NFREC, Marianna, FL (99)

Peanut varieties are continuously being developed, improved, and introduced to the growers. At the time of release, little is known about the susceptibility of new peanut varieties to herbicide injury and this situation has often led to greater injury than anticipated. Research was conducted to evaluate tolerance of newly developed peanut varieties to postemergence herbicides. Three peanut varieties, two recently developed (FloRun T61, runner type; and Walton, virginia type) and one existing commercial variety (FloRun 331, runner type) were tested in the study. Herbicide treatment consisted of early postemergence (EPOST) application of paraquat+bentazon or 2,4-DB (tank-mixed with *S*-metolachlor) at 4 wk after planting (WAP). The EPOST treatments were followed by postemergence (POST) application of either acifluorfen, lactofen, or carfentrazone (tank-mixed with imazapic) at 8 WAP. The results illustrated that there was difference on plant height among peanut varieties at 4 wk after EPOST treatment, but similar response did not exist for injury and canopy width. Across the peanut variety, paraquat+bentazon resulted 3 and 6 cm lesser peanut height and canopy width, respectively, compared to 2,4-DB. There was no effect of peanut variety on injury, canopy height and width, and yield after POST treatment. However, there was a significant response of POST herbicide treatment on peanut injury and yield. At 4 WAT, the injury was higher from carfentrazone applied with imazapic compared to acifluorfen or lactofen applied with imazapic. Peanut yield was similar across peanut varieties; however, the difference existed among herbicide treatments. Among the herbicide program (EPOST fb POST), peanut yield was at least 182 $kgha^{-1}$ lower from carfentrazone+imazapic application compared to other herbicide treatments. The results illustrate that the newly developed peanut varieties (FloRun T61 and Walton) have similar herbicide tolerance to commercial FloRun 331 variety. However, the peanut injury and yield response could vary depending upon herbicide chemistry.

Evaluation of Corn Herbicide for Prickly Sida Control. JW Reister*, T Bararpour; Mississippi State University, Stoneville, MS (100)

Prickly sida (*Sida spinosa*) becoming a difficult weed to control in many crops. A field study was performed at the Delta Research and Extension Center in Stoneville, Mississippi in 2020 to evaluate corn herbicide for prickly sida control. The study was designed as a randomized complete block with 14 treatments and three replications. The plots measured 13.3 ft. wide (four rows) by 20 ft long with a 10 ft alley between each replication. The test was established in a natural population of prickly sida at 14 plants 10 ft^{-2}. The following herbicide treatments were used: 1) Roundup PowerMax (glyphosate) at 32 oz/a; 2) Liberty (glufosinate) at 32 oz/a; 3) AAtrex (atrazine) at 2 qt/a; 4) Enlist Duo ((2,4-D + glyphosate) at 4 pt/a; 5) Capreno (thiencarbazone + tembotrione) at 3 oz/a + Induce (NIS) at 0.25% v/v; 6) Corvus (isoxoflutole + thiencarbazone) at 4 oz/a; 7) AAtrex + Capreno + NIS; 8) AAtrex + Corvus; 9) Halex GT (mesotrione + *S*-metolachlor + glyphosate) at 3.6 pt/a; 10) Callisto (mesotrione) at 6.5 oz/a; 11) 2, 4-D (dimethylamine salt) at 2 pt/a + NIS; 12) Clarity (dicamba) at 1 pt/a + NIS; 13) Gramoxone (paraquat) at 32 oz/a. A nontreated check was included in the test. All herbicides applied postemergence at 3- to 6-leaf prickly sida (2- to 3-inch).Treatment 2, 7, 8, and 13 were the only treatments that provided >90% prickly sida control at 1 week after application (WAA). Capreno (Trt. 5) and Corvus (Trt. 6) treatments provided only 18 to 25% prickly sida control. Treatments 1, 7 and 8 were the only applications that controlled prickly sida 98 to 100% at 2 WAA. Capreno and Corvus applications were the weakest herbicide to control prickly sida (45 to 48%). By 3 WAA, Treatments 1, 4, 7, and 8 were the only herbicide applications that controlled prickly sida 93 to 100%. Callisto application (Trt. 10) only provided 60% prickly sida control. Prickly sida control was 99, 70, 91, 99, 52, 45, 100, 100, 86, 64, 75, 78, and 75% from the herbicide application 1 through 13 by 4 WAA. Overall, the postemergence applications of Roundup PowerMax, Enlist Duo, AAtrex + Capreno + NIS, and AAtrex + Corvus were the best herbicide treatments for controlling prickly sida.

Kyber Clean: an Effective Solution for Managing Resistant Weeds in Enlist Soybean. KA Backscheider*[1], J Armstrong[2], DM Simpson[2], D Johnson[3], K Johnson[4], K Rosenbaum[5], F Meeks[6]; [1]Corteva Agriscience, Franklin, IN, [2]Corteva Agriscience, Indianapolis, IN, [3]Corteva Agriscience, Eagan, MN, [4]Corteva Agriscience, Lafayette, IN, [5]Corteva Agriscience, Coffee, MO, [6]Corteva Agriscience, Johnston, IA (101)

Kyber™ herbicide is a new Corteva Agriscience™ preemergence herbicide that contains three modes of action, pyroxasulfone, flumioxazin, and metribuzin. Kyber™ was launched commercially in 2020 and is an effective preemergence herbicide in an Enlist® soybean program. Trials were conducted in 2021 to evaluate the crop response and weed control with Kyber™ in Enlist® herbicide programs. Minimal (≤10%) crop response was observed with Kyber™ applied when evaluated across several conventional tillage and no-till locations. When used in the Enlist® weed control system, Kyber™ herbicide provided early season residual control of glyphosate-resistant waterhemp (*Amaranthus tuberculatus*), Palmer amaranth (*Amaranthus palmeri),* and kochia (*Bassia scoparia)* with a single postemergence application of 2,4-D choline + glyphosate or glufosinate resulting in season long weed control. Kyber™ herbicide with three modes of action will be an important resistant management tool when used with Enlist® soybean or other soybean herbicide traits.

Multi-state Emergence Modeling for Foxtail (Setaria Spp.) in Mixed-grass Pastures. NT Basinger*1, T Reinhardt Piskackova2, DP Russell3, RG Leon4, ML Flessner5, WC Greene5, FH Oreja4; 1University of Georgia, Athens, GA, 2Czech University of Life Sciences Prague, Prague 6 - Suchdol, Czechia (Czech Republic), 3Auburn University, Madison, AL, 4North Carolina State University, Raleigh, NC, 5Virginia Tech, Blacksburg, VA (104)

Forage producers in the Southeast US are finding foxtail species increasingly problematic in grazing and hay production. Control of these species are can be accomplished through the application of preemergent herbicides. However, when applied at the wrong time, emerged foxtail plants are often unaffected by the herbicides. Four sites across the Southeastern US in Alabama, Georgia, North Carolina, and Virginia, were monitored in 2020 to determine factors affecting the germination of foxtail species. These sites varied in emergence patterns based on thermal time. North Carolina and Georgia tended to have emergence of all of the population by 1000 GDD, while Alabama and Virginia tended to have an elongated periodicity of germination with only 90% of the population emerging at 1000 GDD, but occuring at a slower rate than North Carolina and Georgia. This variability could have significant impacts on weed management for this genus of problematic weeds in pasture.

Dicamba Residues in Leaves, Fruits, and Roots of Tomato Plants Treated with Low Rates of Dicamba at Different Growth Stages. T Tseng*[1], T Bararpour[2], Z Yue[1], AL Miller[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Stoneville, MS (105)

A greenhouse study was conducted in 2020 at the Delta Research and Extension Center in Stoneville, Mississippi, to determine the effect of low rate (simulated drift rate) of dicamba on tomato at different growth stages and possible contamination of the fruit. Tomato (cherry tomato) seeds were planted in the small pots (2.5” x 2.5” x 3”) containing putting-mix on January 20, 2021; they emerged on January 25. Tomato seedlings were transplanted in a bigger pot (4” x 4” x 4.75”) on February 17. The experiment was designed as three (growth stage) by five (treatments) factorial arrangement in a randomized complete block and replicated four times. Treatments were as follows: 1) untreated control; 2) dicamba at 1/16X rate + Non-ionic surfactant (NIS) at 0.25% (v/v); 3) dicamba at 1/32X rate + NIS; 4) dicamba at 1/64X rate + NIS; and 5) dicamba at 1/128X rate + NIS. The 1X rate of dicamba is 16 fl oz/A. The three-growth stage of tomato (application timing) were: A) vegetative stage (before flowering); B) at flowering; and C) at fruiting. One week after application (WAA), tomato at the vegetative stage was most sensitive compared to the flowering or fruiting stage, but in general, tomato injury was not significantly different between the flowering and fruiting stage. Two WAA, tomato at the vegetative stage was still most sensitive compared to the flowering or fruiting stage, but the injury was not different between the flowering and fruiting stage, except at 1/32 X. Tomato injury increased as dicamba rate increased. At 3 WAA, tomato injury from dicamba application was significantly different in terms of the growth stage. Tomato at the vegetative stage was most sensitive compared to the flowering or fruiting stage, but tomato injury was not different between flowering and fruiting stage (except dicamba at 1/32 X). Tomato injury at the vegetative stage increased as the dicamba rate increased. The seedlings at the vegetative stage (application A= 5- to 6-leaf tomato with 9- to 10-inch in height) sprayed on February 24 did not produce any fruit except the untreated check. However, tomato at flowering (application B) and tomato at fruiting stage (application C), which were sprayed with dicamba on March 23 and April 21, produced fruits. Harvested tomato fruits from dicamba application at 1/16 X, 1/32 X, 1/64 X, and 1/128 X and from untreated check (the tomato progeny or F1) were planted on May 4, and seedlings emerged on May 11. The tomato seedlings (F1 = progeny) were evaluated on May 27, June 3, June 10, June 17, and June 24 for any injury or dicamba symptomology. The tomato progeny (F1) were evaluated five times (every week) and did not show any visual dicamba symptomology. The results of the HPLC analysis indicated that none of the fruit samples showed any levels of dicamba. Samples were taken from upper, middle, and lower fruits from each treatment and did not find any dicamba in them. In general, tomato at the vegetative stage was most sensitive compared to the flowering or fruiting stage, but in general, tomato injury was not significantly different between the flowering and fruiting stage. Tomato injury increased as the dicamba rate increased. The tomato progeny (F1) did not show any visual dicamba symptomology. HPLC analysis indicated that none of the fruit samples showed any levels of dicamba.

Response of Creeping Bentgrass and Common Turfgrass Weeds to Plant Growth Regulators. GM Henry*, KA Tucker; University of Georgia, Athens, GA (106)

Frequent use of plant growth regulators (PGRs) may decrease turfgrass recovery from wear and competition with weeds. Several PGRs are utilized in turfgrass and response of new creeping bentgrass (*Agrostis stolonifera* L.) cultivars is unknown. Therefore, the objective of our research was to evaluate the response of several creeping bentgrass cultivars and common turfgrass weeds to PGRs. Research was conducted in 2019 at the Athens Turfgrass Research and Education Center greenhouse in Athens, GA. Creeping bentgrass cultivars ('Penncross', 'L-93', '007', 'V-8', and 'Tour Pro') and weed species {goosegrass [*Eleusine indica* (L.) Gaertn.] and large crabgrass (*Digitaria sanguinalis* L.)} were examined. Plant growth regulator treatments consisted of trinexapac-ethyl (TE) (48 and 96 g ai ha^{-1}) and prohexadione calcium (PC) (116 and 231 g ai ha^{-1}). Plant pots were cut to 2.5 cm after two weeks of growth and above-ground plant tissue was weighed to obtain biomass (g). Only 116 g ai ha^{-1} of PC was required to regulate creeping bentgrass cultivars, while the higher rate (96 g ai ha^{-1}) of TE was needed to provide moderate regulation [40 to 50% growth inhibition (GI)], regardless of cultivar. Some creeping bentgrass cultivars exhibited a differential response to PGRs. The least amount of regulation in response to TE (22 to 33% GI) was observed by 'V-8'; however, 'V-8' was one of the most regulated cultivars by PC (79 to 80% GI). Neither PGR successfully regulated goosegrass (14 to 30% GI), regardless of rate, but moderate regulation of large crabgrass (40 to 49% GI) was observed in response to TE at 96 g ai ah^{-1} and PC at 116 and 231 g ai ha^{-1}. Recurrent PGR applications may shift turfgrass-weed competition dynamics in favor of problematic weeds like goosegrass; however, this effect may be PGR specific.

Tolerance of Iron Cutter Hybrid Bermudagrass to Postemergence Herbicides. GM Henry*, E Begitschke, KA Tucker; University of Georgia, Athens, GA (107)

New turfgrass cultivars are frequently released without a comprehensive understanding about their responses to certain management practices. 'Iron Cutter' hybrid bermudagrass [*Cynodon dactylon* (L.) Pers. × *Cynodon transvaalensis* Burtt Davy] was released from Oklahoma State University in 2019 with significant improvements in drought, traffic, and cold tolerance; however, little is known about its response to common postemergence herbicides. A field study was conducted at the Athens Turfgrass Research and Education Center in Athens, GA during the summer of 2021. Herbicide treatments were initiated on 15 July 2021 and included topramezone at 32 g ai ha^{-1} + metribuzin at 183 g ai ha^{-1} (TM), thiencarbazone + foramsulfuron + halosulfuron (Tribute Total) at 136 g ai ha^{-1}, thiencarbazone + iodosulfuron + dicamba (Celsius) at 233 g ai ha^{-1}, 2,4-D + triclopyr + dicamba + pyraflufen at 1200 g ai ha^{-1} (4Speed XT), foramsulfuron (Revolver) at 15 g ai ha^{-1}, sulfosulfuron (Certainty) at 66 g ai ha^{-1}, monosodium methanearsonate (MSMA) at 2300 g ai ha^{-1}, quinclorac (Drive XLR8) at 830 g ai ha^{-1}, and 2,4-D + mecoprop + dicamba + carfentrazone (SpeedZone Southern) at 227 g ai ha^{-1}. Methylated seed oil was added to Tribute Total, Celsius, Revolver, and Drive XLR8 at 0.5% v/v, while a non-ionic surfactant at 0.25% v/v was added to Certainty. A non-treated check was added for comparison. Sequential treatments were applied on 12 Aug. 2021. All treatments maintained similar turfgrass color (TC), turfgrass quality (TQ), and NDVI measurements as the non-treated check except TM, 4SpeedXT, and Drive XLR8. At 3 weeks after initial treatment (WAIT), TC, TQ, and NDVI for TM (4.5, 5.9, and 0.7, respectively), 4Speed XT (5.1, 5.1, and 0.75, respectively), and Drive XLR8 (5.5, 6.1, and 0.79, respectively) were lower than the non-treated check (7.3, 6.9, and 0.85, respectively). All treatments recovered 4 WAIT, but a similar trend was observed after sequential herbicide applications.

Prickly Sida Control in Cotton and Soybean. JL Reeves*[1], L Steckel[2]; [1]The University of Tennessee, Jackson, TN, [2]University of Tennessee, Jackson, TN (108)

Prickly Sida Control in Cotton and Soybean.Julie L. Reeves*, and L.E. SteckelUniversity of Tennessee – JacksonPrickly sida (Sida spinosa L.) has been very prevalent in Tennessee fields the last few years. Built up seed banks have emerged and growers have reported increasingly poor control of prickly sida especially when spraying dicamba tank mixed with glyphosate. This growing concern initiated research in testing other herbicides on their prickly sida efficacy. A 2021 field study was conducted on dicamba tolerant cotton and soybean with preemergence and postemergence applications. The experiment was conducted at the West TN Research and Education Center in Jackson, TN and arranged in a randomized complete block design. AIXR flat fan and TTI nozzles were used in this experiment. The cotton and soybean fields were burned down with paraquat prior to planting. The cotton experiment consisted of five treatments and the soybean experiment had six treatments. The preemergence herbicide treatments in the cotton experiment included in order 1) untreated check, 2) 24 oz of fluometuron + 24 oz prometryn, 3) 24 oz of fluometuron + 3 oz of pyrithiobac-sodium, 4) 24 oz of fluometuron + 24 oz prometryn, and 5) 24 oz of fluometuron + 3 oz of pyrithiobac-sodium. The postemergence herbicide treatments in the cotton experiment included in order 1) untreated check, 2) 30 oz of glyphosate + 12.8 oz of dicamba, 3) 30 oz glyphosate + 12.8 oz dicamba, 4) 30 oz glyphosate + 12.8 oz dicamba + 3 oz pyrithiobac-sodium, and 5) 30 oz glyphosate + 12.8 oz dicamba + 3 oz pyrithiobac-sodium. The preemergence herbicide treatments in the soybean experiment included an untreated check and a blanket application of 32 oz metribuzin + s-metolachlor. The postemergence herbicide treatments in the soybean experiment included in order 1) untreated check, 2) 30 oz glyphosate + 12.8 oz dicamba, 3) 30 oz glyphosate + 12.8 oz dicamba + 0.10 oz flumetsulam, 4) 30 oz glyphosate + 12.8 oz dicamba + 0.20 oz flumetsulam, 5) 30 oz glyphosate + 12.8 oz dicamba + 0.30 oz flumetsulam, and 6) 30 oz glyphosate + 12.8 oz dicamba + 0.5 oz chlorimuron ethyl. Preemergence treatments were applied immediately after planting and postemergence treatments were applied when prickly sida reached 2 – 3 inches in height. Visual rating of prickly sida control were assessed 14 and 21 days after preemergence treatments were applied and 7, 14, and 21 days after postemergence treatments were applied. Visual prickly sida control ratings were assessed on a scale of 0 to 100% where 0 = no control and 100 = control. Visual cotton and soybean injury ratings were assessed on a scale of 0 to 100 % where 0 = no injury and 100 = plant death. Good prickly sida control preemergence and postemergence in both cotton and soybean experiments. No crop injury from any treatments preemergence or postemergence in cotton or soybean was observed. In the cotton experiment there was no difference of preemergence control of prickly sida in the fluometuron + prometryn treatments compared with the fluometuron + pyrithiobac-sodium treatments. However, at the 21 day after application rating, there was a difference in postemergence control; glyphosate + dicamba had less control compared with glyphosate + dicamba + pyrithiobac-sodium. In the soybean experiment there was a difference between all treatments when rated at 21 days after application. Glyphosate + dicamba + chlorimuron ethyl had the highest control and glyphosate + dicamba + flumetsulam (0.20 oz) provided less control. Control of prickly sida at 90 % or higher was observed across all treatments.

Control of Ryegrass in Northeast Texas Wheat. CA Jones*[1], AD Braley[2], DR Drake[3]; [1]Texas A&M University, Commerce, TX, [2]Texas A&M University Commerce, Commerce, TX, [3]Texas A&M AgriLife Extension Service, Commerce, TX (109)

A study was initiated near Fairley, Tx to evaluate the control of ALS and ACC'ase resistant annual ryegrass in wheat.

Evaluation of Reviton (Tiafenacil) Herbicide in Preplant Burndown Programs. DA Bell*[1], T Bararpour[2], D Akin[3]; [1]Mississippi State University, Leland, MS, [2]Mississippi State University, Stoneville, MS, [3]Helm Agro, Murray, KY (110)

Reviton is a non-selective herbicide preplant burndown of broadleaf and grass weeds in corn, wheat, cotton, and soybeans. A field study was conducted in 2021 at the Delta Research and Extension Center in Stoneville, Mississippi, to evaluate the effectiveness of Revition on horseweed (*Conyza canadensis*), cutleaf-evening primrose (*Oenothera laciniata*), and white clover (*Trifolium repens*). Horseweed seed was broadcasted in the entire experiment site to make sure for uniform distribution per plot. The experiment was conducted as a randomized complete block design with four replications. Plot size was 13.3-ft (four rows) wide by 20-ft long with 10-ft alleys between replications. The following herbicide treatments were used: 1) Reviton at 2 fl oz/a; 2) Reviton at 1 fl oz/a + Roundup PowerMax (glyphosate) at 1 lb ai/a; 3) Sharpen (saflufenacil) at 1 fl oz/a + Roundup PowerMax; and 4) Reviton at 1 fl oz/a + Roundup PowerMax + Valor (flumioxazin) at 2 oz/a. A nontreated check was included in the study. All herbicide applications had MSO at 1% v/v. Horseweed, cutleaf-evening primrose, and white clover height at time of herbicide applications were 5, 6, and 3-inch. Treatment 1 through 4 provided 66 and 66, 90 and 91, 100 and 100, 90 and 84% control of horseweed 3 and 4 weeks after application (WAA), respectively. By 6 WAA, horseweed control was 53, 91, 100, and 79% for treatments 1 through 4. Cutleaf-evening primrose control was 87 and 87, 94 and 95, 85 and 88, 93 and 95% from the herbicide treatment 1 through 4 at 3 and 4 WAA, respectively. Treatment 1 through 4 provided 90, 95, 85, and 93% control of cutleaf-evening primrose by 6 WAA. All herbicide treatments controlled white clover 91 to 98% at 4 WAA. White clover control was 94, 96, 93, and 98% for herbicide treatment 1 through 4 by 6 WAA, respectively. Reviton alone did not provide a good control of horseweed and it needs a tank-mix partner, but it provided excellent (94%) control of white clover. In general, Reviton alone provided 90% control of cutleaf-evening primrose (a difficult weed to control).

Seedling Oat Response to Postemergence Residual Herbicides. MW Marshall*; Clemson University, Blackville, SC (111)

Annual ryegrass has become a serious pest in small grain production in the Southeast United States. It has been confirmed resistant to several herbicide modes-of-action including ACCase, ALS-inhibitors, and EPSP-synthase. Although oat production is relatively small portion of the small grain acreages in the South, there is a sizable production area in the lower coastal plain of South Carolina. This is due to its proximity and market in Charleston, South Carolina. Several postemergence residual herbicides are labeled for wheat for management of resistant ryegrass. These postemergence residual herbicides (i.e., pyroxysulfone and flumioxazin) are not currently labeled for oats. This is attributed to oat sensitivity to these herbicides at the wheat use rates. Very little information exists in the literature on tolerance of seedling oats to these herbicides; therefore, a greenhouse study was initiated in 2021 to determine response of oats to postemergence applications at the spike growth stage. Pyroxysulfone alone, flumioxazin alone, and in combination were evaluated in the greenhouse. Oat variety 'Graham' was seeded in pots in the greenhouse. A final plant density of 10 plants per pot was established. Study was a randomized complete block design with 10 replications. Herbicides were sprayed at the spike to 1-leaf growth stage. At 21 days after treatment, plants were clipped at the soil surface, placed in paper bags, and dried in the oven for 2 days. Biomass for the 10 plants was recorded after the drying time elapsed. The study was repeated 3 times. In the flumioxazin-only treatments, oat biomass ranged from 1.74 g at the 0.016 lb ai/A rate to 0.50g at the 0.13 lb ai/A rate. Similarly, pyroxysulfone treated oat ranged from 1.28 g at the 0.027 lb ai/A rate to 0.46 g at the 0.13 lb ai/A rate. The combination of flumioxazin and pyroxsulfone ranged from 1.44 g to 0.7 g at the rates tested above. The results clearly demonstrate that oat has some tolerance to these herbicides at the rates evaluated in this study. At the 2X rate of flumioxazin and pyroxysulfone, there was a sharp decrease in biomass. The 2X rate would demonstrate the effects sprayer overlap and doubling up on the end-rows. In summary, there is potential for these herbicides in oat for annual ryegrass control. Future research would involve testing these rates of flumioxazin and pyroxysulfone in a field to confirm these results.

Exploring the Mechanism of Resistance to Soil-applied Fomesafen in Palmer Amaranth. G Rangani*; University of Arkansas, Fayetteville, AR (112)

Resistance to protoporphyrinogen oxidase (PPO)-inhibitors in Palmer amaranth is a great concern given the high selection pressure and increasing number of populations with reduced sensitivity to PPO herbicides in the US. We evaluated the effect of five soil-applied herbicides among the Palmer amaranth accessions collected between 2008 and 2015 in Arkansas. Soil-applied saflufenacil, sulfentrazone, and flumioxazin reduced the seedling emergence effectively; however, fomesafen and oxyfluorfen showed reduced efficacy on some accessions. Target-site mutation (TSM) is the major mechanism of PPO resistance, therefore six accessions that showed reduced sensitivity to soil-applied fomesafen were selected for molecular investigations. A total of 15-20 survivors (considering two independent runs) were genotyped for all known resistance-conferring mutations. A total of 27%, 62% and 11% survivors had one, two and three TSMs, respectively. Copy number of PPO2 was determined in each survivor to check if multiple mutations were contributed by additional copy. Two accessions showed the presence of additional copy of PPO2 gene in 2-3 survivors, but the rest of the survivors had only one copy. Since the selected accessions are cross-resistant to other foliar-applied herbicides (Salas-Perez et al., 2017), the presence of non-target site mechanisms along with TSM contributing to soil-applied fomesafen resistance cannot be ruled out. The expression of PPO2 gene will be analyzed to understand the contribution of additional genetic factors. Ref: Salas-Perez, Reiofeli A., Nilda R. Burgos, Gulab Rangani, Shilpa Singh, Joao Paulo Refatti, Leonard Piveta, Patrick J. Tranel, Andy Mauromoustakos, and Robert C. Scott. (2017) Frequency of Gly-210 deletion mutation among protoporphyrinogen oxidase inhibitor-resistant Palmer amaranth (Amaranthus palmeri) populations. Weed Sci 65:718–731

Efficacy of Sicklepod Extract for Protection of Soybean from Soybean Loopers (*Chrysodeixis includens (Walker)*). Z Yue*, N Krishnan, T Tseng; Mississippi State University, Mississippi State, MS (113)

Soybean is the largest crop in terms of planting acreage and commodity value in Mississippi. Insects are one of the most damaging pests in Mississippi soybean production. Various strategies were developed to minimize soybean insect damage, among which insecticide is still the most prevalent. Extracts from some plants contain primary metabolites, secondary metabolites, and phytohormones, where secondary metabolites are small organic molecules functioning for defense purposes. The popular insecticide, bifen, was initially discovered in the chrysanthemum flower extract and then chemically synthesized. In this study, we prepared extracts from weed species such as sicklepod, coffee senna, and sesbania. We tested their efficacy on soybean loopers in the lab and against natural insect populations in the field. The soybean looper mortality was in the order: sesbania > coffee senna > sicklepod. In the field, soybean plants sprayed with coffee senna extract showed less insect defoliation after 40 days of application. The coffee senna extract application may have induced plant defense responses, leading to lower insect defoliation. Salicylic acid and jasmonic acid (defense-related plant hormones) are known to induce plant defense responses. Efforts are underway to identify defense mechanisms associated with sicklepod and coffee senna extract applications.

2021 Survey Results for the Most Common and Troublesome Weeds in Aquatic and Non-Crop Areas. L Van Wychen*[1], DE Carroll[2], R Champagne[3]; [1]Weed Science Society of America, Alexandria, VA, [2]The University of Tennessee, Knoxville, TN, [3]The University of Maine, Orono, ME (114)

The 2021 Weed Survey for the U.S. and Canada surveyed the most common and troublesome weeds in: 1) irrigation and flood control; 2) lakes, reservoirs, and rivers; 3) ponds; 4) forestry; 5) parks and refuges; 6) ornamentals: field nursery crops, outdoor containers, and Christmas trees; and 7) right-of-ways: railways, roads, public utilities. Common weeds refer those most frequently seen while troublesome weeds are the most difficult to control, but not necessarily widespread. There were 289 total survey responses from the U.S. and Canada, of which 88 were from the following 12 Southern Weed Science Society (SWSS) states: Alabama, Arkansas, Florida, Kentucky, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. No responses were submitted from Georgia or Louisiana. The following weed survey results are specific to the SWSS region. The top three common weeds in irrigation were 1) *Eichhornia crassipes*; 2) *Pistia stratiotes*; and 3) *Rotala rotundifolia* while the most troublesome weeds were 1) *Nymphoides cristata*; 2) *Eichhornia crassipes*; and 3) *Vallisneria americana*. The top three most common and troublesome weeds in lakes were *Eichhornia crassipes*, *Pistia stratiotes* and *Hydrilla verticillata.* The top three most common weeds in ponds were 1) *Hydrilla verticillata*; 2) *Algae* spp.; and 3) *Panicum repens* whereas the three most troublesome weeds were 1) a tie between *Algae* spp. and *Eleocharis baldwinii*; and 3) *Nymphoides cristata*. The top three most common weeds in forests were a three-way tie between *Ailanthus altissima*, *Ligustrum sinense*, and *Pyrus calleryana* while the most troublesome weeds were a four-way tie between *Ailanthus altissima*, *Triadica sebifera*, *Imperata cylindrica*, and *Pyrus calleryana.* The top three most common and troublesome weeds in parks were *Imperata cylindrica*, *Schinus terebinthifolius*, and *Lygodium microphyllum*. The most common weeds in ornamentals were 1) *Cyperus* spp.; and 2) a three-way tie between *Digitaria* spp., *Eleusine indica*, and *Euphorbia maculata* while the most troublesome weeds were 1) *Cyperus* spp.; and 2) a three-way tie between *Eclipta prostrata*, *Fatoua villosa*, and *Parthenium hysterophorus*. The top two most common and troublesome weeds for right-of-ways were *Lolium multiflorum* and *Sorghum halepense*. The 2021 weed survey data is available at: www.wssa.net/wssa/weed/surveys/.

Effect of Low Rate of Dicamba on Tomato at Different Growth Stages. T Bararpour*[1], T Tseng[2], R Hughes[1]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Mississippi State, MS (115)

Tomatoes (*Lycopersicon esculentum*) are very sensitive to many herbicides, and with new technologies available in soybean, cotton and other crops, off-target movement of herbicides, such as 2-4,D and dicamba, may become a concern. A greenhouse study was conducted in 2021 at the Delta Research and Extension Center, in Stoneville, Mississippi, to determine the effect of low rate (simulated drift rate) of dicamba on tomato at different growth stages and possible contamination of the fruit. Tomato (cherry tomato) seeds were planted in the small pots (2.5" x 2.5" x 3") containing putting-mix on January 20, 2021. Tomatoes were emerged on January 25. Tomato seedlings were transplanted in a bigger pot (4" x 4" x 4.75") on February 17. The experimental was designed as three (growth stage) by five (treatments) factorial arrangement in a randomized complete block and replicated four times. Treatments were as follows: 1) untreated control; 2) dicamba at 1/16X rate + Non-ionic surfactant (NIS) at 0.25% (v/v); 3) dicamba at 1/32X rate + NIS; 4) dicamba at 1/64X rate + NIS; and 5) dicamba at 1/128X rate + NIS. The 1X rate of dicamba is 16 fl oz/A. The three-growth stage of tomato (application timing) were: A) vegetative stage (before flowering); B) at flowering; and C) at fruiting.One week after application (WAA), tomato at vegetative stage was most sensitive compared to the flowering or fruiting stage, but in general tomato injury was not significant different between flowering and fruiting stage. Two WAA, still tomato at vegetative stage was most sensitive compared to the flowering or fruiting stage, but injury was not significant different between flowering and fruiting stage, except for 1/32 X. Tomato injury increased as dicamba rate increased. At 3 WAA, tomato injury from dicamba application was significantly different in terms of the growth stage. Tomato at the vegetative stage was most sensitive compared to the flowering or fruiting stage, but tomato injury was not different between flowering and fruiting stage (except dicamba at 1/32 X). Tomato injury at the vegetative stage increased as the dicamba rate increased. The seedlings at the vegetative stage (application A= 5- to 6-leaf tomato with 9- to 10-inch in height) sprayed on February 24 did not produce any fruit except the untreated check. However, tomato at flowering (application B) and tomato at fruiting stage (application C), which were sprayed with dicamba on March 23 and April 21, produced fruits. Harvested tomato fruits from dicamba application at 1/16 X, 1/32 X, 1/64 X, and 1/128 X and from untreated check (the tomato progeny or F1) were planted on May 4, and seedlings emerged on May 11. The tomato seedlings (F1 = progeny) were evaluated on May 27, June 3, June 10, June 17, and June 24 for any injury or dicamba symptomology. The tomato progeny (F1) was evaluated five times (every week) and did not show any visual dicamba symptomology. The results of the HPLC analysis indicated that none of the fruit samples showed any levels of dicamba. Samples were taken from upper, middle, and lower fruits from each treatment and did not find any dicamba in them. In general, tomato at the vegetative stage was most sensitive compared to the flowering or fruiting stage, but in general, tomato injury was not significantly different between the flowering and fruiting stage. Tomato injury increased as the dicamba rate increased. The tomato progeny (F1) did not show any visual dicamba symptomology. HPLC analysis indicated that none of the fruit samples showed any levels of dicamba.

No Seed Means No Weeds or No Herbicide-Resistant Weeds. T Bararpour*[1], DA Bell[2], JW Reister[1], JD Peeples[1]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Leland, MS (116)

A field study was conducted in 2021 (third year of the study) 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 (CZ 4649 LL) was planted on April 27, 2021 and emerged on May 3. Plot size was 40 ft [12 rows (40-in row^{-1})] wide by 30 ft long. There were 20 ft alleys between each replication. Approximately 18,000 glyphosate-resistant Palmer amaranth seed were broadcasted per plot (in first year of the study in 2019) for uniform (as much as possible) Palmer amaranth population. 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 untreated control was included. Before soybean harvest, one-meter square samples of weed (from 4 center rows of soybean) were harvested 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 14). Glufosinate rate was 32 fl oz a^{-1}. Glyphosate-resistant Palmer amaranth control was 100, 80, 81, 100, 100, 100, and 100% for herbicide program 1 through 7, respectively (August 10). Also, the herbicide program 1 through 7 provided 93, 89, 96, 98, 98, 100, and 100% control of broadleaf signalgrass (*Urochloa platyphylla*); and 100% control of hemp sesbania (*Sesbania herbacea*); and 100% control of pitted morningglory (*Ipomoea lacunosa*); and 99, 95, 98, 100, 100, 100, and 100% control of prickly sida (*Sida spinosa*), respectively. Soybean canopy coverage was 86, 82, 70, 88, 80, 77, and 92% from herbicide program 1 through 7, respectively (by August 10). Glyphosate-resistant Palmer amaranth seed deposition to the soil seedbank was 0, 21, 33, 0, 1, 0, and 0% as compared to the 100% untreated check plot (visual observation) (September 29). Soybean yield was 54, 56, 44, 52, 56, 53, and 56 bu a^{-1} for plots that received the application of treatment 1 through 7, respectively. The untreated control yielded only 17 bu a^{-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.

Brake, Valor, and Their Tank-Mixture Combinations with Residual Herbicides for Broad- Spectrum Weed Management Programs in Mississippi Peanut. T Bararpour*; Mississippi State University, Stoneville, MS (117)

Weed control is one of the most limiting factors facing peanut (*Arachis hypogaea*) producers in Mississippi. A field study was conducted in 2021 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate Brake, Valor, and their tank-mixture combinations with residual herbicides for broad- spectrum weed management programs in Mississippi peanut. Peanut (Georgia-06G) was planted at a seeding rate of 8 seeds ft^{-1} on June 17, 2021 and emerged on June 23. 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*), and hemp sesbania (*Sesbania herbacea*). The study was designed as a randomized complete block with 15 treatments and four replications. Herbicide treatments were as follows (rate in oz/a): 1) Brake at 16; 2) Brake at 32; 3) Valor (flumioxazin) at 1.5; 4) Valor at 3; 5) Brake at 16 + Valor at 1.5; 6) Brake at 16 + Valor at 3; 7) Brake at 32 + Valor at 1.5; 8) Brake at 32 + Valor at 3; 9) Valor at 3 + Dual Magnum (*S*-metolachlor) at 32; 10) Strongarm (diclosulam) at 0.45 + Dual Magnum; 11) Brake at 16 + Dual Magnum; 12) Valor at 3 + Brake at 16 + Dual Magnum; 13) Valor at 3 + Dual Magnum + Strongarm; 14) Valor at 3 + Dual Magnum + Strongarm + Brake at 16; and 15) nontreated check. All treatments were applied preemergence (PRE). Peanut injury was 5 and 1; 20 and 11; 0 and 0; 5 and 0; 0 and 0; 6 and 0; 5 and 0; 5 and 0; 4 and 0; 0 and 0; 4 and 0; 5 and 0; 3 and 0; 4 and 0 from treatment 1 through 14 at 2- and 3- weeks after emergence (WAE), respectively. There was no peanut injury after 4 WAE. Palmer amaranth control was 81, 84, 89, and 89% for treatment 1, 2, 10, and 12 at 10 WAE, respectively. Treatment 9, 13, and 14 provided 99 to 100% control of Palmer amaranth. The other treatments provided 91 to 97% Palmer amaranth control. Pitted morningglory control was 85, 89, 89, 89, 82, 94, 85, 93, 95, 93, 89, 96, 100, and 100% from treatment 1 through 14 at 10 WAE, respectively. All herbicide treatments provided 93 to 100% control of prickly sida except Brake at 16 fl oz/a (86%). Broadleaf signalgrass was a difficult weed to control. Treatment 1 through 14 provided 61 and 48; 78 and 49; 76 and 54; 80 and 56; 83 and 63; 87 and 75; 84 and 71; 83 and 66; 90 and 90; 83 and 78; 91 and 88; 85 and 77; 100 and 100; 98 and 100% control of broadleaf signalgrass at 6- and 10-WAE, respectively. Treatment 6, 9, and 11 provided comparable results as treatment 13 and 14 in terms of Palmer amaranth, pitted morningglory, hemp sesbania, and prickly sida control (except broadleaf signalgrass control). Based on this study, treatments 13 (Valor at 3 + Dual Magnum + Strongarm) and 14 (Valor at 3 + Dual Magnum + Strongarm + Brake at 16) were the best applications in terms of longer residual activity and broad-spectrum weed control.

Evaluation of Reviton (Tiafenacil) Herbicide in Tank-Mixes for Italian Ryegrass Control. T Bararpour*[1], D Akin[2]; [1]Mississippi State University, Stoneville, MS, [2]Helm Agro, Murray, KY (118)

A field study was conducted in 2021 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate Reviton herbicide in tank-mixes for Italian ryegrass control. The experiment was conducted as a randomized complete block design with 15 treatments and four replications. Plot size was 10-ft wide by 20-ft long with 5-ft alleys between replications. Treatments were: 1) Reviton at 1 fl oz/a; 2) Reviton at 2 fl oz/a; 3) Roundup P-Max (glyphosate) at 1 lb ai/a; 4) Clethodim (select) at 0.094 lb ai/a; 5) Clethodim at 0.125 lb ai/a; 6) Reviton at 1 fl oz/a + Roundup; 7) Reviton at 2 fl oz/a + Roundup; 8) Reviton at 1 fl oz/a + Clethodim at 0.094 lb ai/a; 9) Reviton at 1 fl oz/a + Clethodim at 0.125 lb ai/a; 10) Reviton at 2 fl oz/a + Clethodim at 0.094 lb ai/a; 11) Reviton at 2 fl oz/a + Clethodim at 0.125 lb ai/a; 12) Reviton at 1 fl oz/a + Clethodim at 0.094 lb ai/a + Roundup; 13) Reviton at 1 fl oz/a + Clethodim at 0.125 lb ai/a + Roundup; 14) Paraquat (gramoxone) at 64 fl oz/a; and 15) Untreated check. Herbicide applications were made on March 24, 2021, on 3- to 6-tillers ryegrass. All Reviton applications had MSO at 1% v/v. Clethodim application had COC at 1% v/v and Paraquat application had NIS at 0.25% v/v. Herbicide treatment 1, 3, 4, and 5 provided < 70% control of Italian ryegrass 2 weeks after application (WAA). Only treatment 6 through 14 provided 83 to 90% ryegrass control by 3 WAA. Italian ryegrass control reduced from 90 to 83% from paraquat application (Trt. 14) from 2 to 3 WAA, respectively. Tank-mix application of Reviton with clethodim (Trt. 9) increased Italian ryegrass control to 93% as compared to Reviton (64 to 65%) (Trt. 1 and 2) or clethodim (69 to 74%) (Trt. 4 and 5) alone at 4 WAA. Roundup application provided only 30 to 46% Italian ryegrass control from 2 to 4 WAA. Italian ryegrass control was only 35% from the application of Roundup (Trt. 3). Therefore, Italian ryegrass population in the test area was glyphosate-resistant ryegrass. Italian ryegrass control reduced over time from single application of paraquat (Trt. 14). By 8 WAA, Italian ryegrass control from single application of paraquat was only 58%. In general, adding Reviton (1 fl oz/a) to the clethodim (0.125 lb ai/a) (Trt. 9) significantly increased glyphosate-resistant Italian ryegrass control from 80 to 94% at 5 WAA. However, there was not significantly different between treatment 5 and 9 at 6 through 8 WAA. Single application of paraquat did not control glyphosate-resistant Italian ryegrass. Using the herbicide Reviton mixed with herbicide such as clethodim, has a better outcome to control glyphosate-resistant Italian ryegrass. Tank-mixes of Reviton with clethodim may help to combat clethodim-resistant Italian ryegrass.

Cotton and Soybean Response to Low Rates of Dicamba, 2,4-D, and Loyant. T Bararpour*; Mississippi State University, Stoneville, MS (119)

A field study was conducted in 2021 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate cotton and soybean response to low rates of Clarity (dicamba), 2,4-D amine (2,4-D), Loyant (florpyauxifen-benzyl), and Facet (quinclorac). Soybean (CZ 4649 LL) and cotton (ST 4550) were planted on April 27 and May 25, respectively (two separate studies). The experimental was designed as two (growth stage) by four (herbicide) factorial arrangement in a randomized complete block and replicated four times. Plot size was 13 ft wide (four rows) by 20 ft long. Herbicide used were: 1) Clarity; 2) 2,4-D amine; 3) Loyant; and 4) Facet L. A nontreated check was included in the study. All herbicides were sprayed at 1/16 X of recommended rate (X). Herbicide was sprayed at flowering and at beginning of pod stages for soybean; and at 4- to 6-leaf and at the flowering stages for cotton. The recommended rate of Clarity, 2,4-D amine, Loyant, and Facet L were 16, 32, 16, and 32 oz/a, respectively.Soybean: There was significant differences between herbicide in terms of soybean injury. Loyant, Clarity, 2,4-D, and Facet L caused 51, 39, 9, and 1% (averaged over growth stage) soybean injury 17 weeks after emergence (WAE). Soybean injury from herbicide application in terms of growth stage was significant. Soybean injury was 15 and 29% (averaged over herbicide) at beginning of pod and at flowering stages, respectively. Soybean yield was 54, 27, 22, and 61 bu/a from 2,4-D, Clarity, Loyant, and Facet applications at flowering stage, respectively. Plots that received 2,4-D, Clarity, Loyant, and Facet applications at 1/16 X at the beginning of pod provided 45, 8, 7, and 59 bu/a soybean yield, respectively. The nontreated check plot produced 53 bu/a yield. Clarity and Loyant applications at 1/16 X reduced soybean yield 49 and 59% at flowering and 85 and 87% at beginning pod stage, respectively. Therefore, Loyant drift could be as worst as clarity in soybean. Cotton: There was significant differences between herbicide in terms of cotton injury. Facet L Loyant, Clarity, and 2,4-D caused 13, 23, 23, and 58% (averaged over growth stage) cotton injury 12 WAE, respectively. Cotton injury from herbicide application in terms of growth stage was significant. Cotton injury was 15 and 32% (averaged over herbicide) at 4- to 6-leaf and at flowering stage, respectively. Seedcotton yield was 885; 3,528; 3,332; and 3,537 lb/a from 2,4-D, Clarity, Loyant, and Facet applications at 4- to 6-leaf stage, respectively. Plots that received 2,4-D, Clarity, Loyant, and Facet applications at 1/16 X at the flowering stage provided 61; 1,053; 1,478; and 2,249 lb/a seedcotton yield, respectively. The nontreated check plot produced 3,450 lb/a seedcotton yield. 2,4-D application at 1/16 X reduced seedcotton yield 74% at 4- to 6-leaf cotton and 98% at the flowering stage.

Effect of Tillage, Tarping, and Post-application Irrigation on Methyl Isothiocyanate (MITC) Soil Air Distribution Following Dazomet Application in Sandy Soil. E Gomiero Polli*[1], MC LeCompte[1], RR Rogers[1], K Ahmed[1], C Silcox[2], T Gannon[1]; [1]North Carolina State University, Raleigh, NC, [2]AMVAC, Lincoln University, PA (120)

Dazomet is a broad-spectrum pre-plant soil fumigant commonly used in horticultural and turfgrass systems. This fumigant reacts to water in the soil when in presence of oxygen and releases methyl-isothiocyanate (MITC) gas which effectively controls soilborne-pest and -pathogens, and weeds. Previous studies have demonstrated inconsistent control by dazomet. As MITC is highly water-soluble, mobile in soil, and volatile, efficacy may be influenced by cultural practices conducted before and after application. The objective of this study was to analyze the influence of tillage, tarping, and post-application irrigation on MITC concentration, distribution, and persistence following dazomet application in sandy soil. A field study was conducted in July 2021 at Sandhills Research Station in Jackson Springs, NC. The study was organized as a split-split-plot design of 2 x 4 x 6 with 3 repetitions in which the whole plot was the presence or not of the tarp, sub-plot the sample timing (0, 1, 3, and 5 days after application), and sub-sub-plot the sampling depth (0-4 cm, 4.1-8 cm, 8.1-11 cm, 11.1-15 cm, 16.1-23 cm, and 23.1-30 cm). Dazomet was applied using a drop spreader calibrated to deliver 191 kg ha^{-1}. After application, tarped treatments were tilled to a 10 cm depth using a tractor-mounted rotary tiller and subsequently rolled utilizing a tractor-mounted roller. All treatments were then irrigated with 15 mm of water to achieve soil saturation. Following saturation, tilled treatments plots were tarped with plastic sheets and then sealed by covering the perimeter with non-treated soil. Additional post-application irrigation was applied to non-tarped treatments at 13, 6, and 3 mm at 1, 2, and 3 days after treatment (DAT), respectively. Soil gas samples of 60 mL were collected using an AMS Gas Vapor Probe (GVP) soil gas probe. After collection, the soil gas samples were deposited into a headspace vial containing 1mL of ethyl acetate GC grade, then stored in a cooler, and transported to the laboratory where herbicide residues analyses were performed using high-performance gas chromatography. MITC concentration data were subjected to analysis of variance in SAS software and treatment means were computed using Tukey's least significant procedure (a=0.05). A significant interaction was observed between depth and DAT. At 0 DAT, MITC concentration was higher from 0 to 8 cm. However, after one day, the concentration was higher from 4.1 to 15 cm. At 3 and 5 DAT, MITC concentration was lower than at 0 and 1 DAT and similar at all depths. No difference in MITC concentration was observed between tarped/tilled and non-tarped/non-tilled/post-irrigated treatments. As greater MITC concentration was observed at shallower soil depths in a short period post-application, Dazomet efficacy may be dependent on the target pest/pathogens/weed's distribution in the soil, life cycle, and sensibility to this fumigant. Further studies will investigate the effect of tarp removal at 5 DAT on MITC concentration at 5, 7, and 10 DAT compared to non-tarped treatments.

Impact of Target Surface and Potassium Acetate on Secondary Movement of Dicamba. M Zaccaro-Gruener*, JK Norsworthy, MC Castner, TL Roberts; University of Arkansas, Fayetteville, AR (121)

The continued off-target movement of dicamba led the U.S. Environmental Protection Agency in the fall of 2020 to require the addition of a volatility-reducing agent (VRA) to the dicamba formulations labeled for use in dicamba-resistant (DR) crops. Two field experiments were conducted in 2021, at the Milo J. Shult Agricultural Research and Extension Center, in Fayetteville, AR. The objective of this research was to test the magnitude to which dicamba volatility was impacted by the addition of potassium acetate (VRA) to a dicamba plus potassium acetate premix (XtendiMax with VaporGrip) plus glyphosate applied to different target surfaces. Treatments were made to trays of soil or DR cotton seedlings that were then placed in the center of low tunnels established along two rows of susceptible soybean used as bioindicators. Air samples in the center of the tunnels were collected for 48 hours after application. Average injury to soybean was the highest (26%) when glyphosate was added to dicamba without a VRA. Treatments including VRA resulted in 10% and 11% injury with and without glyphosate added to the solution, respectively. The pH analysis of solutions showed acidification provided by the addition of glyphosate to dicamba. However, the addition of VRA increased the pH of the solution above 5, even when glyphosate was present. The laboratory analysis of the air samples showed a significant 5-fold reduction in the amount of dicamba detected in the air when VRA was added to dicamba alone. The addition of the VRA to dicamba plus glyphosate reduced the amount of dicamba detected by half of that from the treatment lacking the adjuvant. Field and analytical results indicate that the use of VRA provided a significant reduction of dicamba volatilization.

Palmer Amaranth (*Amaranthus palmeri*) Reproductive Biology Under Variable Thermal and Soil Moisture Stresses. A Maity*, SE Kezar, MV Bagavathiannan; Texas A&M University, College Station, TX (122)

Wide genetic diversity and high phenotypic plasticity of Palmer amaranth (*Amaranthus palmeri*) are the key to its aggressive invasiveness and unrestricted adaptation to any adversities, as observed across the U.S. states. Compared to a number of other weeds, Palmer amaranth reportedly exhibits unambiguously high resilience to the biotic and abiotic stresses. Effects of various climatic stressors on plant vegetative and reproductive traits have been studied in a large number of crop species. However, weed species infesting different cropping systems didn't receive similar levels of attention, though weeds interfere and compete with crops for critical resources and ultimately impact yield and profits. We studied Palmer amaranth reproductive biology under four temperature regimes, 40/35 C, 35/30 C, 30/25 C, and 25/20 C day/night and four levels of soil moisture, 100%, 75%, 50%, and 25% field capacities in controlled environment growth chambers. Flowering started significantly sooner and more number of viable pollen were observed under lower air temperature, which increasingly decreased at higher temperature condition. Pollens were smaller, shriveled, and sometimes disrupted under stress conditions. Although, only a negligible number of plants flowered at 40/35 C and a few in 35/30 C, the stigmas apparently became stickier under high temperature condition. Overall, the plants under moisture stress apparently did not show any impact on pollen and stigma viability at a given time of the day during peak flowering time. However, individual pollens and stigma had shorter longevity with increase in these stresses, leading to fewer seed set under high temperature and moisture conditions. Findings of this study are useful in understanding likely changes to Palmer amaranth reproduction capacity influencing the population dynamics under future climate change scenarios.

The Response of Palmer Amaranth, Large Crabgrass, and Soybean Grown Alone and in Competition to a Moisture Gradient. W Everman*[1], MA Granadino[1], DJ Contreras[1], GM Henry[2]; [1]North Carolina State University, Raleigh, NC, [2]University of Georgia, Athens, GA (124)

Soybean is especially sensitive to drought stress during vegetative stages hastening flowering and physiological maturity, and reducing yield due to a smaller seed size. Drought exposed soybean during flowering stages have been shown to increase pod abortion. Palmer amaranth (Amaranthus palmeri S. Watson) and Large crabgrass [Digitaria sanguinalis (L.) Scop.] are ranked as two of the most troublesome and common weeds, respectively, in soybean crop production. Palmer amaranth's invasive nature and resistance to certain herbicides have ranked it among the most troublesome weeds in soybean production, reporting losses of up to 78% at a density of only 8 palmer plants m-2. Large crabgrass is a common weed in many cropping systems, though it has been controlled effectively through the use of herbicide, it is capable of reducing soybean yields up to 37% at 16 plants m-2. Limited information on Palmer amaranth and large crabgrass interference in soybean cropping systems under water deficit conditions is available. To evaluate competition under moisture stress 6 water table depth gradient tanks were constructed. A gravel layer at the bottom of the tanks allowed a water table to sit freely and provide a soil moisture gradient. The tanks were split in nine rows starting at the bottom at approximately 30 cm height from the water table and going up to approximately 155 cm. Decreasing volumetric water content was observed as height from the water table increased. Species composition was made up of a monoculture of the three species (Soybean, Palmer amaranth and large crabgrass) and a paired combination of each. Decreasing water content and competition were found to be highly significant factors influencing soybean and large crabgrass growth. Palmer amaranth presented an increased root growth at water deficit, resulting in a high tolerance to moisture stress.

Quantifying Acetochlor Release from Microcapsules with Respect to Time and Temperature. TL Grey*[1], KM Eason[2], KS Rucker[3], SJ Bowen[1]; [1]University of Georgia, Tifton, GA, [2]The University of Georgia, Tifton, GA, [3]Bayer, Tifton, GA (125)

Acetochlor is a chloroacetamide herbicide with a water solubility of 230 mg/L, with microbial degradation as main dissipation mechanism. It is formulated as Warrant® in a micro-encapsulated with a polymer shell wall to allow controlled release for extended weed control. Studies were conducted using a thermal gradient table to determine the effect of temperature on the release of acetochlor over time.

Efficacy of Plant Based Sicklepod Deer Repellent in Soybean Production System. Z Yue*[1], MW Shankle[2], PS Sharma[1], AL Miller[1], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Pontotoc, MS (126)

Deer damage of soybean was first concerned by the agriculture community in the 1960s and gradually became agreed in the community in the US during the next forty years. Mike Conover estimated the annual deer damage of row crops (including soybean) in the US to be $4.5 billion. Numerous efforts have been made to alleviate deer damage in soybean. Fencing is one of the methods tried but usually not feasible for large planting acreage of soybean. Many deer repellents were also developed, among which putrescent egg solids appeared in the 1990s and dominated the deer repellent market. It was commonly observed that deer avoided many plants because they contained secondary metabolites such as terpenes in pine trees and mints, tannins in oak, and capsaicin in pepper. We developed an extract from sicklepod weed with anthraquinone derivatives as the active deer repellent ingredient. Our deer repellent studies conducted in captive deer facilities and the forest were successful. Still, they failed twice in the row crop soybean environments because deer avoided the experimental area to browse adjacent soybean. This time with a unique field layout, we achieved our soybean deer browsing observation goal. Results from the improved field layout combined with our earlier forest studies concluded that the plant-based sicklepod extract was an effective deer repellent. In addition, the traditional concept of soybean deer damage was leaf browsing. This project also shows that deer-related seedling loss in soybean before the V1 stage can reach at least 50% and up to 84%. A higher weed infestation may also drive this loss in deer browsed areas, thus leading to greater competition with the weeds.

Plant Sterols: Potential Pre-emergent Non-synthetic Herbicides. K Kumar*[1], LR Griffing[2]; [1]Griffing Biologics LLC, Hearne, TX, [2]Texas A&M University, College Station, TX (127)

The unanticipated off-target effects of application of synthetic herbicides in agriculture and home gardening has created a need for eco-friendly herbicides for crop protection. A new strategy for sustainable weed management is to use of plant-derived natural inhibitors of weed emergence as an effective alternative to synthetic herbicides. To explore this strategy, we have focused on a natural (non-synthetic) way to change the metabolism and balance of plant sterols in the newly-germinating weed seed. Our model is that these sterols are important for weed emergence because mutants of the sterol biosynthetic pathway such as *fackel*, *hydra1*, *smt1*, *smt2* and *cvp1* in model plant systems such as Arabidopsis and tobacco have severe dwarfing phenotype and altered vascular development. The natural inhibitors of sterol metabolism that we have chosen are the sterols themselves. We have found that sterols exert an end-product inhibition of sterol content in plants when applied with an encapsulation agent that solubilizes the sterol and allows it to enter the plant. The encapsulation agent is a cyclodextrin in a formulation that has a specific molar ratio to sterol. Exogenous application of certain plant sterols in cyclodextrin leads to a reduction in endogenous sterols in plants and mimics the phenotype of sterol mutants. Our findings support the model that sterols are important for weed emergence because exogenous sterol application reduces root growth in the newly-emerged radicle in the germinated seed. Greenhouse trials show almost complete suppression of emergence of *Poa annua*, *Amarathus palmeri* (glyphosate resistant) and *Ambrosia sp*. at micromolar concentrations. Preliminary field trials also show reduced emergence of *Amaranthus palmeri*. To further evaluate this non-synthetic pre-emergent herbicide with a novel mode of action (MOA), field tests are continuing. In the lab we are exploring the mechanism of stage-specific, post-germination inhibition of growth, leading to reduced weed emergence.

Efficacy of Directed Energy on Weed Seeds. LM Lazaro*, G LaBiche; LSU Ag Center, Baton Rouge, LA (128)

Historically, management strategies have focused on short-term reduction of the most troublesome weeds in a field based on annual economic thresholds, without a specific focus on the long-term ramifications of soil seedbank management. Restricting the weed seedbank has a large impact on future population density and influences management practices of these weeds in soybean production systems. Harvest weed seed control (HWSC) tactics incorporate mechanical and cultural management strategies to target weed seeds present at harvest. The Weed Seed Destroyer (WDSD) has been developed to destroy weed seeds during crop harvest using directed energy but has yet to be tested in soybean or rice on weeds common to these crops in the southern United States. Thus, the objective of this research was to determine the effectiveness of the WDSD in southern soybean and rice. The experiments were conducted using a stationary WDSD unit. First, the efficacy of the WDSD was evaluated on weed seeds individually incorporated into a known amount of soybean or rice chaff. Secondly, varying temperature settings of the WDSD unit were tested to determine the effects on weed seed kill rates. The WDSD demonstrated high weed seed kill for small seeded weeds and moderate kill rates for large seeded weeds regardless of crop chaff material. An increase in temperature was directly correlated to an increase in weed seed kill, regardless of weed species. These results show the potential for the WDSD unit to be used in reducing weed seed inputs back to the soil seedbank.

Reviton and Other New Herbicides from Helm. D Akin*1, B Waggoner2, J Whitehead3; 1Helm Agro, Murray, KY, 2Helm Agro, Salem, IL, 3Helm Agro, Oxford, MS (129)

Overview of new herbicides from Helm-- Reviton (tiafenacil, Group 14 preplant burndown and cotton harvest aid), Katagon (premix of tolpyralate + nicosulfuron) for POST in corn, Zone Defense (premix of sulfentrazone + flumioxazin) for PRE in soybean, and others.

Syngenta: New Products, Label Amendments, Stewardship Commitment, and Updates. ET Parker*[1], M Kitt[2], SA Strom[3], JD Weems[4]; [1]Syngenta Crop Protection, Vero Beach, FL, [2]Syngenta Crop Protection, Greensboro, NC, [3]Syngenta Crop Protection, Champaign, IL, [4]Syngenta Crop Protection, Hermiston, WA (130)

Syngenta has committed to invest 2 billion dollars globally in sustainable agriculture technologies to accelerate innovation for farmers and nature with a goal of two new breakthrough technologies per year. These new break-through technologies will focus on delivering low residue levels, soil heath, biodiversity, and or carbon mitigation. Each year, Syngenta strives to deliver new innovative and sustainable products and technologies to enable our customers to have both short- and long-term growth for their operations. During this presentation Syngenta will provide updates on new products, label amendments and stewardship topics.

Smart Spray Technology for Row Middle Weed Control in Vegetables. N Boyd*[1], RK Sandhu[2], A Schumann[3]; [1]University of Florida/Institute of Food and Agricultural Sciences-Gulf Coast Research and Education Center, Wimauma, FL, [2]University of Florida, Wimauama, FL, [3]University of Florida, Lake Alfred, FL (131)

In plasticulture production systems most of the herbicides are applied to the bare soil between the raised beds (row middles). Growers typically apply more than one banded application per season for broadleaf and grass control. Smart spray technology can be used to apply herbicides only where weeds occur in the row middle. A prototype smart sprayer was developed at the Gulf Coast Research and Education Center (GCREC) in Balm, FL, that utilizesYOLO-V3 convolutional neural networks to identify weeds. Two field experiments were conducted to evaluate accuracy and efficacy of the novel technology. The prototype sprayer successfully identified and applied herbicides on 84% and 65% of total weeds in Fall 2020 and Spring 2021, respectively. Total herbicide volume was 47% and 51% lower when applied with the smart sprayers when compared with banded applications. Smart spray technology has the potential to be an effective weed management tool for row middles in plasticulture production systems.

Is Rice Tolerant to Early-season Applications of Dicamba? CH Arnold*[1], JK Norsworthy[1], P Carvalho-Moore[1], LB Piveta[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (132)

In the southern United States, dicamba is currently used in Xtend and XtendFlex cotton and soybean systems in addition to corn, grain sorghum, and non-crop areas. Dicamba is currently not approved for use in rice; however, dicamba could serve as an additional herbicide for broadleaf weed control in rice. In 2021, a field trial was conducted at the Rice Research and Extension Center near Stuttgart, AR to determine rice tolerance to early-season applications of dicamba. Dicamba was applied at three distinct timings (preemergence, 1-leaf stage of rice, 5-leaf stage of rice) at rates of 560 g ae ha^{-1} (1X) and 1,120 g ae ha^{-1} (2X). Dicamba at a 1 and 2X rate, respectively caused 71 and 91% injury to rice two weeks after the preemergence application. The preemergence injury partly resulted from delayed emergence as evidenced by stand counts being reduced 17 and 36% compared to the nontreated check at 1 and 2X rates of dicamba three weeks after application. As applications were delayed, a reduction in injury followed, with 39 and 48% injury observed two weeks after applying dicamba at the 1-leaf growth stage at 1 and 2X rates, respectfully. Injury was reduced further at the 5-leaf rice application, as evidenced by 8 and 12% injury at a 1 and 2X rate two weeks after application. By four weeks after flooding of rice, the crop had recovered to the point of having =5% visible injury for both dicamba rates and all timings, except the 2X rate of dicamba applied preemergence. Based on these results, it appears that dicamba can be severely injurious to rice early in the season, and caution should be taken to avoid applications of dicamba onto the crop.

Hard Water and AMS Effect on Glyphosate-Based Grass Control in the Enlist Weed Control System. JT McCaghren*, S Li, RD Langemeier, L Pereira; Auburn University, Auburn, AL (133)

The Enlist weed control system allows growers to tank mix glyphosate, 2,4-D, and/or Liberty (glufosinate) to control a broad spectrum of weeds. It has been documented that certain salts of 2,4-D, including the choline salt (Enlist One), can antagonize glyphosate control of grassy weeds. Additionally, hard water ions such as calcium and magnesium are also known to reduce glyphosate efficacy. Previous literature states that with the addition of water conditioners, such as diammonium sulfate (AMS) antagonism by both 2,4-D and hard water ions can be overcome, however little information is available about when both antagonists are present. A study was created with the objectives of evaluating the effects of annual grass control based on 1) tank mixtures of glyphosate + Enlist One and glyphosate + Enlist One + Liberty compared to glyphosate alone, 2) comparing tank mixtures of each treatment in both hard or distilled water, 3) analyzing the effects AMS in overcoming antagonism. The study was conducted in summer of 2021 in Elmore and Henry counties in Alabama. This study included a randomized complete block design with four replications at each site. Visual ratings were taken at 7, 14, 21, and 28 days after treatment (DAT). Biomass was recorded at 28 DAT. Glufosinate had little overall effect on grass control. The results indicate that both hard water and Enlist One can antagonize glyphosate annual grass control. However, AMS is able to overcome all antagonism even when all products are combined in hard water.

Effect of Adjuvant on Herbicidal Weed Control in Soybean (*Glycine max* L.). DM Dodds, SC Baker*; Mississippi State University, Mississippi State, MS (134)

Herbicides are commonly used for weed control in soybean. In addition, adjuvants are frequently used to optimize herbicide effectiveness. However, new adjuvants are introduced to the market each year, often with little to no data supporting purported benefits. Therefore, this study was conducted to evaluate the effect of several adjuvants on Amaranthus spp., prickly sida, and barnyardgrass control. Studies were conducted near Starkville, MS using acifluorfen (280 g ai ha^{-1}), fomesafen (421 g ai ha^{-1}), and cloransulam-methyl (17.6 g ai ha^{-1}). Additional studies evaluating grass control were conducted near Brooksville, MS using clethodim (136 g ai ha^{-1}), quizalofop-p-ethyl (139 g ai ha^{-1}), and fluazifop-p-butyl (421 g ai ha^{-1}). At both locations the following adjuvants were evaluated: Agri-Dex, Penetrator Plus, Dyne-A-Pak, Destiny HC, Class Act NG, Induce, Liberate, Navigator HC, StrikeLock, Zarr, MSO Concentrate with Leci-Tech, and Verifact. Visual weed control ratings were taken at 7, 14, 21, and 28 days after treatment (DAT). At 21 DAT, grass control was not affected by herbicide-adjuvant combination. Application of quizalofop and clethodim resulted in the greatest control at 84 and 82%, respectively. At 28 DAT, differences in broadleaf control were observed due to herbicide-adjuvant combinations. Application of fomesafen and acifluorfen produced the greatest control of Amaranthus species with 59 and 56% control, respectively. Application of acifluorfen resulted in greatest prickly sida control at 78%. Adjuvants had little to no effect on weed density and control thus growers are encouraged to utilizing the adjuvant that best fits their particular operation.

Duration of Weed Control Following Preemergence Herbicide Application in Soybean. CK Meyer*, DM Dodds, JS Calhoun, Z Ugljic, GA Stephens, JA Patterson; Mississippi State University, Mississippi State, MS (135)

Weed control is one of the critical tasks growers face each year. Numerous preemergence weed control options are available in soybean (*Glycine max*). However, it has become commonplace for pre-blended herbicides to be used in soybean. Historical data often exists on each component of these premixes; however, data is often lacking on weed control efficacy of when more than one product is applied as part of a single formulation. Therefore, this experiment was conducted to evaluate various preemergence herbicides and effectiveness with regard to weed control. Herbicides evaluated included: acetochlor, cloransulam-methyl, clomazone, dimethenamid-P, flumetsulam, fomesafen, flumioxazin, imazaquin, metribuzin, pyridazinone, pendimethalin, pyroxasulfone, S-metolachlor, sulfentrazone, sulfentrazone + S-metolachlor, S-metolachlor + metribuzin, S-metolachlor + fomesafen, sulfentrazone + metribuzin, acetochlor + fomesafen, sulfentrazone + flumioxazin, and flumioxazin + pyroxasulfone. Morningglory (*Ipomoea* spp.), prickly sida (*Sida spinosa*), and tall waterhemp (*Amaranthus tuberculatus*) control was evaluated at the R.R. Foil Plant Science Research Center, Mississippi State, MS and the Black Belt Branch Experiment Station near Brooksville, MS in 2021. 35-49 days after application, flumioxazin + pyroxasulfone and sulfentrazone + flumioxazin at provided the greatest morningglory control: 58% greater compared to the UTC. At the same evaluation periods, application of sulfentrazone + flumioxazin, and clomazone provided 85% greater prickly sida control compared to the UTC. Tall waterhemp control 35 – 49 days after treatment was 91% greater compared to the UTC following the application of sulfentrazone + flumioxazin, cloransulam-methyl, and flumioxazin. This data indicates that sulfentrazone + flumioxazin provided broad spectrum weed control for up to 49 days after planting. Utilization of preemergence herbicides can provide significant weed control benefits and alleviate the pressure on postemergence herbicides for weed control in soybean.

Evaluation of Pre-emergence Johnsongrass Control in Sugarcane Seedlings. CB Baucum*[1], LM Lazaro[2], AJ Orgeron[2]; [1]Louisiana State University, Baton Rouge, LA, [2]LSU Ag Center, Baton Rouge, LA (136)

Sugarcane varieties are developed and evaluated at the LSU AgCenter's Sugar Research Station. While a multitude of weeds can be found at the station, johnsongrass is the most problematic weed issue, and often outcompetes newly planted sugarcane seedlings. Several preemergence (PRE) herbicides are labeled for use in sugarcane and provide excellent control of seedling johnsongrass in vegetatively propagated sugarcane. Anecdotal observations suggest that sugarcane seedlings following the transplanting process, are less tolerant of some labeled PRE herbicides. Due to the lack of information and published research on the tolerance of sugarcane seedlings to PRE herbicides, a two-year field experiment was conducted to determine the effects of eight commonly used PRE herbicide treatments on sugarcane seedlings from ten sugarcane families. Results revealed that the metribuzin treatment, significantly injured sugarcane seedlings. Additionally, a supplemental experiment was conducted to evaluate the efficacy of the corresponding PRE herbicide treatments in controlling seedling johnsongrass. Johnsongrass seed were sowed into a fallowed sugarcane field and emergence was counted at 7, 14, and 28 days after herbicide application (DAA). Aboveground johnsongrass biomass was harvested 28 DAA. Results showed that the pendimethalin + atrazine (2.32 + 2.24 kg ha^{-1}) treatment as well as the metribuzin (1.68 kg ha^{-1}) treatment provided the highest level of seedling johnsongrass control. Based upon these studies, the pendimethalin + atrazine (2.32 + 2.24 kg ha^{-1}) treatment should be considered from the current sugarcane seedling weed management program at the Sugar Research Station.

Weed Suppression by Cotton Chromosome Substitution Lines at Different Cover Crop Production Systems. AL Miller*[1], GA Fuller[1], JC Argenta[2], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (137)

Weedy plant species have been and continue to be an extreme issue affecting crops, including cotton. A specific weed type that is of a major nuisance to cotton (*Gossypium hirsutum*), in particular, is Palmer amaranth (*Amaranthus palmeri*). Plamer amaranth's unfortunate ability to form herbicide resistance has created a dire need for alternative methods that are more sustainable in controlling weed populations, besides the most common form- chemical control by way of herbicides. Four cotton chromosome substitution (CS) lines were found to be highly allelopathic against Palmer amaranth. It is critical to explore the effects of integrating allelopathic cotton with cover crops on weed suppression. In the current study, four allelopathic cotton CS lines (CS-10, CS-34, CS-1, and CS-6), a cultivar (UA 48), and CS parent (TM1) were chosen. Treatments consisted of the cotton accessions in combinations with four cover crop treatments. The cover crops included were rye (*Secale cereal*), crimson clover (*Trifolium spp.*), hairy vetch (*Vicia spp.*), and radish (*Raphanus raphanistrum*). Data taken represented the percentage of weed density for five different weed species carpetweed (*Mollugo verticillata*), large crabgrass (*Digitaria sanguinalis*), smallflower morningglory (*Jacquemontia tamnifolia*), Palmer amaranth (*Amaranthus* palmeri), and yellow nutsedge (*Cyperus esculentus*). Certain cover crop combinations successfully reduced weed density, including rye and vetch on Palmer amaranth. CS- 38 was shown to resude Palmer amaranth height by a mean of 58.46%, 7 DAE, while CS- 27 only reduced Palmer by 5.12%. The knowledge of weed suppressive abilities of specific cover crops and the use of new allelopathic cotton CS varieties could be crucial to the successful battle against herbicide-resistant weeds growing among cash crops and hindering these crops' ability to thrive. Although much is factually known about cover crops, more research and discovery need to be accomplished with more detail and among different treatments to realize the full potential of their use in agricultural environments.

Rice Exposure to a Sub-Lethal Concentration of Paraquat During Reproductive Growth Stages. TD Burrell II*, JA Bond; Mississippi State University, Stoneville, MS (138)

Influence of sub-lethal concentrations of paraquat on the reproductive growth stages in rice T.D. Burrell II, T.L. Sanders, J.A. Bond, H.D. Bowman, T.W. Eubank, G.A. Mangialardi Paraquat-based herbicide treatments are recommended for weed control in Mississippi, particularly where glyphosate-resistant weeds are prolific. In the event of off-target movement, as much as 25% of the herbicide can move from a few meters up to several kilometers. This issue can cause severe crop injury as well as yield loss to the non-target rice crop. Given the issue at hand, research was conducted to evaluate the influence of an off-target application on rice during its reproductive growth stages. Field studies were conducted in 2019, 2020, and 2021 at Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate rice response to a sub-lethal concentration of a paraquat during its reproductive growth stages. The experiment design was a randomized complete block with four replications. Paraquat 28 g ai ha^{-1} was applied 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 for comparison. Visible estimates of rice injury were recorded 3, 7, 14, and 28 d after treatment (DAT). Rice height was recorded 14 DAT and maturity. 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. Rice growth and development was compromised following exposure to sub-lethal concentrations of paraquat during its reproductive growth stages. Rice exposure to paraquat during the reproductive stages when the plant is growing and grain production begins has a detrimental effect on rough rice yield. Rice injury 3 and 7 DAT was greatest following paraquat exposure at PD, 2.5-cm IE, and 25% moisture content. Injury was = 40% and = 58% following exposure at PD, 2.5-, and 7.5-cm IE compared with nontreated control. Rough rice yield was reduced at all stages of reproductive growth compared with the nontreated control with the greatest reduction occurring following exposure at 7.5-cm IE. Applications of paraquat-based herbicide treatments of fields in proximity to rice should be avoided if conditions are favorable for off-target movement of paraquat.

Low-Dose Multiple Exposure Effects of Auxin Herbicides on Soybean. G Oakley*[1], DB Reynolds[1], KL Gage[2], BG Young[3], JK Norsworthy[4], JA Bond[5], M Loux[6], KW Bradley[7], GR Kruger[8]; [1]Mississippi State University, Mississippi State, MS, [2]Southern Illinois University Carbondale, Carbondale, IL, [3]Purdue University, Brookston, IN, [4]University of Arkansas, Fayetteville, AR, [5]Mississippi State University, Stoneville, MS, [6]The Ohio State University, Columbus, OH, [7]University of Missouri, Columbia, MO, [8]BASF Corporation, Research Triangle Park, NC (139)

Crop yields are adversely affected by off-target movement of herbicides each year. This study was performed to ascertain whether multiple, sublethal herbicide exposures affect soybean productivity. The effects of dicamba and 2,4-D on soybean (*Glycine max* (L.) Merr.) productivity were investigated over 17 site-years. A single, sublethal application of dicamba applied to non-dicamba tolerant soybean at V3, R1, or R3 reduced yield 10 to 15%. A dicamba application at R5 had no effect on soybean grain yield. Multiple sublethal applications of dicamba applied at all possible combinations of V3, R1, R3, and R5 growth stages reduced soybean grain yield 7% to 37% compared to the soybean that received no dicamba application. In relation to a single exposure at R1, an additional exposure at either V3 or R3 reduced yield an additional 2 to 23%. Three or more sublethal applications of dicamba did not further decrease yield relative to soybean having been exposed to dicamba at R1/R3. A single application of 2,4-D at 5.6 g ae ha^{-1} applied to V3, R1, R3, or R5 soybean did not affect grain yield. Conversely, multiple 2,4-D exposures at the V3/R1, V3/R3, or R1/R3 growth stages reduced yield up to 7%. Three or more applications of 2,4-D had no further effect on yield relative to exposing soybean to 2,4-D twice between V3 and R3. Exposing soybean to multiple, sublethal rates of dicamba or 2,4-D can reduce yield relative to a single exposure and may be most deleterious when exposure occurs from flowering to initial pod set.

Evaluation of Non-Uniform Populations of Inbred and Hybrid Clearfield Rice Cultivars. TW Eubank*, JA Bond; Mississippi State University, Stoneville, MS (140)

Assessing Non-uniform Rice (*Oryza sativa* L.) Populations for Replant Considerations. Thomas W. Eubank, Jason A. Bond, Hunter D. Bowman, Tameka L Sanders, Taylor D. Burrell, Gregory A. Mangialardi Optimal plant populations are critical for achieving high yields in direct-seeded, delayed-flood rice production. Historically, seeding rates for rice produced in the midsouthern U.S. were 90 to 112 kg seed ha^{-1}. However, with new hybrid cultivars, production techniques, and precision planting equipment, as well as whole-farm economic shifts, seeding rates have been reduced. With reduced seeding rates, achieving an optimal plant population while avoiding replant situations has become critical. Therefore, research was conducted to investigate yield penalties associated with inadequate, non-uniform plant populations for modern rice cultivars. To evaluate the performance of rice cultivars with inadequate, non-uniform plant populations, two field studies were conducted from 2019 to 2021 at the Delta Research and Extension Center in Stoneville, MS. The experimental design for both studies was a randomized complete block with four replications. In the inbred cultivar study, seed of inbred, herbicide-resistant 'CL153' was drill-seeded 73, 64, 52, 40, 29, and 18 kg ha^{-1} in mixtures with inbred, herbicide-susceptible 'Rex' 0, 9, 21, 33, 44, and 55 kg ha^{-1}. Likewise, in the hybrid cultivar study, seed of hybrid, herbicide-resistant 'CL XL7521' was 29, 25, 20, 16, 11, and 8 kg ha^{-1} mixed with hybrid, herbicide-susceptible 'XP753' 0, 4, 9, 13, 18, and 21 kg ha^{-1}. These cultivars were chosen because CL153 and CL XL7521 exhibit the Clearfield trait, while Rex and XP753 are susceptible to imidazolinone herbicides. The seeding rate mixtures were utilized to produce target populations of 100, 85, 70, 55, 40 and 25% of the recommended seeding rate of 73 kg ha^{-1} for CL153 and 29 kg ha^{-1} for CL XL7521. Imazamox at 87 and 44 g ai ha^{-1} was applied at the two- to three- leaf and four- to five- leaf growth stages, respectively, to eliminate Rex and XP753 and simulate a non-uniform crop stand. Visible injury was assessed 7, 14, and 21 d after second imazamox application (DAT). Rice density was recorded 21 DAT. The number of days to 50% heading was determined in each plot as an indication of maturity. At maturity, rough rice yield, panicle density, and seeds $panicle^{-1}$ were recorded. All data were subjected to ANOVA with means separated using estimates of the least square means at $p = 0.05$. Results from the inbred cultivar study demonstrated that reducing seeding rates by up to 60% produced similar yields compared with the 100% target plant population. At the 100% target plant population, rice maturity occurred 3 d sooner than the 25% target population. In the hybrid cultivar study, reducing seeding rates by 75% produced yields comparable to the 100% target plant population. Rice dry weight was reduced 27% at the lowest target plant population. Results indicate rice seeded at the lower target populations produced similar yields to the 100% target populations. These results indicate that rice yields comparable to those with commercial standard seeding rates can be achieved with reduced plant populations in both hybrid and inbred cultivars. With proper management practices, rice seeding rates could possibly be reduced to maximize economic efficiency in Mississippi rice production.

The Influence of Cover Crop Type and Establishment Method on Tall Waterhemp Suppression. SR Reeves*[1], DB Reynolds[1], JA Bond[2], B Blackburn[1], BJ Varner[1], G Oakley[1], NT Glenn[1], AL Wilber[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Stoneville, MS (141)

The Influence of Cover Crop Type and Establishment Method on Tall Waterhemp Suppression SR Reeves, DB Reynolds, JA Bond, GR Oakley, BJ Varner, BL Backburn, NT Glenn, AL Wilber As herbicide resistant weeds become more prevalent, non-herbicidal methods of control, such as cover crops, are becoming more widely used for overall weed suppression. Tall waterhemp (*Amaranthus tuberculatus)* has become resistant to multiple herbicide modes of action and creates agronomic difficulties in soybean (*Glycine max*). Various cover crop(s), rates, mixtures, and establishment methods were used to investigate the best overall cover crop management practice for the control of tall waterhemp. Multiple field experiments were conducted in Starkville and Brooksville, Mississippi in 2020 and 2021. The experiment was a 6 x 4 factorial arrangement of treatments within an RCB design with factor A being the cover crops and factor B being establishment methods. Six different cover crop rates and mixtures were used for this experiment: 134 kg/ha of cereal rye (*Secale cereal*), 134 kg/ha of wheat (*Triticum aestivum*), 11 kg/ha of radish (*Raphanus sativus*), 101 kg/ha of cereal rye with 7 kg/ha of radish, 101 kg/ha of wheat with 7kg/ha of radish, and a blend of 56kg/ha cereal rye, 56kg/ha of wheat and 5.6 kg/ha of radish. Four establishment methods were used in conjunction with all the cover crops rates and mixtures. Interseeding of the cover crops, into the R7 growth stage of soybean, was the only treatment that occured pre-harvest. Broadcast followed by tillage, tillage followed by broadcast and drilling occurred post-harvest of the previous year's soybean crop. Data were subjected to SAS 9.4 utilizing Fisher's protected LSD at a = .05. Pre-termination cover crop biomass samples were taken using quarter meter quadrant square. Weed control ratings were taken 0, 14,21, and 28 days after planting (DAP). Data suggest that interseeding at the R7 growth stage was least effective in establishing a cover crop for tall waterhemp suppression. Radishes were determined to have the least tall waterhemp suppression capabilities. Wheat was determined to have the greatest cover crop biomass and provided the greatest tall waterhemp suppression.

Cotton (*Gossypium hirsutum* L.) Tolerance to Non-labeled Herbicides in Mississippi. AB Gaudin*[1], Z Ugljic[1], DM Dodds[1], DB Reynolds[1], BK Pieralisi[1], G Morgan[2], J Krutz[1], D Spencer[1]; [1]Mississippi State University, Mississippi State, MS, [2]Cotton Incorporated, Cary, NC (142)

Broadleaf weed control in cotton *(Gossypium hirsutum* L.) has been impacted by herbicide resistance. Compounding this problem is few herbicide modes of action labeled for broadleaf weed control in cotton. This study was conducted to determine whether herbicides not labeled for use in cotton provide effective weed control with minimal crop injury and impact on yield. Studies were conducted near Starkville, MS on a Sumter silty clay loam and a Mantachie loam soil as well as near Brooksville, MS on a Brooksville silty clay soil. Ametryn (1800 g ai ha^{-1}), bentazon (840 g ai ha^{-1}), florpyrauxifen-benzyl (29.5 g ai ha^{-1}), topramezone (24.6 g ae ha^{-1}), and topyralate (29.2 g ai ha^{-1}), were applied to cotton at two timings, 3 to 5-node or 8 to10-node growth stage. Fifty-six days after application, cotton injury ranged from 24 to 43% and 15 to 51% following application of ametryn, bentazon, florpyrauxifen-benzyl, topramezone, and topyralate at either the 3 to 5-node or 8 to10-node stage, respectively. Seedcotton yield following both herbicide application timings ranged from 750 to 1909 kg ha^{-1}. With the exception of bentazon, seedcotton yield following each herbicide application at each timing decreased from 28 to 53%. Bentazon applied to 3 to 5-node cotton or 8 to 10-node cotton had no effect on seedcotton yield and may warrant further investigation to determine viability in cotton production systems. All other herbicides evaluated are not viable for use in cotton due to increased crop injury and decreased yield.

Sustainable Cotton Production: Optimizing Living Much Vegetation-free Strip Width in Cotton. S Shome*, N Gaur, M Levi, NT Basinger; University of Georgia, Athens, GA (143)

Georgia is the second-largest producer of cotton in the Southern United States after Texas. Weed infestations in cotton fields have increased over the past decade to a point where they interfere with the economic threshold and cause irreversible economic damage in cotton production. To counteract weed infestations, cover crops are used. Cover crops have a smothering effect, improve soil health properties, attract beneficial insects, and help with pollination. Cover crops when sown within and in between crops is known as living mulch. White clover (Trifolium repens L.) a perennial living mulch is used in the study with the objective to optimize the living mulch vegetation-free strip width (VFSW) in cotton. The study was conducted at two locations: J. Phil Campbell Research and Education Center (JPCREC) in Watkinsville, Georgia, and the Southeast GA Research Center (SEGREC) in Midville, Georgia. The experiment used a randomized block design, with a factorial arrangement of treatments. The first factor being the VFSW (0, 0.15, 0.30, 0.60, and 0.90 m) and the second factor being cotton seed rate (2 or 4 seeds 0.30 m-1 row) resulting in 10 treatments. Cotton was evaluated for cotton skips four-weeks after planting to determine the effect of living mulch on cotton stand establishment. Data on plant growth (height, phenology, node number) was collected biweekly. Finally, before harvest 10 plants per plot were selected randomly to evaluate cotton yield parameters (boll plant-1, lint boll-1, seed cotton yield, and lint yield). Cotton stands were impacted by the 0 m VFSW regardless of planting density. Phenological differences were also noted, as 0.90 m cotton tended to mature earlier, and 0.15 m and 0.30 m cotton mature later at the JPC which did not occur at SEGREC. Analysis from the 3-parameter Gompertz model showed that the optimal VFSW for JPC was 0.30 m while 0.90 m (bare ground) was the only acceptable for Midville to maximize yield. Seeding rate did not impact yield at either location. Hence 2 seeds 0.3 m-1 will be more advantageous for growers. The yields at Midville, GA were higher than JPC, GA. Except for the 0 m VFSW, stand establishment was within the planted range for all VFSW at both the sites.

The Effect of Volatility Reducing Agents (VRA) on Dicamba Volatility. NT Glenn*[1], KW Bradley[2], JK Norsworthy[3], DB Reynolds[1], BG Young[4]; [1]Mississippi State University, Mississippi State, MS, [2]University of Missouri, Columbia, MO, [3]University of Arkansas, Fayetteville, AR, [4]Purdue University, Brookston, IN (144)

The Effect of Volatility Reducing Agents (VRA) on Dicamba Volatility Nicole T. Glenn, Samuel R. Reeves, Ben L. Blackburn, Beau J. Varner, Graham R. Oakley, Daniel B. Reynolds Abstract In recent years, off-target movement of dicamba containing herbicides through volatilization has become problematic resulting in increased regulatory requirements necessitating use of volatility reducing agents (VRA) for application. Experiments were conducted to determine the effect of VRAs on dicamba volatility of three herbicides commonly used in dicamba tolerant (DT) crops. Three VRA materials were evaluated for their effect on dicamba volatility from tank mixtures of the K-salt of glyphosate (Roundup PowerMax) with the bis aminopropyl methylamine (BAPMA) salt of dicamba (Engenia), metolachlor + diglycolamine salt of dicamba (Tavium), and diglycolamine salt of dicamba (XtendiMax) as determined by percent visual injury, plant height, stand count, and nanograms of dicamba per polyurethane foam tube (PUF). Three VRA products, K-Leaf (29% K_2O), Sentris (K_2CO_3), and Vaporgrip (CH_3CO_2K) were evaluated with each dicamba containing herbicide tank mixture as compared to each tank mixture alone. Results of low tunnel field trials conducted on non-DT soybeans (*Glycine max* (L.) Merr.) in Starkville and Brooksville Mississippi show that all three VRA products reduced dicamba volatility as compared to the dicamba tank mixture alone at both 14 and 28 days after treatment (DAT). The level of reduction did not differ among VRA products. In general, the BAPMA salt of dicamba tank mixed with glyphosate was the most volatile of the dicamba tank mixtures with the diglycolamine pre mixture with metolachlor (Tavium) exhibiting the least amount of volatility alone. Three humidome trials conducted in a greenhouse showed the same treatment effects. Analytical data show that all three VRAs reduced dicamba volatility 94 to 99% but differences did not exist among VRA products. These data show that all three VRA products reduced volatility of the dicamba tank mixtures and that no differences were observed among VRA products. These data would suggest that when comparing these three products that economics may dictate choice as efficacy did not differ among the products.

Long-term Management Strategies for Plamer Amaranth Control in Cotton. TC Smith*[1], JK Norsworthy[1], T Barber[2], JA Fleming[1], MM Houston[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (145)

One of the most troublesome weeds in the United States cropping systems is Palmer amaranth. Crops such as cotton have a delayed canopy closer providing the ideal environment for Palmer amaranth escapes to develop. A field trial was initiated to evaluate the impact of weed management practices over a three-year period on Palmer amaranth population in cotton. The trial was initiated in 2018 at the Lon Mann Cotton Research and Extension Center near Marianna, AR. It consisted of 16 treatments and 4 replications. The treatments combined dicamba and non-dicamba herbicide systems with non-chemical strategies such as tillage, cover cropping (cereal rye), and zero-tolerance. Results showed a one-time tillage event in 2018 (moldboard plow) reduced weed emergence in years 1 and 2 after the practice, but not in year 3. In year 3, an 82% reduction in Palmer amaranth emergence was observed from the adoption of a cover crop. The use of dicamba and non-dicamba herbicide systems plus zero-tolerance approach showed comparative results, both causing a 63% reduction in Palmer amaranth emergence. Therefore, results showed that cereal rye and the dicamba and non-dicamba systems with zero-tolerance approaches significantly impacted Palmer amaranth emergence in cotton.

Soybean Response to Multiple Dicamba Drift Events at Varying Time Intervals. BN Hiatt*[1], LM Lazaro[2], DO Stephenson[3], D Miller[4]; [1]Louisiana State University, Baton Rouge, LA, [2]LSU Ag Center, Baton Rouge, LA, [3]LSU Ag Center, Alexandria, LA, [4]LSU AgCenter, St Joseph, LA (146)

The over reliance on herbicides has ultimately resulted in increased selection pressures on weeds leading to herbicide resistance in soybean crops. Introduction of dicamba resistant soybean cultivars have become an effective tool in managing herbicide-resistant weeds due to the diversification of mode of action from conventional soybean system herbicides. However, the increased risk of off target movement, or drift, to neighboring susceptible crops is of concern for producers. Concurrently, risk of multiple exposures of dicamba to a single soybean crop is likely. The objectives of this research are to identify and quantify soybean injury data associated with exposure to dicamba at multiple drift events at various time intervals during the growing season and to determine the effect of multiple exposures and varying timings of dicamba on soybean yield. Field trails in Louisiana were conducted over five site-years in which simulated drift rates of dicamba were applied to non-dicamba tolerant soybean at 7 g ae a^{-1} beginning at V3/V4 growth stage. Subsequent treatments of the same rate of dicamba were applied at varying time intervals of 0, 1, 3, 5, 7, and 10 days over 1, 2, or 3 applications. Height measurements and visual injury ratings were assessed at 7, 14, and 28 days after treatment. At harvest, simulated yield measurements, such as number of nodes, number of pods, plant height, plant dry weight, total number of seeds and the number of damaged seeds were collected. Overall, soybean injury ratings increased significantly with an increase in the number of exposures and when the exposure events were closer together. Although multiple exposures in higher frequencies did promote higher rates of injury, single exposure events of dicamba resulted in statistically similar rates of injury. Yield reduction was consistent among all treatments at all locations. In order to mitigate yield losses in non-dicamba tolerant soybean, prevention of any dicamba exposure is necessary.

Classification of 2,4-D Salts and Formulation Components Using Machine Learning Models. B Blackburn*[1], DB Reynolds[1], A Brown[1], D Sparks[1], M Caprio[2], DM Simpson[3], BJ Varner[1], G Oakley[1], SR Reeves[1], NT Glenn[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS, [3]Corteva Agriscience, Indianapolis, IN (147)

With the introduction of Enlist crops, 2,4-D is now used to control broadleaf weeds in cotton (Gossypium hirsutum). Along with its increased use, damage from off-target movement (OTM) is expected to increase. In order to mitigate damage, new formulations of 2,4-D with lower OTM have been introduced; however, damage to susceptible species caused by these formulations is visually indistinguishable from existing formulations. Therefore, experiments were conducted to determine if various formulations of 2,4-D could be differentiated in injured cotton tissue by utilizing Fourier-transform infrared spectroscopy (FTIR) coupled with machine learning algorithms and if plant part sampled or time interval between exposure and sampling would affect classification.Treatments included 1.06 kg ae/ha of 2,4-D acid (Unison), 1.06 kg ae/ha ae/a of 2,4-D amine (Weedar 64), 1.06 kg ae/ha of 2,4-D ester (Weedone LV4), 1.06 kg ae/ha of 2,4-D choline (Enlist One), 2.19 kg ae/ha of a 2,4-D choline glyphosate premix (Enlist Duo), and 1.06 kg ae/ha of glyphosate (Roundup PowerMax). In addition, 1.06 kg ae/ha of glyphosate (Roundup PowerMax) was added to all applications except Enlist Duo and the control. Each treatment was applied to plots consisting of two 76-cm x 12.2 m rows with four replications. Each experimental unit was sectioned into 2.44 m sections for temporal sampling at 7, 14, 21, and 28 DAT. Prior to application, ribbons were tied to 10 individual plants within each section at the highest exposed leaf to mark the highest growth point for each plant. During sample collection, tissue was collected based on application status: tissue samples collected below the ribbon, which were directly treated with 2,4-D, were labeled as treated, samples collected above the ribbon, which grew post 2,4-D treatment and were not directly treated with 2,4-D, were labeled as new growth, and then composite samples were collected containing both treated leaves and new vegetative growth. Samples were immediately frozen after harvest until they could be processed for spectral analysis.Each sample was then analyzed using FTIR spectroscopy, and a spectral image was generated for each sample. The spectral data were then imported and analyzed using RStudio. Various classification models were constructed using the k-nearest neighbor algorithm with timing and application status (treated tissue, new growth tissue, and composite tissue) as factors, and Tukey's test was used for model comparison. The model constructed using the pooled cotton tissue samples with all timings and types produced an overall accuracy of 73%. Two models were significantly more accurate than the pooled model when only using application status as a factor, the model constructed using treated tissue samples, and the model using new growth tissue samples. The model constructed using tissue collected 14 DAT was the only model significantly different from the pooled model when looking at timing as the only factor. Lastly, when constructing models using both timing and application status as factors, three models were significantly different from the model constructed using the pooled timing and type tissue samples, with the model constructed using tissue samples that were directly treated with 2,4-D and collected 14 days after treatment producing the highest accuracy of any model, with 96% classification accuracy.

Evaluation of Control of Failed Stands of Corn (*Zea mays* L) and Soybean (*Glycine max* (L.) Merr.). GA Mangialardi*[1], JA Bond[1], D Gholson[1], T Allen[2], J McCoy[3]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Leland, MS, [3]Mississippi State University, Verona, MS (148)

Evaluation of control of failed stands of corn (*Zea mays* L.) and soybean (*Glycine max* L. Merr.) Mangialardi GA, Bond JA, McCoy JM, Allen T, Gholson DM, Eubank TW, Bowman HD, Burrell TD Early spring planting in Mississippi often involves dealing with significant rainfall, leaving producers with cool and saturated soils that are less than optimal for germination. Corn yield relies on the uniformity of the stand after planting. Research has reported that in fields with late-emerging plants, yield can be decreased 10 to 65% compared to fields with uniform stands. Optimal seedling density of soybean is a minimum of 247,000 plants ha^{-1}. If initial plant densities are below that threshold, planting into these below optimal densities has been reported to increase yield. Only when plant densities were < 91,000 plants ha^{-1} was yield increased when plants were terminated, and the field was replanted. The objective of this research was to find the most effective herbicide treatment, application timing, and replant timing after application to control a failed stand of corn and soybean. Two studies replicated four times, studies were conducted at the Delta Research and Extension Center in Stoneville, MS and North Mississippi Research and Extension Center in Verona, MS from 2020 to 2021 to evaluate control of failed stands of corn and soybean with different herbicide treatments and application timings, as well as control of a failed stand of corn with soybean planted 1 and 7 d after treatment (DAT). This consisted of two studies replicated four times. Treatments in both studies were arranged as a two-factor factorial within a randomized complete block design with four replications. The termination study included a non-treated check where the replant study did not. In the termination study, Factor A was herbicide treatment and included paraquat alone at 841 g ai ha^{-1}, paraquat at 841 g ha^{-1} plus at metribuzin 211 g ai ha^{-1}, and clethodim at 51 g ai ha^{-1} plus glyphosate at 1,121 g ae ha^{-1}. Factor B was application timing with treatments at VC (cotyledon growth stage) then every 5 d until VC + 20 d. Soybean treatments were identical but did not include clethodim plus glyphosate. In the replant study, all treatments were applied to V2 (two collared leaves) growth stage corn. Factor A was herbicide treatment with the treatments identical to the termination study. Factor B was replant timing and included soybean planted 1 and 7 DAT following each treatment. In the termination study, paraquat plus metribuzin provided the greatest control 3 DAT at all application timings. No treatment controlled corn > 50% 3 d after VC application. At 7, 14, and 21 DAT evaluations, clethodim plus glyphosate provided $\geq$ 90% control across all application timings. Paraquat alone provided the least amount of control, controlling corn only $\leq$ 60% at all evaluations and timings. The greatest control of a failed stand of soybean at 3 DAT evaluation was following VC + 10 application timing with both treatments. Control 3 DAT was lower with earlier and later applications, indicating soybean can be too big or too small to control 3 DAT. At 7, 14, and 21 DAT evaluations, both treatments provide $\geq$ 90% control at all application timings besides control only being 70% at VC application timings. In the replant study, pooled across soybean replant timing, paraquat plus metribuzin provided the greatest control 3 DAT compared with other treatments alone. At 14 and 21 DAT, clethodim plus glyphosate controlled more corn than paraquat plus metribuzin and paraquat alone. Even though control with clethodim plus glyphosate was greater than with paraquat plus metribuzin 14 and 21 DAT, paraquat plus metribuzin controlled the simulated failed corn $\geq$ 92% at both evaluations. Control of simulated failed corn stand with paraquat alone never exceeded 50% at 3 to 21 DAT. Yield in plots with no herbicide treatment to control the simulated failed corn stands was only 340 kg ha^{-1}. Soybean yield in all plots receiving herbicide treatment targeting simulated failed corn stands were similar and $\geq$ 2,150 kg ha^{-1}. Results from the termination study indicated that from VC + 5 d to VC + 20 d, simulated failed corn stand can be controlled with paraquat plus metribuzin 3 DAT. Clethodim plus glyphosate provides the most consistent control across all growth stages at 7, 14, and 21 DAT. Paraquat alone was not effective in controlling a failed stand of corn. Both paraquat alone and paraquat plus metribuzin controlled a failed stand of soybean, but a quicker termination will occur with VC + 10 application timing. Results of the replant study demonstrate the importance of terminating failed stands of corn before replanting because of the dramatic reduction in yield in the plots not treated with herbicide. If applied at V2, both clethodim plus glyphosate and paraquat plus metribuzin will control a failed stand of corn.

Sensitivity of Fluazifop-resistant Grain Sorghum to ACCase-inhibiting Herbicides. JA Fleming*[1], JK Norsworthy[1], MV Bagavathiannan[2], N Godara[1], TC Smith[1], T Barber[3]; [1]University of Arkansas, Fayetteville, AR, [2]Texas A&M University, College Station, TX, [3]University of Arkansas System Division of Agriculture, Lonoke, AR (149)

Sensitivity of Fluazifop-Resistant Grain Sorghum to ACCase-inhibiting HerbicidesA collaboration between the University of Arkansas Systems Division of Agriculture and Texas A&M University has resulted in a new line of grain sorghum with known resistance to the acetyl CoA carboxylase (ACCase)-inhibiting herbicide fluazifop. While this grain sorghum line has known resistance to fluazifop, it is believed to have cross-resistance to other ACCase inhibitors in the aryloxyphenoxypropionate (fop) family. A field trial was conducted to evaluate the sensitivity of fluazifop-resistant grain sorghum to ACCase inhibitors from the fop, cyclohexanedione (dim), and phenylpyrazolin (den) families in Fayetteville, AR, in 2020 and 2021. Eleven different ACCase-inhibiting herbicides were tested at two rates, and fluazifop was tested at three rates. The goal was to understand how fluazifop-resistant grain sorghum would respond to different ACCase inhibitors under field conditions to help make decisions for the future commercialization of this technology. A low level of sensitivity, not exceeding 12% injury, was observed when fop and den herbicides were applied at the 2- to 3-leaf stage. Conversely, fluazifop-resistant grain sorghum was susceptible to applications of dim herbicides where greater than 90% injury was caused by 1X rates of sethoxydim and clethodim. These results show potential for use of utilize multiple ACCase-inhibiting herbicides from the AOP and "den families for postemergence grass control in this line of grain sorghum, with an option existing for control of volunteer plants using a dim.

Melatonin as a Potential Safener Against 2,4-D Injury in Cotton. JC Argenta*[1], AL Miller[2], T Tseng[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (150)

Melatonin (N-acetyl-5-methoxytryptamine) is a well-known molecule for regulating sleep, mood, immune system and others, in humans and animals. Melatonin is an essential molecule in physiological processes such as germination, photosynthesis, flowering, senescence, and others in plants. In the recent years, melatonin has been shown to protect against biotic and abiotic stressors. It also has been suggested that melatonin can act as an essential reactive oxygen species (ROS) scavenger, protecting plants against herbicide damage. Therefore, the objective of this study was to evaluate the effect of melatonin in cotton sprayed with sublethal doses of 2,4-D. Plants were grown in the greenhouse at an average temperature of 35°C/25°C (day/night). When plants were at the two expanded leaf stages, melatonin at 100µM was added by drenching the soil for 3 consecutive days. In non-melatonin treatment, the soil was drenched with distilled water. Following melatonin treatment, all plants were sprayed with 0, 5, 25, 50, and 75% of 2,4-D field rate (0.8 kg/ha^{-1}). Herbicide injury was evaluated at 7, 14, 21, and 28 days after application (DAA). At 28 DAA, shoot and root biomass were collected. The data were subjected to analysis of variance (ANOVA) at a= 0.05 using the software R®. At 5% of 2,4-D, plants treated with melatonin showed significantly lower herbicide injury when compared to no-melatonin treatment (p=<0.001). Although melatonin-treated plants had a higher shoot and root biomass, the difference was not significant when comparing plants sprayed with 5% of 2,4-D. When 25, 50, and 75% of the field rate were applied, no significant injury between melatonin treated and untreated plants were found. Further research needs to be conducted to confirm our findings. Melatonin may act as a ROS scavenger, but only at the lower rate of 2,4-D. At higher herbicide rates, plants may require more prolonged melatonin treatment to induce their defense mechanisms.

Initial Insights into the Mechanism of Glufosinate Resistance in Palmer Amaranth. P Carvalho-Moore*[1], JK Norsworthy[1], J Hwang[1], F Gonzalez Torralva[1], GL Priess[1], T Barber[2], TR Butts[2], JS McElroy[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]Auburn University, Auburn, AL (151)

Resistance to glufosinate in Palmer amaranth (*Amaranthus palmeri* S. Watson) was first reported in 2021 in Arkansas. Thus far, the resistance mechanism is unknown. In order to find alternative control and correct management approaches, it is important to determine the resistance mechanism. This study aimed to investigate the resistance mechanism behind glufosinate resistance in Palmer amaranth accessions in Arkansas. Experiments were designed to quantify cytoplasmatic and chloroplastic glutamine synthetase (*GS1* and *GS2*) copy number and expression. Seedlings of two susceptible (SS1 and SS2) and three glufosinate-resistant accessions (19-62, 20-58, and 20-59) were grown in a greenhouse at the Milo J. Shult Agricultural Research & Extension, Fayetteville, AR. Gene copy number assay was conducted with nontreated plants from the susceptible accessions and glufosinate survivors from the resistant accessions sprayed with glufosinate at 656 g ai ha^{-1}. Four biological replications were tested for each accession, and each sample was repeated twice. Native gene expression analysis was conducted with nontreated plants from the five accessions previously mentioned. Three biological replications were tested for each accession, and each sample was repeated twice. Gene copy number and expression assays were performed by quantitative PCR. Gene copy number and expression were calculated relative to two reference genes in each assay. Relative to the two reference genes, accessions 20-58 and 20-59 had a significant increase in copy number. Accession 20-58 had an average of 34 *GS2* copies, while accession 20-59 had 85 and 86 copies. The two susceptible accessions and 19-62 had an average of 2 *GS2* copies. All accessions showed only one *GS1* copy. In regards to gene expression, accession 20-58 showed an increase in *GS2* expression of 13- and 24-times, and 20-59 showed a 15- and 31-times increase. Similar to the results obtained in the *GS2* gene copy number assay, the susceptible and 19-62 accessions showed no increase in *GS2* expression. For *GS1* expression, gene expression showed a slight increase in the accessions 19-62 and 20-58 (3- and 2.7-fold) compared to the other accessions for the first pair of reference genes. As for the second primer pair, no difference was found within the accessions for *GS1* expression. The increase in gene amplification and overexpression of the glutamine synthetase enzyme, specifically the chloroplastic isoform, is likely the mechanism conferring resistance to glufosinate in accessions 20-58 and 20-59. Glutamine synthetase is the targeted enzyme by glufosinate. The overproduction of this enzyme allows resistant plants to maintain the photorespiration pathway after glufosinate applications. Future efforts will focus on understanding the resistance mechanism of accession 19-62.

Growth Analysis of Herbicide-resistant and Susceptible *Amaranthus palmeri* Biotypes. J de Souza Rodrigues*[1], TL Grey[1], KM Eason[2]; [1]University of Georgia, Tifton, GA, [2]The University of Georgia, Tifton, GA (156)

Palmer amaranth is a native species to the Southwestern US, whose expansion across the country has been occurring over the past few decades. With its continual spread across the US, multiple cases of herbicide resistance have been reported. One of the first reported cases of evolved resistance for Palmer amaranth was to trifluralin in South Carolina in 1989. Plant development is related to changes in the environment and plant genetics as a consequence of evolution and adaptation to the environment. Palmer amaranth is well-known for its plasticity, and in order to observe the changes over time, plants of susceptible and resistant biotypes were grown and analyzed. Seeds of susceptible were collected in the early 2000s, whereas glyphosate-resistant was collected in 2017, both from Georgia. Palmer amaranth seeds were sown in trays and grown in a greenhouse until both biotypes reached 8 to 10 cm tall. The seedlings were transplanted to round buried pots (76 x 76 cm) filled with loamy sand soil. The experimental design was a randomized complete block with a factorial structure (2x5) of two biotypes and five harvest dates over time. Data collected included plant height, number of leaves, and leaf area recorded at every harvest date, following a destructive analysis for biomass quantification. These measurements were then used to quantify plant volume, leaf area ratio (LAR), specific leaf area (SLA cm^2/g), and Net Assimilation Rate (NAR $g.cm^{-2}$ ground area day^{-1}). Data recorded included chlorophyll content (SPAD) and was subjected to LMM in R. Data indicated that susceptible Palmer amaranth biotype plants from the early 2000s had greater behavior variability across the harvest dates for all variables evaluated with respect to LAR, SLA, and NAR. The analyzed data suggest that the susceptible biotype is more sensitive to environmental changes (such as temperature), while the resistant presented a more stable growth pattern throughout the evaluations, for LAR, SLA, and NAR. The age gap between biotypes could explain why the resistant biotype is more stable in the current environment. Further studies approaching plant growth are essential to visualize and quantify whether herbicide resistance can somehow affect plant fitness. Also, how these changes impact the plant community level and weed management.

Effect of Herbicide Concentration on Atrazine, Pyroxasulfone, and Saflufenacil Dissipation Under Field and Lab Conditions. RL Landry*[1], L Steckel[2], TC Mueller[3]; [1]University of Tennessee Knoxville, Knoxville, TN, [2]University of Tennessee, Jackson, TN, [3]University of Tennessee, Knoxville, TN (157)

Widespread herbicide resistant weeds over the last several years have fueled a renewed interest in the utility of soil-applied residual herbicides. Residual activity of a herbicide is based on a myriad of factors within and among environments. A common assumption used in simulation models examining herbicide persistence is that herbicide degradation is independent of application rate. These studies compared herbicide concentration on dissipation with three commonly used residual herbicides under field and lab conditions. Atrazine, pyroxasulfone, and saflufenacil represent herbicides with a relative field persistence of medium, high, and low, respectively. Field studies were conducted over two years where herbicides and rates were assembled in a factorial arrangement of treatments and herbicides were applied at rates of 100, 1000, and 10000 g ai ha^{-1}. These application rates are quite divergent from labeled rates, and were used to elucidate the effect of herbicide dose on subsequent dissipation. Soil samples were collected on selected intervals over the course of 52 weeks to detect dissipation of the herbicides. The field study indicated that persistence is affected by herbicide concentration. Higher herbicide concentrations exhibited slower dissipation rates while lower herbicide concentrations exhibited more rapid dissipation. Lab studies used a factorial arrangement of treatments where the three herbicides were combined with high and low rates based on water solubility. Soils were placed in an incubator set for ambient temperature conditions. Lab studies generally agreed with the field studies, and indicated higher herbicide concentrations showed slower herbicide dissipation compared with the lower herbicide concentrations. These studies suggest that herbicide concentration has an effect on the dissipation of atrazine, pyroxasulfone, and saflufenacil in field and lab conditions. This finding would be important for those using herbicide degradation rates in simulation modeling, since herbicide degradation is often assumed to be independent of rate applied.

A Bioassay to Determine *Poa annua* Responses to Indaziflam. BD Pritchard*[1], J Brosnan[2], JJ Vargas[3]; [1]University of Tennessee Knoxville, Knoxville, TN, [2]Univeristy of Tennessee, Knoxville, TN, [3]University of Tennessee, Knoxville, TN (158)

Herbicide resistance within *Poa annua* is widespread in managed turfgrass systems. In 2020, a *P. annua* collection from a golf course in the southeastern United States was reported to be resistant to indaziflam as well as six other mode-of-action groups. Considering *P. annua* is the most troublesome weed in turfgrass, a bioassay to screen other collections with putative indaziflam resistance is needed. A dose response experiment was conducted with ten concentrations of indaziflam (0, 250, 500, 750, 1000, 1250, 1500, 2000, 4500, and 9000 pM) in Gelrite® culture during 2021. An herbicide-susceptible (S1) collection of *P. annua*, a resistant standard (Site 3A), and a collection with putative-resistance to indaziflam (Site 18) were included in this experiment. Petri dishes were filled with 80 mL of Gelrite® (3.75 g L^{-1}) containing technical grade (= 98%) indaziflam (Sigma-Aldrich, St. Louis, MO) and rifampicin (1000 ppm). Each plate was sealed with parafilm after placing 15 seeds of a single collection on the Gelrite® surface. During the experiment, all plates were placed at a 75° angle to facilitate gravitropic root growth and stored in a growth chamber set to a constant air temperature of 16 °C. Each indaziflam concentration was replicated five times per *P. annua* collection. At 14 days after seeding (DAS), the length of root tissue (mm) protruding from each seed was recorded with digital calipers. Root length data from each *P. annua* collection (N = 75) were expressed as a percentage of the non-treated (0 pM indaziflam) and subjected to non-linear regression analysis to calculate indaziflam concentrations required to reduce root growth by 75% (EC_{75}). Statistically significant differences were detected among *P. annua* collections with the EC_{75} for the herbicide-susceptible collection measuring 740 pM [95% confidence interval (CI) = 663 to 829 pM] compared to 2685 pM (CI = 2137 to 3559 pM) for Site 3A and 4819 pM (CI = 3413 to 7459) for Site 18. This work will be repeated in 2022 to further validate a discriminatory dose to screen *P. annua* responses to indaziflam in Gelrite® culture.

Peanut Response to Forestry Herbicides: Imazapyr and Triclopyr. C Abbott*, EP Prostko; University of Georgia, Tifton, GA (159)

Imazapyr and triclopyr are herbicides used in non-cropland areas, highway rights-of-ways, grass pastures, conservation reserve program (CRP) acres, and forestry sites. Georgia has over 4,451,542 ha of evergreen forests (pine trees) and is the nation's top producer of peanut (*Arachis hypogaea* L.) with 335,889 ha planted in 2021. Imazapyr and triclopyr injury has been observed in peanut fields due to the close proximity and interface between pine tree production and peanut fields. Limited data on peanut response to imazapyr and triclopyr is available. Therefore, the objective of this research was to determine the effects of PRE and POST applications of imazapyr and triclopyr on peanut. Separate, irrigated, small-plot field trials were conducted in 2020 and 2021 at the UGA Ponder Research Farm near Ty Ty, Georgia. Twin-row peanuts were planted on April 27, 2020 and May 3, 2021 with variety 'GA-06G'. Herbicide treatments were arranged in a complete randomized design in a three (time) X four (rate) factorial arrangement with four replications. Imazapyr and triclopyr timings were preemergence (PRE) [1 day after planting (DAP)] and postemergence (POST), either 28 DAP or 58 DAP. Imazapyr rates were 0 (NTC), 4.2 (1/100th X), 42 (1/10th X), and 420 g ai ha^{-1} (1X). Triclopyr rates were 0 (NTC), 8.4 (1/100th X), 84 (1/10th X), and 840 g ai ha^{-1} (1X). Treatments were applied using a CO_2-powered, backpack sprayer calibrated to deliver 140 L ha^{-1} at 275 kPa with 11002AIXR nozzles. The plot area was maintained weed-free using a combination of labeled herbicides and hand-weeding. Data collected included peanut density, visual estimates of stunting/epinasty/chlorosis, plant height, canopy width, and yield. All data were subjected to ANOVA using PROC GLIMMIX and means separated using the Tukey-Kramer Method (P=0.05). Peanut density was significantly reduced by 48% with triclopyr at the 1X rate when applied PRE but not by any other rate or timing. Imazapyr did not impact peanut density at any time or rate. Triclopyr at the 1X rate caused significant peanut stunting at all three timings (9-58%) and significant epinasty (5%) at the 58 DAP timing. When averaged over timing, imazapyr caused significant visual stunting at the 1/10thX and 1X rate (24-55%), and significant chlorosis at the 1X rate (20%). When triclopyr was applied at 28 or 56 DAP, peanut yields were significantly reduced by the 1X rate (45% and 57%, respectively). No yield losses occurred from triclopyr applied at the 1/10thX and 1/100thX rates when applied PRE or POST. Imazapyr significantly reduced peanut yield at the 1/10th and 1X rate (15% and 67%, respectively) when averaged over all timings. In summary, peanuts were more sensitive to imazapyr than triclopyr. Drift rates of triclopyr and imazapyr less than 1/10thX should not result in significant peanut yield loss.

Programmatic Approaches to Control Quinclorac-Resistant Smooth Crabgrass (*Digitaria ishaemum*) in Bermudagrass (*Cynodon* Spp.) Turf. AD Putri*; Mississippi State University, Mississippi State, MS (160)

The auxin-mimicking herbicide quinclorac controls crabgrass (*Digitaria* spp.) post-emergence in cool- and warm-season turfgrass species. Quinclorac-resistance has been confirmed in smooth (*D. ischaemum*) and large crabgrass (*D. sanguinalis*). Two Mississippi smooth crabgrass populations suspected of quinclorac resistance were characterized using standard rate-response screens. They required 5 and 80 times more quinclorac to reach 50% biomass reduction than susceptible populations. Field experiments were conducted to evaluate programmatic approaches to control a resistant population. Treatments included the sequential application of pre-emergence herbicides on February 17/April 10, 2020, and February 25/April 6, 2021, alone or in combination with 0.84 kg quinclorac ha^{-1} applied post-emergence on April 10, 2020, and April 6, 2021, followed by a second application of quinclorac alone on June 18, 2020, and June 16, 2021. Pre-emergence treatments included 0.05 kg indaziflam ha^{-1}, 0.84 kg prodiamine ha^{-1}, 0.56 kg dithiopyr ha^{1}, and 0.47 kg prodiamine ha^{-1} + 0.21 kg imazaquin ha^{1} + 0.73 kg simazine ha^{-1}. Commercial standards applied on April 10/June 18, 2020, and April 6/June 16, 2021, included: 0.16 kg pinoxaden ha^{-1} and 2.27 kg MSMA ha^{-1}. Four weeks after the last application, all treatments except quinclorac (2020 and 2021), dithiopyr (2020), and pinoxaden (2020) controlled quinclorac-resistant smooth crabgrass greater than 90%. Various standard pre-emergence herbicides adequately controlled the resistant population. The combination of quinclorac with pre-emergence strategies provided greater control of smooth crabgrass than quinclorac alone. Ongoing research investigates the mechanism of quinclorac-resistance in the two Mississippi populations. Future research should screen a wider distribution of populations, and cross- and multiple-resistance should be investigated.

Distribution of Herbicide-resistant Italian Ryegrass in Arkansas. L Adams*[1], T Barber[2], JK Norsworthy[3], TR Butts[2]; [1]University of Arkansas, Greenwood, MS, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Fayetteville, AR (161)

Italian ryegrass (*Lolium perenne L. ssp. multiflorum* Lam. Husnot) is one of the most troublesome weeds in Arkansas row crop production due to its ability to compete at a high level for essential nutrients and evolve resistance to commonly used herbicides. In Arkansas, Italian ryegrass has been confirmed resistant to herbicide groups such as ALS-inhibitors, ACCase-inhibitors, and glyphosate. As a result, growers are left with limited herbicide options for effective control of Italian ryegrass. The objective of this research was to test populations of Italian ryegrass from across the Arkansas south Delta for resistance to clethodim, imazamox, glyphosate, and paraquat. Experiments were conducted at the Milo J. Shult Agriculture Research and Extension Center in Fayetteville, Arkansas to determine the distribution of herbicide-resistant Italian ryegrass populations. Herbicide treatments included clethodim at 136 g ai/ha, imazamox at 52.5 g ai/ha, glyphosate at 841 g ai/ha, and paraquat at 1161 g ai/ha. Clethodim, paraquat, and imazamox had a crop oil concentrate at 1% volume. Herbicide treatments were applied to Italian ryegrass seedlings at the two- to four-leaf growth stage using a moving-nozzle sprayer equipped with 8002E nozzles delivering 190 L ha-1 at 220 kPa. Treated plants were evaluated for survival 3 weeks after treatment (3 WAT) based on live/dead plants to determine the percent resistance of each population. A total of 20 populations across 8 counties were tested. Results indicate that on average 40% of samples were resistant to clethodim, 35% were resistant to imazamox, 95% were resistant to glyphosate, and 0% were resistant to paraquat.

Herbicide Program Evaluation for Control of Knotroot Foxtail (*Setaria parviflora*) in Bermudagrass (*Cynodon dactylon*) Pastures. LM Dyer*[1], NT Basinger[1], P McCullough[2], GM Henry[1]; [1]University of Georgia, Athens, GA, [2]University of Georgia, Griffin, GA (162)

Knotroot foxtail (Setaria parviflora Poir. Kerguélen) is the only perennial Setaria species and is native to the United States (US). Knotroot foxtail is becoming increasingly problematic in pastures and hayfields across the Southeastern US and closely resembles yellow foxtail (Setaria pumila Poir. Roem. & Schult.). Both knotroot and yellow foxtail have similar above ground identifiable features that can create scouting confusion for growers. Current PRE-herbicide programs can minimize the impact of annual Setaria spp., but an herbicide program for control of knotroot foxtail in pastures has not been established. Studies were established in established bermudagrass (Cynodon dactylon L. Pers.) pasture at two locations, one in Clarke County Georgia and one in Oconee County Georgia in 2020 and 2021. Treatments were either applied in the fall, spring, or combinations of fall and spring applications. Fall applications included glyphosate (352.08 g a.i. ha-1and 701.58 g a.i. ha-1), hexazinone (1,348.2 g a.i. ha-1), nicosulfuron (59.03 g a.i. ha-1) metsulfuron-methyl (15.76 g a.i. ha-1), and an untreated check. Spring applications included indaziflam (67.18 g a.i. ha-1), pendimethalin (4,462.27 g a.i. ha-1), and an untreated check. Three harvests per season were conducted to determine bermudagrass yield and weed biomass for each species present, including knotroot foxtail. Data was analyzed by Fall and Spring applications. Treatments containing indaziflam increased knotroot foxtail biomass at harvest 1 compared to untreated check and at harvest 2 compared to pendimethalin. However, applications of pendimethalin and indaziflam both increased yield in bermudagrass in each harvest with a season increase in yield by 223.5% using indaziflam and 209.2% with pendimethalin compared to no herbicide application. Fall applied hexazinone increased the biomass of knotroot foxtail compared to nicosulfuron. Fall applied nicosulfuron increased bermudagrass yield compared to the low rate of glyphosate in yearly totals. Producer's should be applying a spring treatment of either pendimethalin or indaziflam to increase their bermudagrass stand. A good stand of bermudagrass is a good defense against weed biomass. More research to examine the efficacy of indaziflam on establish perennialized knotroot foxtail, knotroot foxtail seed and other Integrated Weed Management methods for control of this species in pastures and hayfields are necessary.

Confirmation of Paraquat-resistant Italian Ryegrass (*Lolium multiform*) in North Carolina Row Crops.
JH de Sanctis*[1], CW Cahoon[1], W Everman[1], T Gannon[1], ZR Taylor[2], JC Forehand[1]; [1]North Carolina State University, Raleigh, NC, [2]North Carolina State University, Sanford, NC (163)

Italian ryegrass is a major agronomic weed across North Carolina and growers have long struggled with herbicide resistance. In the fall of 2020, multiple growers reported unsatisfactory control of Italian ryegrass after sequential burndown applications of paraquat in south-central North Carolina. The objectives of this study were to confirm paraquat-resistant Italian ryegrass in North Carolina and determine the level of resistance in a whole-plant dose-response bioassay. Plants that survived paraquat under field conditions were collected and grown in separate greenhouses for seeds. Progeny from populations collected in the field were seeded under greenhouse conditions along with four known paraquat-susceptible biotypes. Treatments included ten paraquat rates, varying from 0.0625X to 32X, where 1X represents the maximum label rate of paraquat (840 g ai ha^{-1}). Plants were harvested 28 days after application and dry biomass weights were converted to biomass reduction. Based on the effective dose required to reduce biomass 50% (ED50), the putative paraquat-resistant Italian ryegrass biotypes were 21- to 60-fold resistant to paraquat when compared to the averaged ED50 of susceptible populations. If converted to g ai ha^{-1}, the ED50 of putative paraquat-resistant population varied from 633 to 1887 g ai ha^{-1} whereas the average ED50 of susceptible populations was 31.5 g ai ha^{-1}.

Evaluation of Florpyrauxifen-benzyl &Amp; Aminopyralid in Florida Pastures. CA R. Sales*[1], BA Sellers[1], P Devkota[2], MO Wallau[3]; [1]University of Florida, Ona, FL, [2]University of Florida, Jay, FL, [3]Universitry of Florida, Gainesville, FL (164)

The relatively new herbicide premix florpyrauxifen-benzyl & aminopyralid has been introduced as a resource for producers to control troublesome weeds in pastures. Tropical soda apple (*Solanum viarum*) and dogfennel (*Eupatorium capillifolium*) are two of the most problematic weeds in Florida pastures and rangeland. Studies were conducted at two locations in central Florida to determine the efficacy of florpyrauxifen-benzyl & aminopyralid, if tank-mix partners are needed for optimum weed control, and to determine the tolerance of the common forage grasses. Visual estimates of dogfennel control 30 days after treatment (DAT) were at least 70% when florpyrauxifen-benzyl & aminopyralid (9 + 93 g ai ha^{-1}) was tank-mixed with triclopyr & fluroxypyr (210 + 70 g ai ha^{-1}), dicamba & 2,4-D (420 + 1,121 g ai ha^{-1}) and 2,4-D (1,597 g ai ha^{-1}) . The control increased throughout the season with over 90% dogfennel control by 120 DAT. Control of tropical soda apple (TSA) was at least 85% 30 DAT regardless of treatment. Forage tolerance studies demonstrated bermudagrass (*Cynodon dactylon*) and stargrass (*Cynodon nlemfluensis*) tolerant to florpyrauxifen-benzyl & aminopyralid, while this premix alone (9 + 93 g ai ha^{-1}) resulted in approximately 25% less biomass than untreated limpograss (*Hermarthria altissima*). However, this was transient and not observed at 60 DAT. Overall, the new herbicide premix with a tank-mix provides similar control of dogfennel and tropical soda apple compared to the standard tank-mix of 2,4-D & aminopyralid + triclopyr & fluroxypyr; however, caution may need to be exercised when applying this new herbicide premix to limpograss.

Evaluation of Weed Control with Alite 27 in HPPD-Tolerant Cotton. J. Dudak*[1], Z. Treadway[1], T. Baughman[1], T. Barber[2], C. Cahoon[3], A. Culpepper[4], S. Nolte[5], A. Hixson[6]; [1]Oklahoma State University, Ardmore, OK; [2]University of Arkansas System Division of Agriculture, Lonoke, AR; [3]North Carolina State University, Raleigh, NC; [4]University of Georgia, Tifton, GA; [5]Texas A&M AgriLife Extension, College Station, TX; [6]BASF, Lubbock, TX (165) ABSTRACT Weeds are continually evolving resistance to many of the common herbicide sites of action labeled for use in cotton production. This in combination with observations of weeds resistant to auxin herbicides is of considerable concern to weed management practitioners. One of the methods to reduce pressure on the auxin herbicide technology is through the application of residual herbicides at planting. However, this can add additional challenges since early season cotton injury is often observed with these applications. BASF is currently integrating a tolerance trait to isoxaflutole (HPPD inhibitor) in cotton to provide producers another tool for weed management. Studies were conducted to evaluate the use of isoxaflutole on weed efficacy, cotton response and lint yield. A multi-state research project was conducted at seven locations across the cotton belt, including: Tillar, AR; Ty Ty, GA; Clayton, NC; Bixby, Altus, and Fort Cobb, OK; and College Station, TX. HPPD-tolerant cotton was planted and managed based on local growing practices. The following herbicide treatments were applied PRE at 6 of 7 locations: isoxaflutole (112 g ai ha^{-1}) alone and either diuron/fluometuron (560-1120 g ai ha^{-1}) or fomesafen/fluridone (210-275 g ai ha^{-1}) alone or in combination with isoxaflutole. All PRE treatments were followed by a POST application of dicamba (560 g ae ha^{-1}) + dimethenamid-P (673 g ai ha^{-1}) + glyphosate (1648 g ai ha^{-1}) + potassium carbonate (406 g ai ha^{-1}). At Tillar, AR PRE treatments included: fluometuron (841 g ai ha^{-1}) alone or in combination with isoxaflutole (112 g ai ha^{-1}), fluometuron + prometryn (560 g ai ha^{-1}), and a three-way combination of all three herbicides. Three POST applications of various herbicide combinations were made following all PRE treatments at Tillar. Less than 10% visible cotton injury was observed at any location 2 weeks after planting (WAP). Additionally, the incidence of injury did not increase when isoxaflutole was combined with other herbicides. Isoxaflutole alone PRE controlled Palmer amaranth (*Amaranthus palmeri* S. Watson) and annual grass 97% or greater 2 WAP at Altus, Bixby, Fort Cobb, and Ty Ty. Isoxaflutole + diuron was the only PRE treatment that controlled over 90% of Palmer amaranth and annual grass at all locations 4 weeks after the POST application. Control of Palmer amaranth and annual grass was excellent season long at Tillar, AR. Cotton lint was harvested at all three Oklahoma locations however, differences among treatments were only documented at Bixby. Diuron, fomesafen, and isoxaflutole + diuron yielded higher than isoxaflutole or isoxaflutole + fomesafen. Isoxaflutole exhibited excellent cotton tolerance while providing control of Palmer amaranth and annual grass when used as part of an overall cotton herbicide management program.

Phosphorus Fertilization Influences Critical Period of Weed Control in Sweet Corn on Organic Soils.
AG Rodriguez*, D Odero; University of Florida, Belle Glade, FL (166)

Efforts have been made to reduce phosphorus (P) applications to agricultural fields and loads to drainage canals due to water quality concerns in the Everglades Agricultural Area. Understanding the effect of P in sweet corn in competition with weeds is essential for making decisions on appropriate fertilization levels. Therefore, a field experiment with a split-plot arrangement was conducted in 2020 in Belle Glade, FL, to evaluate the influence of P applications on the critical period of weed control (CPWC) in sweet corn on organic soils. Main plots consisted of three P fertilization levels (0, 75, and 150 kg P ha^{-1}) and individual sets of treatments were applied to subplots to represent increasing duration of weed interference and duration of weed-free periods. The beginning and end of the CPWC based on a 5% acceptable yield loss level were determined by fitting log-logistic and Gompertz models to represent the increasing duration of weed interference and the duration of weed-free period, respectively. The results indicate that CPWC in sweet corn varied from 15 to 51 days after emergence, depending on the P fertilization level. The CPWC was estimated to be V4 to R2, V6 to R1, and V7 to V12 stage at 0, 75, and 150 kg P ha^{-1}, respectively. The recommended and highest P fertilization level (150 kg P ha^{-1}) delayed the beginning and hastened the end of the CPWC in sweet corn. These results show that reductions in P fertilization in sweet corn may require more intensive weed management practices to prevent yield losses.

Confirmation and Control of Auxin Resistant Palmer Amaranth in Tennessee. DC Foster*[1], L Steckel[1], PA Dotray[2]; [1]University of Tennessee, Jackson, TN, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX (167)

Reports of Palmer amaranth (*Amaranthus palmeri* S. Wats.) escapes in auxin-based cropping systems became notably more prevalent in Tennessee in 2019 and 2020. It was determined that in many cases, dicamba or 2,4-D were applied timely to small (<10cm) Palmer amaranth. In 2020, greenhouse studies were conducted at Texas Tech University to confirm resistance of Palmer amaranth populations obtained from Tennessee. In 2021, field experiments were conducted at the West TN AgResearch and Education Center and two growers' fields in Madison and Lauderdale counties where reports of Palmer amaranth escapes in previous years were prevalent to determine the level of resistance of these populations to dicamba and 2,4-D. Malathion insecticide (a cytochrome p-450 inhibitor) was investigated to examine if resistance could be due to enhanced metabolism of the herbicides. Experiments were also conducted to determine the best herbicide programs to control resistant Palmer amaranth populations. Results indicate that in the field, only 40-60% of Palmer amaranth <10 cm tall were controlled using 0.56 kg dicamba ha^{-1} and 45-65% were controlled with 1.12 kg 2,4-D ha^{-1}. Malathion did not increase control with dicamba, regardless of application timing; the tank mix of malathion and 2,4-D increased control compared with 2,4-D alone on <10 cm Palmer amaranth. This result might indicate metabolic resistance is in part causing the loss of control. Results on management suggest that the best option for growers will be sequential applications of dicamba or 2,4-D with glufosinate 7-10 days apart with no preference on order of herbicides applied.

Cover Crops and Selected Cultivars for Weed Management in Organic Sweetpotato Production. I Schlegel Werle*, M Machado Noguera, S Karaikal, P Carvalho-Moore, J Kouame, N Roma-Burgos; University of Arkansas, Fayetteville, AR (168)

Integrated weed management (IWM) systems that include non-chemical tactics for weed control are necessary as weed resistance to herbicides increases. Nine sweetpotato (*Ipomoea batatas* L.) cultivars were evaluated for weed-suppressive ability, growth traits, and yield. Experiments were conducted at Fayetteville and Kibler, AR. The split-plot studies evaluated weed infestation (broadleaf spp., grass spp., or weed-free) as mainplot and nine sweetpotato cultivars as subplot. 'Beauregard-14' had the longest vines, whereas 'Hatteras' and 'Heartogold' had the tallest canopy at 5 and 7 WAT in Kibler and Fayetteville. 'Heartogold' had the largest leaf area at both locations. This cultivar reduced weed biomass 2- to 4-fold in both locations. Yield ranged from 27218 kg ha^{-1} to 77935 kg ha^{-1} in weed-free plots and was reduced by 53- and 63% with grass and broadleaf weeds across locations, respectively. 'Beauregard-14'and 'Bayoubelle-6'were the high-yielding cultivars in Kibler and Fayetteville. The best performing cultivars were integrated with cereal winter cover crops in Kibler and Augusta. The split-split plot tests included weeding (with or without) as mainplot; cover crop (winter wheat+clover, cereal rye+clover, fallow) as subplot; and sweetpotato cultivar (four) as sub-subplot. A 4.9-fold and 2.4-fold decrease in yield was observed in weedy plots in Augusta and Kibler, respectively. 'Bayou Belle-6' was the highest yielding cultivar at both locations. In Augusta and Kibler, rye+clover increased yield by 38 and 73%, respectively. Cultivars 'Bayou-Belle-6' and 'Beauregard-14' and mixed cover crops such as rye+clover are viable tools to reduce weed interference in IWM.

Response of Louisiana Weedy Rice Accessions to Benzobicyclon. B Greer*[1], C Webster[2], DC Walker[2], E Webster[1], JA Williams[2]; [1]Louisiana State University, Baton Rouge, LA, [2]LSU AgCenter, Baton Rouge, LA (169)

The introduction of imidazolinone-resistant (IR) rice (*Oryza sativa* L.) provided producers with an effective herbicide option for weedy rice control and other problematic broadleaf and grass weeds in rice production. Weedy rice is a general term which refers to the F_2 generation of cultivated hybrid rice, outcrosses, and wild-type red rice (*O. sativa* L.). Soon after the release of IR-rice, IR-weedy rice populations were reported due to outcrosses of IR-rice with red rice and the F_2 generation hybrid IR-rice germinating in succeeding growing seasons. Benzobicyclon, the first 4-hydroxyphenoxypyruvate-deoxygenase (HPPD)-inhibiting herbicide labeled in U.S. rice production, may have potential for control of weedy rice. Tolerance to benzobicyclon is conferred by the presence of a fully functional HPPD Inhibitor Sensitive 1 (HIS1) gene in rice. Field studies were conducted in 2020 and 2021 at the Rice Research Station near Crowley, Louisiana to evaluate the tolerance of 71 weedy rice accessions collected from around Louisiana and southern Arkansas to benzobicyclon. The experimental design was a randomized complete block design with a two-factor factorial arrangement of treatments with four replications. Factor A consisted of benzobicyclon applied at 0 or 373 g ai ha^{-1}. Factor B consisted of weedy rice accessions with differing locations or phenotypes in the same location. Weedy rice accessions were phenotypically characterized by hull color, leaf pubescence, height, and presence or absence of awns. Because benzobicyclon must be converted into its active form, benzobicyclon hydrolysate, in flood water; galvanized metal square rings were utilized to contain the benzobicyclon treated water within the plot area. Each square ring was further broken down into four equal quadrants, which represented the four replications. Separate treated and nontreated bays were utilized to ensure that benzobicyclon treated water did not affect nontreated weedy rice accessions. Weedy rice accessions were subsampled, pre-germinated, and hand broadcasted into the flooded research area, where a pin-point flooding system was later utilized. Herbicide applications were made at the three- to four-leaf growth stage utilizing a CO_2-pressurized backpack sprayer calibrated to deliver 94 L ha^{-1}. Tissue samples were collected approximately 7 d prior to herbicide application for Kompetitive Allele Specific PCR (KASP) genotyping to evaluate functional trait markers for the HIS1 and the IR gene. Plant heights were collected at 0 and 28 d after treatment (DAT), visual control ratings were taken at 14 and 28 DAT, and fresh weight biomass data was collected at 28 DAT. KASP genotyping data found that an insertion or deletion at locus 1462 coded for the functional or dysfunctional HIS1 allele, respectively. Weedy rice with the dysfunctional allele made up 20% of the accessions, and benzobicyclon controlled these accessions 28 to 97% at 28 DAT. Whereas weedy rice with the functional allele made up 66% of the accessions, and benzobicyclon controlled these accessions 0 to 14% at 28 DAT. Weedy rice that contained both the functional and dysfunctional alleles made up 10% of the accessions, and benzobicyclon controlled these accessions 0 to 67% at 28 DAT. Of the 15 weedy rice accessions that had the dysfunctional gene, only two were also susceptible to imidazolinone herbicides. Since HIS1 and IR genes both occur on chromosome 2, it is likely that IR weedy rice is also tolerant to benzobicyclon. This research indicates that benzobicylon is unlikely to control a majority of the weedy rice in Louisiana.

An Investigation into the Impacts of Pre-Emergent Herbicide Program on the Health and Productivity of HLB-Affected Citrus Trees. N Timilsina*[1], O Batuman[2], F Alferez[2], D Kadyampakeni[3], R Tiwari[1], R Kanissery[1]; [1]University of Florida/Institute of Food and Agricultural Sciences-Southwest Florida Research and Education Center, Immokalee, FL, [2]University of Florida, Immokalee, FL, [3]University of Florida, Lake Alfred, FL (170)

Exploring the non-target crop effects of pre-emergent herbicides is imperative for developing a weed suppression strategy in citrus crops: an industry currently afflicted by devastating Huanglongbing (HLB) disease. Thus, the current study investigates the impacts of pre-emergent herbicide programs on the health and productivity of HLB-affected citrus trees. Replicated field trials were established in two commercial citrus groves in 2021, mainly focusing on the Southwest Florida citrus production region. The herbicide treatments were studied in the sandy soil of Florida under citrus production with an average pH of 6.19 and 0.93% organic matter. The non-target impacts of two pre-emergent herbicide active ingredients (a.i), indaziflam and diuron, were evaluated on one of Florida's major juice-producing citrus cultivars, Hamlin. The study used six herbicide concentrations, a non-treated control, and a weed checked control arranged in a completely randomized design with four replications. Treatments applied at PRE include indaziflam at 0.105, 0.210, and 0.420 kg/ha rates and diuron at 1.821, 3.643, and 7.286 kg/ha rates. Test herbicides were sprayed three months before the commercial harvest. Pre-harvest fruit drop and fruit detachment force (FDF) were recorded at pre-determined intervals. Fruits were harvested on the last week of November 2021, and yield was quantified. Visual evaluations of weed coverage were taken from each herbicide program. Total fruit drop for each treatment was converted to a percentage of pre-treatment fruit count. Weed coverage evaluation data collected from each herbicide program was converted into weed control percentage. Significance differences in the treatment means were assessed by Tukey's HSD test (a=0.05) using R. The weed coverage data showed that test herbicides provide significant weed control 3 months after the application. Weed control effectiveness increased with the increasing rate of test herbicides. However, no significant effect was observed on the pre-harvest fruit drop and FDF from any pre-emergent herbicide applications evaluated in this study. Among the various herbicide and the rate levels evaluated, a significantly higher yield was only observed in the plots that received the highest rate of diuron. These results indicated that the pre-emergent herbicides applied within the labeled range of rates for citrus are crop safe and provide effective weed control in the HLB-affected 'Hamlin' citrus. The study suggests a further long-term investigation on the impacts of pre-emergent herbicide persistence on citrus health and productivity.

Response of Non-Irrigated Peanut to Multiple Rates of Delayed Flumioxazin Applications. NL Hurdle*[1], TL Grey[2]; [1]University of Georgia, Collierville, TN, [2]University of Georgia, Tifton, GA (171)

Georgia peanut growers provide nearly 50% of the total United States peanut supply annually. Growers achieve these high yields by utilizing potent and effective herbicides as part of an integrated weed management program. One effective herbicide in peanut production is flumioxazin. Once applied PRE, flumioxazin provides control during the critical weed free period of weeks three through eight after planting. It is applied to over 65% of the United States peanut acres and over 75% of Georgia peanut acres. Injury has been noted under adverse conditions such as cool soil temperature and rainfall or irrigation, but little information is available for non-irrigated peanut. Non-irrigated peanut studies were performed in 2020 and 2021 to investigate for the response of peanut to flumioxazin applications at multiple rates and timings. Studies were performed in Plains and Tifton, Georgia with flumioxazin being applied between zero and 14 days after planting at 27, 54, 107 g ai ha. Data collected included plant population, plant width, percent injury compared to the non-treated control, percent weed control, and yield and analyzed using Tukey's HSD set at an alpha of 0.05. Analysis indicated peanut noted the greatest amount of injury 10 days after planting at the highest rate at both locations and years. Yield differences were indicated only at the Tifton location and indicated that as rate and application time after planting increased, yield decreased. These data support previous studies in that flumioxazin has potential to cause injury to peanut when applied under non-irrigated conditions.

Hydrilla Response to Intermittent-Pulse Herbicide Treatments. TL Darnell*[1], BP Sperry[2], CM Prince[3]; [1]University of Florida/ Center for Aquatic Invasive Plants, Gainesville, FL, [2]US Army Corps of Engineers, Gainesville, FL, [3]University of Florida, Gainesville, FL (172)

Hydrilla [*Hydrilla verticillata* (L.f.) Royle] is one of the most troublesome submersed aquatic weeds in the US. Registered herbicide options are limited in aquatic systems. Therefore, optimizing available herbicide efficacy is paramount to improved hydrilla management. A potential option for herbicide optimization is through an application technique termed "intermittent-pulse" exposure where an active herbicide exposure time precedes a rest phase (no herbicide present) followed by an active herbicide exposure. This "on/off/on" regime has varied exposure times for the initial treatment, rest phase, and final treatments to maximize herbicide efficacy. However, little is known of the appropriate initial, rest, and final exposure time requirements for success. The dipotassium salt of endothall was used as the active ingredient due to its widespread use for hydrilla management, especially in flowing water scenarios. Consequently, small-scale mesocosm experiments were conducted to evaluate the effects of varying intermittent-pulse exposures of the dipotassium salt formulation of endothall for hydrilla control. The current research aimed to evaluate the effect of varying initial and final herbicide treatment times and the effect of a varying rest phase on reducing hydrilla biomass. All three experiments were set up as completely randomized designs with five replicates. Results indicated that an initial exposure duration (2, 4, 8, or 12 hour) influenced biomass reduction less than other application technique components. Percent biomass reduction of pulsed herbicide treatments showed that a 2-, 4-, 8-, and 12-hour initial exposure reduced biomass by 80, 71, 62, and 83 %, respectively, compared to the control. However, biomass was reduced 78, 52, and 30% compared to the nontreated control from 16-, 40-, and 64-hour rest phases, respectively. Static herbicide treatments resulted in more consistent biomass reduction compared to pulsed treatments. Pulsed herbicide applications may have the ability to reduce hydrilla biomass more effectively than conventional herbicide applications, but further work to refine an initial treatment, rest phase, and final treatment scheme is required before recommending this treatment regime.

Confirmation of Novel Multiple Herbicide-resistant Redroot Pigweed (*Amaranthus retroflexus*) in North Carolina. EA Jones*, RJ Andres, DJ Contreras, CW Cahoon, JC Dunne, KM Jennings, RG Leon, W Everman; North Carolina State University, Raleigh, NC (173)

Farmers have limited chemical options to control *Amaranthus* spp. in conventional soybeans, relying mainly on acetolactate synthase (ALS)-inhibting and protoporphyrinogen oxidase (PPO)-inhibiting herbicides. In 2019 (Camden County, NC) and 2020 (Pasquotank County, NC), complaints of control failures with ALS- and PPO-inhibiting herbicides on redroot pigweed (*Amaranthus retroflexus* L) were reported by two different farmers in North Carolina. Greenhouse dose-response assays confirmed that the Camden and Pasquotank County redroot pigweed populations exhibited decreased susceptibility to ALS and PPO-inhibiting herbicides compared to multiple herbicide-susceptible redroot pigweed populations, suggesting the evolution of resistance. Sequencing the ALS DNA and PPX cDNA of the redroot pigweed populations provided evidence that the Camden County population exhibited a $Trp_{574}Leu$ mutation in the ALS gene and an $Arg_{98}Gly$ mutation in the PPX2 gene. The gene sequencing provided further evidence that the Pasquotank County population exhibited an $Ala_{198}His$ mutation in the ALS gene (novel mutation in the genus and species) but no mutation was present in the PPX2 gene. These two populations represent the first confirmed cases of PPO-inhibiting herbicide-resistant redroot pigweed in the United States; as well as the first confirmed cases of this particular herbicide resistance profile inhabiting the United States. While no mutation was found in the PPX gene of the Pasquotank County population, we suggest that this population has evolved resistance to PPO-inhibiting herbicides but the mechanism of resistance is to be determined.

Evaluation of Glyphosate and Dicamba Antagonism on Annual Grasses. RD Langemeier*[1], S Li[1], DP Russell[2], A Culpepper[3], CW Cahoon[4], P Devkota[5], KJ Price[1], JT McCaghren[1], L Ianhez Pereira[1]; [1]Auburn University, Auburn, AL, [2]Auburn University, Madison, AL, [3]University of Georgia, Tifton, GA, [4]North Carolina State University, Raleigh, NC, [5]University of Florida, Jay, FL (175)

Glyphosate and dicamba are often tank mixed to achieve broad spectrum control of troublesome weeds. While previous literature has documented antagonism between glyphosate and dicamba tank mixes an increase in the presence of the glyphosate tolerant/resistant grasses has increased the importance of this problem. Dicamba label restrictions also reduce the number of tools available to fight this problem. The objectives of this study were to evaluate the annual grass control affected by 1) weed size at application, 2) tank mixing dicamba and glyphosate compared to glyphosate applied alone, 3) addition of a drift reduction agent, 4) higher spray volume, 5) increasing glyphosate rate, 6) separating dicamba and glyphosate application, and 7) addition of adjuvants. The study was conducted in summers of 2020 and 2021 in sites in Alabama, Florida, North Carolina, and Georgia. Visual injury was recorded 10 and 20 days after treatment (DAT). Addition of a DRA, nozzle selection or increasing spray volume did not have a significant effect on grass control efficacy. Application to smaller grasses numerically increased efficacy at all sites but this effect was only significant at the North Alabama site. Addition of dicamba to the tank mix significantly reduced grass control by 21-29% in North Alabama. Consistent, but smaller numerical reductions in grass control at other sites were observed but were not statistically significant. Applying dicamba with a separate boom, but within 30 seconds of glyphosate application resulted in 8-28% better control than a comparable tank mix. When the glyphosate rate was increased from 1260 to 1890 g ae ha-1 in a glyphosate + dicamba tank mix there was a trend for increased control, but control was numerically lower than glyphosate alone at 1260 g ae ha-1 at all sites. However, control was improved by separating applications and increasing glyphosate rate.

Evaluating the Efficacy and Non-target Injury Potential of Triclopyr When Applied as a Basal Bark Treatment. CA Oberweger*[1], SF Enloe[2]; [1]Center for Aquatic and Invasive Plants - University of Florida, Gainesville, FL, [2]University of Florida, Gainesville, FL (176)

Triclopyr is used for woody plant control in Florida natural areas. Recently, an acid formulation (Trycera) was labeled for aquatic habitats and can be used for basal bark applications. However, non-target injury on native species in wetland environments has been reported. Literature on the response of these species to triclopyr is minimal and the pathways of triclopyr non-target injury remain uncertain. A potential mechanism of non-target injury includes the movement of triclopyr via flooding. To assess this pathway, a mesocosm study was conducted over the summer and fall of 2020. This study utilized 16 (94-L) tubs, planted with brazilian peppertree *(Schinus terebinthifolia*), sugarberry *(Celtis laevigata)*, red maple (*Acer rubrum)*, and buttonbush (*Cephalanthus occidentalis)*. Sample wells were installed in each tub for water sampling. Treatments included 1) basal oil only, 2) basal oil + flooding, 3) basal oil + triclopyr acid -applied as Trycera herbicide (34 g ae/L), 4) basal oil + flooding + triclopyr acid (same concentration). Flooding was applied to a depth of 7.5-cm immediately following treatment and maintained for 21 days. Post treatment water sampling indicated triclopyr was present at concentrations of up to 6470 µg L^{-1} in the flooding treatment. However, triclopyr concentrations in samples wells from the non-flooded treatment reached a maximum of 16 µg L^{-1}. Non-target damage was significantly higher in the triclopyr + flooding treatment compared to the triclopyr treatment without flooding for red maple and sugarberry but not buttonbush. Following the initial study, a dose response study was performed over the summer and fall of 2021 to examine the variation in species response to triclopyr that was previously observed. The second study utilized 16 (75-L) tubs, each with 2 species and 4 replicate pots per species. Species included sugarberry, red maple, and buttonbush. Treatments included eight concentrations of triclopyr ranging from 0 to 125 ppm. Injury data included weekly collection of % defoliation for three months following treatment and a final measurement of live cambium height at 112 days after treatment. For defoliation at 49 days after treatment, analysis using logistic regression indicated differential sensitivity to triclopyr between the three species, with increasing sensitivity in the order of buttonbush, red maple, and sugarberry. However, longer term evaluation of live cambium height at 112 days after treatment indicated red maple was more sensitive to triclopyr than the other species. Data from these studies indicated that triclopyr non-target injury was significantly increased when flooding followed basal bark application and that there was considerable variation in the sensitivity of the non-target species tested. These findings will assist wetland managers in improving triclopyr stewardship when using basal bark applications in wetlands, where seasonal flooding is common.

Evaluating Herbicide Antagonism Following Application of Dicamba, 2,4-D, Glyphosate, and Clethodim. JA Patterson*, DM Dodds, Z Ugljic, JH Hughes; Mississippi State University, Mississippi State, MS (177)

Herbicide antagonism is a common issue growers throughout the southern United States face. Tank-mixtures of grass control herbicides and synthetic auxin herbicides can be antagonistic, resulting in reduced grass weed control. Data is lacking regarding time between mixing and application with respect to antagonism. Therefore, greenhouse experiments were conducted at the R.R. Foil Plant Science Research Center in Starkville, MS to evaluate time that graminicides and auxin herbicides are in solution and the resultant effect on grass weed control. Treatments included: clethodim + dicamba; clethodim + 2,4-D; glyphosate + dicamba; and glyphosate + 2,4-D, which were each applied at increasing time intervals following initial mixing. These time intervals included: application immediately after mixing, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, and 24 hours after mixing. At 28 days after treatment, clethodim + 2,4-D applied six hours after mixing provided greater barnyardgrass control than when applied 30 minutes, 1 hour, and 2 hours after mixing. These data suggest that waiting six hours after mixing to apply clethodim + 2,4-D could be a viable method for overcoming auxin herbicide antagonism for grass weed control when using these herbicides. At 28 days after treatment, glyphosate + 2,4-D applied 30 minutes after mixing provided greater barnyardgrass control than when the same mixture was applied at all other time intervals following mixing. In general, mixtures containing clethodim + 2,4-D or dicamba provided greater barnyardgrass control than mixtures containing glyphosate + 2,4-D or dicamba, possibly suggesting that clethodim is less-antagonized by synthetic auxins than glyphosate. Further research is needed to validate these conclusions.

Purple Nutsedge Tuber Production and Viability in Response to Postemergence Herbicides. E Begitschke*, KA Tucker, CJ Wang, GM Henry; University of Georgia, Athens, GA (178)

Purple nutsedge (*Cyperus rotundus* L.) is one of the most problematic turfgrass weeds due to a high growth rate, aggressive rhizomes, and prolific tuber production. Long-term purple nutsedge control is dependent on the absorption and subsequent translocation of postemergence herbicides throughout vegetative propagules. Field research with pyrimisulfan (Vexis), a relatively new acetolactate synthase inhibiting herbicide, yielded substantial reductions in purple nustsedge stands; however, little is known about its impact on rhizome and tuber production. Therefore, research was conducted to evaluate single and sequential applications of postemergence herbicides on purple nutsedge morphology in a controlled environment. Purple nutsedge was established in the Athens Turfgrass Research and Education Center greenhouse complex in Athens, GA in 2020 by planting 7 tubers pot^{-1}. Treatments were initiated on 1 July 2020 and consisted of single and sequential applications of pyrimisulfan and EH1663 at 52.5 g ai ha^{-1}, single applications of sulfentrazone (Dismiss) at 420 g ai ha^{-1}, and sequential applications of sulfentrazone at 210 g ai ha^{-1}. A non-treated check was added for comparison. Vexis and EH1663 treatments resulted in 27 to 29 tubers and rhizome dry weights of 0.7 to 1.1 g 61 days after single applications, while Dismiss tuber number and rhizome weight was 114 and 9.2 g. These morphological responses coincided with purple nutsedge control of 73, 85, and 10% in response to Vexis, EH1663, and Dismiss, respectively. Tuber numbers of 39 and 30 along with rhizome weights of 7.6 and 2.6 g were observed 60 days after sequential applications of Vexis and EH1663. Sequential applications of Dismiss resulted in similar tuber number (173) and rhizome weight (48.6 g) as the non-treated check (182 and 54.6 g, respectively). Reduced tuber number and rhizome weight in response to Vexis and EH1663 corresponded to 94% control 60 days after sequential applications.

Influence of Low Rates of 2,4-D on Cotton Fiber Quality. KR Russell*[1], PA Dotray[2], BR Kelly[1]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX (179)

With the increase in acres planted to auxin-tolerant cotton (*Gossypium hirsutum*), the number of preplant, at-plant, and postemergence applications of dicamba and 2,4-D choline to aid in the control of troublesome broadleaf weeds including glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats) has increased. More dicamba and 2,4-D choline applications means an increased risk of off-target movement. Field studies were conducted in 2019-2021 at the Texas Tech University New Deal Research Farm equipped with subsurface drip irrigation to evaluate dicamba-tolerant cotton response to various rates of 2,4-D choline when applied at four growth stages (first square + two weeks, first bloom, first bloom + two weeks, and first bloom + four weeks). A CO_2-pressurized backpack sprayer with a carrier volume of 15 gallons per acre and TTI11002 nozzles was used to apply 2,4-D choline at 0.95 (1X), 0.095 (1/10X), 0.019 (1/50X), 0.0095 (1/100X), 0.0019 (1/500X), and 0.00095 (1/1000X) lb ae/a. Deltapine 1822 XF cotton was planted in 40-inch rows. Plots, 4-rows by 30 feet in length, were replicated four times and kept weed-free throughout the growing season. Cotton was box mapped prior to harvest to determine boll number and distribution as affected by rates and application timing. Plots were machine harvested to determine lint yield. Fiber quality measurements were analyzed at the Fiber & Biopolymer Research Institute at Texas Tech University. Relative to the non-treated control, yield loses observed in all years at the first square + two weeks application were from a reduction in boll number above node 10. At the first bloom + four weeks application, only the 1X rate of 2,4-D choline resulted in a yield loss in all three years. Micronaire, fiber length, and uniformity were negatively influenced by the 1/10X and 1X rates of 2,4-D choline at various timings in 2019 and 2020. In addition, short fiber content, neps, and seed coat neps increased where micronaire, fiber length, and uniformity were negatively impacted. The use of 2,4-D can be an effective tool to control troublesome weeds; however, it is important to understand the implications it can have on susceptible cotton.

Impact of Species Selection on Plant Community, Sod Tensile Strength, and Translocation Rooting of a Pollinator-garden Sod. D Koo*, S Askew, CG Goncalves, M Goatley, J Brewer, JM Craft, JM Peppers; Virginia Tech, Blacksburg, VA (180)

Interest in promoting pollinator species for managed landscapes has grown recently. The establishment of perennial native plants often takes a few years and establishment projects are often lost to unwanted weedy vegetation. Mature sod of pollinator-serving, native plants that is free of weeds would be highly desirable to related industries. The objective of this study is to evaluate the potential for establishing sod that includes pollinator-serving plants as assessed via sod tensile strength and rooting strength after sod transplanting. Multi-year field trials were conducted at Virginia Tech's Glade Road Research Facility and Turfgrass Research Center in Blacksburg, VA to examine the impact of base species selection – native grass mix (*Schizachyrium scoparium*, *Elymus virginicus*, and *Sorghastrum nutans)*, *Bouteloua gracilis*, *Festuca rubra*, and *Achillea millefolium* on 1) pollinator-plant community of 20 pollinator-serving, native forbes (Ernst Mesic to Dry Native Pollinator Mix) including predominately *Rudbeckia hirta*; 2) sod tensile strength when harvested conventionally and grown in native soil over 2.5 mm or 12 mm jute, organic netting or when grown via plasticulture using a native soil mix over a plastic tarp; and 3) translocation rooting strength of pollinator-garden sod. When sod was harvested conventionally, tensile strength was insufficient to create transportable sod at one year after seeding regardless of the type of organic netting utilized. At two years after seeding, sod tensile strength was not measurable for the 12 mm jute netting because the netting interfered with the harvesting operation causing sod to be fractured and nontransportable. The 2.5mm netting had completely degraded after two years and sod tensile strength increased when the base species mix included *F. rubra* compared to the native grass mix or *B. gracilis*. *Achillea millefolium* as a base mixture generated sod tensile strength that was similar to *F. rubra*, the native grass mix, and *B. gracilis*. Although *F. rubra* as a base mixture produced pollinator-garden sod with two times higher tensile strength than native grass and *B. gracilis* bases, it competed with desirable pollinator-serving plants as evidenced by significant reduction in *R. hirta* establishment compared to other base species. When any of the four plant communities were grown over plastic, they produced sod tensile strengths of 13 to 19 kg at 1.5 years after establishment and did not differ with respect to base species. Based on a review of the literature regarding sod tensile strength of ornamental turfgrasses, such as *Cynodon dactylon* and *Poa pratensis*, pollinator-garden sod produced via plasticulture over 1.5 years had sod tensile strength similar to that of ornamental turfgrasses that are conventionally harvested in one season. When plasticulture sod was transplanted and allowed to acclimate for 4 months, rooting strengths were 566 to 706 kg m^{-2} with no differences between base species mixture. This rooting strength is similar to that reported by Goatley and Schmidt (1991, HortScience) for *P. pratensis* at 1 month after transplanting. These data suggest that it is possible to produce transportable sod of pollinator-serving plant communities, but plant communities should not be predominated by *F. rubra* and will require 1.5 to 2 years of growth.

Barnyardgrass Control with POST Herbicides Following Rice Exposure to Sub-Lethal Concentrations of Paraquat. TL Sanders*, HM Edwards, JD Peeples, JA Bond; Mississippi State University, Stoneville, MS (181)

Barnyardgrass Control with POST Herbicides Following Rice Exposure to a Sub-Lethal Concentration of Paraquat Sanders, T.L., Edwards, H.M., Peeples, J.D., and Bond, J.A. In Mississippi, rice is routinely in early seedling growth stages when preplant and/or PRE herbicides are applied to corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), and soybean [*Glycine max* (L.) Merr.]. Paraquat-based herbicide treatments are commonly applied preplant and/or PRE in these crops; therefore, off-target movement onto adjacent rice fields may occur. Off-target movement can result in crop damage, including visible injury, delayed maturity, and yield losses to sensitive crops in adjacent fields. After an off-target movement event has occurred, weed management is still necessary. Therefore, research was conducted to evaluate rice response and barnyardgrass control with POST herbicides after exposure to a sub-lethal concentration of paraquat. Field studies were established at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, from 2019 to 2021 to evaluate barnyardgrass control with POST herbicides following exposure to a sub-lethal concentration of paraquat. 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). Visible estimates of aboveground rice injury and barnyardgrass control were recorded 3, 7, 14, 21, 28 and 42 d after labeled herbicide treatment (DAT). Rice heights were recorded 21 d after labeled herbicide treatment and at maturity, and rough rice yield was collected at maturity. All data were subjected to ANOVA with means separated with estimates of the least square means at P=0.05. Rice injury 3 and 7 DAT was $\geq$83% among POST herbicide treatments following paraquat exposure except with quinclorac and cyhalofop (80%) 7 DAT. Rice injury 14, 21, 28, and 42 DAT was < 70% among POST herbicide treatments following exposure to paraquat. No differences in barnyardgrass control following paraquat exposure were detected 3, 7, 14, 21 and 28 DAT among POST herbicide treatments (>88%) except control with florpyrauxifen-benzyl (87%) was less than other treatments 7 DAT. Barnyardgrass control 42 DAT was $\geq$ 83% with imazethapyr and propanil. Rice height was reduced $\geq$ 8% among POST treatments following paraquat exposure. Rough rice yield was greater following imazethapyr (9300 kg ha-1) and lower with floryprauxifen benzyl and no labeled herbicide (paraquat alone) ($\leq$ 6700 kg ha-1). Applications of paraquat-based herbicide treatments to fields in proximity to rice should be avoided if conditions are conducive for off-target movement. However, after an off-target movement event has occurred, weed management is still necessary. POST herbicide treatments for weed management are effective following rice exposure to paraquat and herbicide choice should be based on weed spectrum.

Response of Goosegrass and Smooth Crabgrass to PRE and POST-applied Methiozolin. JM Peppers*, S Askew; Virginia Tech, Blacksburg, VA (182)

Control of goosegrass and smooth crabgrass in creeping bentgrass putting greens is difficult due to a lack of selective herbicides that safely offer control of these grasses. Methiozolin is a newly registered herbicide that is primarily used to selectively control annual bluegrass in creeping bentgrass putting greens. Although the methiozolin product label indicates that it can selectively control goosegrass and smooth crabgrass, no peer-reviewed research has examined this claim. Field and greenhouse experiments were conducted in order to evaluate the herbicidal efficacy of methiozolin on goosegrass and smooth crabgrass. Two field trial locations were established in 2020. One trial was located on a fallow area that is regularly infested with goosegrass and crabgrass, and the other trial was established on a creeping bentgrass putting green that is typically infested with smooth crabgrass. In both locations, methiozolin was applied either once or twice at 0.5 kg ai ha^{-1}. Methiozolin treatments were compared to bensulide (9 kg ai ha^{-1}), bensulide plus oxadiazon (6.7 and 1.7 kg ai ha^{-1}), and siduron (3.4 kg ai ha^{-1}). A greenhouse study was established to evaluate the herbicidal efficacy of methiozolin applied to goosegrass and smooth crabgrass preemergence and postemergence at different growth stages. Methiozolin was applied at 0.125, 0.25, 0.5, 1, and 2 kg ai ha^{-1} to goosegrass and smooth crabgrass at preemergence, 1-2 leaves, 3-4 leaves, 1 tiller, and 3 tillers. At the fallow site, two applications of methiozolin controlled goosegrass similarly to bensulide and bensulide plus oxadiazon in early July. Single applications of methiozolin and siduron did not control goosegrass compared to the nontreated. Two applications of methiozolin controlled smooth crabgrass better than the nontreated. However, bensulide, bensulide plus oxadiazon, and siduron controlled smooth crabgrass greater than two applications of methiozolin. Single applications of methiozolin did not control smooth crabgrass at this location. At the creeping bentgrass putting green location, single applications of methiozolin controlled smooth crabgrass greater than the nontreated, but less than the other treatments. Sequential applications of methiozolin controlled smooth crabgrass similarly to siduron and bensulide plus oxadiazon, but bensulide alone was the most effective treatment at this location. In the greenhouse, the label rate of methiozolin (0.5 kg ai ha^{-1}) controlled 3-4 leaf smooth crabgrass, 1-2 leaf goosegrass and smooth crabgrass >80%. All examined rates of methiozolin controlled both goosegrass and smooth crabgrass preemergence. Results from these trials indicate that methiozolin has the potential to control goosegrass and smooth crabgrass, but the timing must be close to germination to achieve acceptable control.

Effect of Cereal Rye Termination Timing on Palmer Amaranth Emergence and Growth Rate. Implications for Optimizing Herbicide Programs. C Sias*, ML Flessner, KW Bamber, S Peters; Virginia Tech, Blacksburg, VA (183)

The evolution of herbicide resistance, led by Palmer amaranth (*Amaranthus palmeri*), has highlighted the need for non-chemical weed control options. Cover crops are known to suppress Palmer amaranth, but questions remain regarding termination practices to maximize weed control benefits and if herbicide inputs can be reduced in the presence of a cover crop. An experiment was conducted in 2021 to determine the effect of cover crop termination timing on Palmer amaranth emergence patterns and growth rate. Treatments included "planting brown" (cereal rye terminated two weeks before soybean planting), "planting green" (cereal rye terminated at soybean planting), and a no cover (winter fallow) check. Palmer amaranth emergence counts and growth rate were evaluated from new emergence cohorts every two weeks up to 10 weeks after the planting green termination. To explore herbicide program optimization, simulated herbicide programs were compared consisting of all relevant combinations of PRE and POST herbicides from 1-, 2-, and 3- pass programs that resulted in Palmer amaranth control at soybean canopy. PRE herbicides were assumed to suppress Palmer amaranth for 28 days, after which the number of days to reach 10 cm in height was used to determine when and if a POST1, POST1 + residual, or POST2 herbicide application(s) were necessary. Simulated herbicide program analysis indicated that the simplest and most cost-effective cover crop and herbicide regime was winter fallow with a single POST herbicide. Among cover crop termination options (planting green versus brown), planting green with a single POST herbicide optimized inputs. This finding contradicts previous research and survey data, likely due to the abnormally dry May experienced in this study. Although more site-years are necessary, this information will provide better recommendations for herbicide programs when integrating cover crops.

Characterizing and Controlling Pronamide and PSII-inhibiting Herbicide Resistant *Poa annua*. AL Wilber*[1], EB De Castro[1], JD McCurdy[1], MJ Ignes[2]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (184)

Annual bluegrass (*Poa annua*) is among the most troublesome turfgrass weeds in the world, ranking in the top 10 of most common and troublesome weeds in grass crops, pasture, and turfgrass. Historically, turfgrass managers have relied on pre- and postemergence herbicides to control annual bluegrass, but resistance to multiple modes of action has increased the difficulty of control over time. A field study was conducted in 2019 and 2020 to evaluate alternative tank mixtures of herbicides to control a suspected resistant annual bluegrass population in a bermudagrass [*Cynodon dactylon* (L.) Pers.]–annual bluegrass fairway. The study was conducted as a randomized complete block design with four replications. Annual bluegrass control (%, compared to the nontreated) and cover were visually evaluated on 10 Mar. 2020 and 3 Mar. 2021. The mixture of 0.016 kg indaziflam ha^{-1}, 1.12 kg simazine ha^{-1}, and Tribute Total (0.04 kg combined ai ha^{-1}) applied on 25 Nov. and 20 Dec. 2019; and 17 Nov. 2020 and 1 Dec. 2021 was the only treatment that provided greater than 90% control in both years. Similarly, a single application of 1.12 kg prodiamine ha^{-1}, 1.12 kg simazine ha^{-1}, and 0.019 kg trifloxysulfuron ha^{-1} (25 Nov. 2019 and 17 Nov. 2020) provided 92 and 89% control, respectively. Results varied between years for other single and sequential treatments. Greenhouse dose-response screens were conducted in 2021 to characterize the suspected simazine- and pronamide-resistant population using seven rates of pronamide and simazine (0 to 18 × standard labeled rates). The pronamide rate required to reduce foliar biomass 50% compared to the nontreated (GR_{50}) for the resistant (R) biotype was 20 times greater than that of the susceptible (S) biotype (6.62 vs. 0.32 kg ai ha^{-1}, respectively). The simazine rate required for GR_{50} of the R biotype was 10 times greater than that of the S biotype (2.59 vs. 0.26 kg ai ha^{-1}, respectively). Field research identified tank mixtures to adequately control an annual bluegrass population that was confirmed resistant to pronamide and simazine. Ongoing research investigates the resistance mechanism of this and other multiple-resistant populations.

Performance of Residual Herbicide Combinations in Oklahoma Soybean. ZR Treadway*, JL Dudak, TA Baughman; Oklahoma State University, Ardmore, OK (185)

Soybean producers have continually been faced with difficult decisions regarding weed management. Resistance to acetolactate synthase (ALS), glyphosate, and protoporphyrinogen oxidase inhibiting (PPO) herbicides along with reports of glufosinate and auxin resistance has only increased this dilemma. One option in this battle is use of PRE residual herbicide combinations with multiple modes of action. Experiments were conducted in 2020 and 2021 to evaluate four modes of action for PRE residual weed control in dicamba-tolerant soybean. Treatments included chloransulam-methyl (36 g ai ha^{-1}), metribuzin (417 g ai ha^{-1}), pyroxasulfone (95 g ai ha^{-1}), or sulfentrazone (163 g ai ha^{-1}). Herbicides were applied alone, as well as in two- and three-way combinations. Treatments were followed by a POST application of dicamba (567 g ae ha^{-1}) + glyphosate (329 g ae ha^{-1}). Soybean injury never exceeded 10% with any treatment at any point during the growing season. Palmer amaranth (*Amaranthus palmeri* S. Watson) was present in four of six site years. The only PRE treatment that controlled Palmer amaranth 2 weeks after planting (WAP) at least 98% was a three-way combination of metribuzin + pyroxasulfone + sulfentrazone. Similar control was achieved at 3 of 4 locations with all treatments except with chloransulam-methyl alone and in combination with pyroxasulfone + sulfentrazone. Control of Palmer amaranth, 4 WAP, was at least 98% at three of the four site years, with pyroxasulfone in a two or three-way combination with chloransulam-methyl and metribuzin; and chloransulam-methyl+metribuzin+sulfentrazone. Following the POST application control of Palmer amaranth at all locations was at least 97% with all three-way combinations and with pyroxasulfone + metribuzin. Large crabgrass (*Digitaria sanguinalis* (L.) Scop.) was present in four of six site years. Control, 2 WAP, was at least 90% at all locations with any treatment that included metribuzin except when in combination with sulfetrazone. Large crabgrass control 4 WAP was at least 97% at 3 of 4 locations with all two and three-way PRE combinations except sulfentrazone in combination with either chloransulam-methyl or metribuzin, or chloransulam-methyl + pyroxasulfone. Following the POST application, metribuzin + pyroxasulfone tank-mixed together or combined with chloransulam-methyl or sulfentrazone were the only treatments to control large crabgrass 98% or greater across all site years. All treatments increased yield when compared to the untreated check, but there was no consistent yield increase among treatment combinations. However, it was noted that chloransulam-methyl applied alone was the only treatment that yielded equal to or below the herbicide treatment trial average at all locations. This is most likely due the prevalence of ALS-resistant Palmer amaranth in Oklahoma soybean. Additionally, only treatments that included pyroxasulfone yielded equal to or greater than the trial average. These experiments highlight the need for residual herbicide combinations to combat weeds over different geographical and environmental conditions. These combinations can also assist in protecting new POST technologies that most Oklahoma soybean producers are implementing as part of their overall weed management program.

Response of Green Antelopehorn Milkweed (*Asclepias viridis* W.) to Auxinic Herbicides. KL Broster*, H Quick, JD Byrd, Jr.; Mississippi State University, Mississippi State, MS (186)

Green antelopehorn milkweed (*Asclepias viridis*), a native wildflower perennial to Mississippi (USDA Plants Database), can be fatally toxic to livestock when consumed and easily found in forages and pastures (Mulligan, 1979; Blackwell, 1990). A field study was conducted in Oktibbeha Co., Mississippi at two field locations with dense populations of already established green antelopehorn, one in a cattle pasture and another in a hayfield, to observe the response of green antelopehorn milkweed to herbicides. Fourteen treatments were organized in a randomized complete block design with four replications applied to 2.4 by 3 m plots. Before application green antelopehorn densities were recorded as the average of 2 1 m^2 subsamples per plot and was repeated at the end of the growing season prior to frost. Densities will be counted against emergence. Treatments included: Vastlan (triclopyr choline salt) at 4.67 and 2.34 L ha^{-1}, Remedy Ultra (triclopyr butoxy ester) at 4.67 and 2.34 L ha^{-1}, Garlon 3A (triclopyr triethyl amine) at 6.23 and 3.12 L ha^{-1}, Trycera (triclopyr acid) at 6.52 and 3.26 L ha^{-1}, MezaVue (aminopyralid + picloram + fluroxypyr) at 2.34 and 1.17 L ha^{-1}, DuraCor (aminopyralid + florpyrauxifen-benzyl) at 1.46 and 0.73 L ha^{-1}, and Grazon P+D (2,4-D + picloram) at 9.35 and 4.67 L ha^{-1}. Applications occurred June 11, 2020 and May 25, 2021, with a CO^2 backpack sprayer with XR8003 nozzles at 280.6 L ha^{-1} and application pressure of 310 kPa walking 4.8 KPH. Visual green antelopehorn control ratings were taken 2 and 4 weeks after application (WAT). Data were analyzed using R Studio (Version 1.3.959), subjected to ANOVA, to compare treatments across location and year, then means separated using Fisher's LSD (a = 0.05). Visual injury of milkweed 1 MAT observed differences in location, as well as year. At the cattle pasture in 2020, Duracor at 0.73 L ha^{-1} was least injurious of all treatments except Garlon 3A at 3.12 L. Similar results were observed in 2021 with the addition of Duracor being similar to Vastlan at 2.34 L ha^{-1}. The hay pasture had differences in injury between years across all locations. In 2020, Grazon P+D at 9.35 L ha^{-1} caused more injury to milkweed than Vastlan at 2.34 L ha^{-1}, Remedy Ultra at 2.34 L ha^{-1}, Garlon 3A at 6.23 and 3.12 L ha^{-1}, Trycera at 3.26 L ha^{-1}, and Duracor at 0.73 L ha^{-1}. Duracor at 0.73 L ha $^{-1}$ had less injury than Vastlan at 2.34 L ha^{-1}, Garlon 3A at 3.12 L ha^{-1}, and Trycera at 3.26 L ha^{-1}. In 2021, no differences in treatments were observed, primarily due to more variability in green antelopehorn densities. Comparing triclopyr formulations across both years Remedy Ultra at 2.34 L ha^{-1} was least injurious than all other triclopyr treatments, except for Remedy Ultra at 4.67 L ha^{-1}.

Sweet Potato Allelopathy, a Strategy for Sustainable Weed Management Under Field Conditions. V Varsha*[1], IS Werle[2], MW Shankle[3], SL Meyers[4], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Arkansas, Fayetteville, AR, [3]Mississippi State University, Pontotoc, MS, [4]Purdue University, West Lafayette, IN (187)

The excessive use of herbicides has resulted in the development of resistance in weeds, and mechanical methods are laborious, time-consuming, and cause soil erosion. A more sustainable and effective approach for weed management is critical in agriculture to meet the growing need to feed the global population. Keeping that in view, the current study was conducted at two locations in Mississippi, under field conditions to determine the allelopathic effect of sweet potato varieties on weed density. Five sweet potato varieties that showed significant allelopathic suppression of weeds in the greenhouse experiment were planted in two-row plots along with a commercial variety B14. After three weeks of sweet potato transplanting, seeds of three weed species (yellow nutsedge, goosegrass, and Palmer amaranth) were sown in between the rows of all the plots. Weed cover by weed species was recorded at 14, 21, and 28 days after sowing (DAS) of the weed seeds. Weed cover for the natural weed species present in the field was also recorded. At 14 DAS, only native weeds were able to grow in the plots. Even at 21 and 28 DAS, the growth of other native weeds was 20-90% higher than the three studied weeds in plots at both places. Analysis of variance showed that after 21 and 28 DAS, only broadleaf signalgrass cover was significantly variable in the periphery of different sweet potato varieties. In the perimeter of the five varieties, the overall weed density at both locations was lower than the commercial variety Beauregard. Among all the varieties, the weed density was highest in the presence of the variety Heart-O-Gold, followed by Beauregard. The findings of this study will help in identifying sweet potato varieties able to suppress the growth of different weeds in the field and reduce the dependency on herbicides in sweet potato fields.

Exploring the Use of Photosynthesis and Pigment Inhibiting Herbicides for Smutgrass (Sporobolus Indicus) Management. ZS Howard*[1], WJ Stutzman[2], SA Nolte[3]; [1]Texas A & M University, College Station, TX, [2]Texas A&M University Agrilife Extension, College Station, TX, [3]Texas A&M AgriLife Extension, College Station, TX (188)

Smutgrass (*Sporobolus indicus*) is a non-native perennial weed that is problematic due to its exclusion from most livestock grazing preference, ability to cause serious displacement of desire forage, and its difficulty to control once established. The current control by broadcast herbicide recommendation (hexazinone) is expensive and can be complex as timing and environmental conditions are a key factor in its effectiveness. An exploration of new strategies is needed and ongoing to understand how this weed can be managed. Though not currently labeled for use in pasture forage systems, several hydroxyphenylpyruvate dioxygenase (HPPD) inhibitors and one photosystem II (PSII) inhibitor include a grazing rest period on the label when grazing crop residues, indicating their potential compatibility within alternative forage systems. This trial was initiated in the fall of 2021 and included treatments of clomazone, topramezone, mesotrione alone and with additions of atrazine when recommended by the label for increased grass control. Standard recommendations of hexazinone, glyphosate, and their combination using a reduced rate of hexazinone were also included. At 60 days after treatment (DAT), the combination of hexazinone and glyphosate provided acceptable smutgrass control but injured the bahiagrass (*Paspalum notatum*) enough that grazing strategies would need to be heavily adjusted for the remaining fall. Applications of hexazinone, glyphosate, and topramezone plus atrazine greatly suppressed the smutgrass, and only the glyphosate treatment caused enough damage to the bahiagrass to warrant a reduction in stocking rates. This research indicates that glyphosate is still the best practice for smutgrass control prior to pasture renovation, and if smutgrass control without renovation is desired, hexazinone alone remains the best option when in a bahiagrass forage.

Long-term Effect of Tillage, Crop Rotation, and Dicamba-based Herbicide Programs on Palmer Amaranth Control in Cotton. R Vulchi*[1], JA McGinty[2], MV Bagavathiannan[1], 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 (189)

A three-year field experiment was conducted at College Station and Thrall, TX to evaluate the role of tillage type, crop rotation, and herbicide programs for glyphosate-resistant Palmer amaranth (AMAPA) control in dicamba-resistant cotton. The main plots were three tillage types: no-till cover cropping, strip-till, and conventional tillage. The subplots were two cropping sequences: continuous cotton for three years and cotton-sorghum-cotton rotation; and sub subplots were four herbicide programs: untreated check, weed-free check, a low input program (LI), and high input program (HI). In cotton, LI consisted of two POST applications of glyphosate (1.26 kg a.e./ha) plus dicamba (0.56 kg a.e./ha); HI consisted of fluometuron PRE (1.12 kg a.e./ha), tank mix of glyphosate (1.26 kg a.e./ha), dicamba (0.56 kg a.e./ha), and acetochlor (1.26 kg a.e./ha) as POST, and diuron (1.12 kg a.e./ha) as layby application. In sorghum, LI consisted of two POST applications of atrazine (1.12 kg a.e./ha); HI consisted of dimethenamid-p as PRE (0.84 kg a.e./ha), POST application of atrazine (1.12 kg a.e./ha) plus huskie (0.245 kg a.e./ha) and layby application of atrazine (1.12 kg a.e./ha). Visual AMAPA control ratings were recorded at 28 DA PREs, POST-1, POST-2, and a week before harvest. Data is separated by locations and then by year because significant interactions were observed. In College Station, at 28 DA PREs application AMAPA control ranged between 96-100% in conventional tillage, and 66-93% in no-till cover cropping over the three years. The difference in control in no-till cover cropping was attributed to crop rotation with sorghum in 2020. At 28 DA POST-1 application, LI provided >95% control during 2019, however, their efficacy dropped to 50% and 68% in continuous no-till cover cropping, strip-till respectively during 2020. On the other hand, HI provided >95% AMAPA control when rotated with sorghum in all tillage types. By 2021, only HI within crop rotation area provided >95% control, and LI within continuous cotton recorded <55% control. At 28 DA POST-2 application, HI provided >95% when rotated with sorghum in all tillage types, the highest being in conventional tillage area with >99% control during the experiment. At the week before harvest timing, rotating sorghum with cotton during the alternate year provided >95% control in the following year compared to 40% control in continuous cotton within cover cropping. At Thrall, 28 DA PREs application, crop rotation provided >99% control by the end of the third year in all tillage types. At 28 DA POST-1 application, HI in all tillage types provided >95% control by the end of the third year. At 28 DA POST-2 application, both conventional and no-till provided greater than 95% control compared to 85% control in strip-till over three years. HI provided >95% control compared to <65% in LI a week before harvest at the end of the experiments. HI, crop rotation and tillage provided consistent AMAPA control at both locations, emphasizing the importance of residual herbicides, an alternate mode of action for sustainable AMAPA management.

Influence of Herbicides on Germination and Quality of Palmer Amaranth (*Amaranthus palmeri*) Seed.
LD Moore*, KM Jennings, D Monks, RG Leon, MD Boyette, DL Jordan; North Carolina State University, Raleigh, NC (190)

Laboratory and greenhouse studies were conducted to evaluate the effects of chemical treatments applied to Palmer amaranth (*Amaranthus palmeri* S. Wats.) seeds or gynoecious plants that retain seeds to determine seed germination and quality. Treatments applied to physiologically mature Palmer amaranth seed included acifluorfen, dicamba, ethephon, flumioxazin, fomesafen, halosulfuron, linuron, metribuzin, oryzalin, pendimethalin, pyroxasulfone, *S*-metolachlor, saflufenacil, trifluralin, and 2,4-D plus crop oil concentrate applied at 1× and 2× the suggested use rates. Use of dicamba, ethephon, halosulfuron, oryzalin, trifluralin, and 2,4-D resulted in decreased seedling length by an average of at least 50%. Due to the observed effect of dicamba, ethephon, halosulfuron, oryzalin, trifluralin, and 2,4-D, these treatments were applied to gynoecious Palmer amaranth inflorescence at the 2× registered application rates to evaluate their effects on progeny seed. Dicamba use resulted in a 24% decrease in seed germination, whereas all other treatment results were similar to those of the control. Crush tests showed that seed viability was greater than 95%, thus dicamba did not have a strong effect on seed viability. No treatments applied to Palmer amaranth inflorescence affected average seedling length; therefore, chemical treatments did not affect the quality of seeds that germinated.

A Real-time Weed Escape Detection System and Web User Interface for Precision Weed Control Applications. BB Sapkota*, MV Bagavathiannan; Texas A&M university, College Station, TX (191)

Detecting late-season weed escapes at the individual plant level and treating them with herbicides at great precision is no longer a myth. Currently, this process is accomplished in three steps: 1) image acquisition with unmanned aerial systems (UAV) in the field, 2) image-stitching, processing, and analysis in the computer laboratory, and 3) precision spraying using image analysis derived geo-coordinates. This entire process can at times be lengthy, laborious, and unproductive. Here, we propose a system that improves and accelerates the weed detection and herbicide application process. The system we developed has two components: 1) a module (camera plus on-board data processor) capable of real-time weed detection, and 2) a web interface that facilitates actionable data retrieval. The camera system comprises of an Arducam® 12 MP HQ CSI camera for imaging, a Jetson nano®-4GB GPU memory for real-time image processing, and an Emlid Reach® – M GPS module for recording real-time kinetic-GPS coordinates. The web interface system displays detected weed coordinates with Google-earth base imagery and information about weed size/count, and includes an option for the users to download shapefiles containing geo-coordinates. The system also determines treatment zones using an unsupervised machine learning algorithm and generates shapefiles for them. In the preliminary investigation, Italian ryegrass (*Lolium perenne* ssp. *multiflorum*) plants in a fallow land were targeted as a proof of concept. The single-shot detector, a popular deep learning model, was trained to detect ryegrass and the trained model was embedded in Jetson nano for real-time detection. Preliminary results show that weeds can be effectively detected with onboard processing. However, geo-coordinates obtained with this approach may entail large errors due to a lack of corrections for roll, pitch, and yaw during the UAV flight. Further investigations are being made to improve the accuracy of weed detection and geo-coordinate extraction.

Image-Based Detection and Site-Specific Control of Late-Season Weed Escapes in Cotton Using an RTK-GPS Guided Remotely Piloted Aerial Application System. U Torres*[1], DE Martin[2], BB Sapkota[1], B Gurjar[1], M Kutugata[1], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]USDA-ARS, College Station, TX (193)

Management of uncontrolled weed escapes in the late-season is important to reduce seedbank input and future weed infestations. Common waterhemp (*Amaranthus tuberculatus* Moq. Sauer), a prolific and problematic weed in southeast Texas cotton, can produce more than one million seeds per plant and it is imperative to target late-season escapes to minimize seedbank addition. Site-specific treatment using a remotely piloted aerial application system (RPAAS) may be effective in this regard. Additionally, aerial RGB images captured using an Unmanned Aerial System (UAS) can be utilized for detection of weed escapes and subsequent treatment using the RPAAS. A field experiment was conducted in mid-September 2021 at the Texas A&M University Research Farm in College Station, TX to investigate two objectives: 1) detect late-season waterhemp escapes in cotton using UAS-based aerial RGB imagery, and 2) evaluate the effectiveness of using an RTK-GPS guided RPAAS for site-specific treatment of late-season waterhemp escapes in cotton. Treatments included 1) an RPAAS-based herbicide application with weeds located using manually obtained geo-coordinates, 2) an RPAAS-based herbicide application with weeds located based on image analysis derived geo-coordinates, 3) a backpack herbicide application, and 4) an untreated check. Paraquat (Gramoxone®) herbicide was used in the experiment since it allowed for effective estimation of herbicide spray coverage and injury based on visual evaluations. First, the accuracy of RPAAS targeting individual waterhemp escapes based on exact coordinates obtained through manual recording was evaluated. Additionally, visible plant injuries were recorded at 10 days after treatment, and efficacy between RPAAS treatments and conventional backpack application were compared. The overall accuracy of waterhemp detection using image analysis was 63%; the low detection accuracy is partly due to distortion caused by ortomosaicking errors during post-processing, and the size differences of late-season waterhemp escapes inter-mingled within cotton canopy. Compared to backpack applications, the efficacy of drone-based applications was significantly lower due to insufficient coverage. Waterhemp control efficacy may have been greater for a systemic herbicide under these conditions, but not tested in this study. This experiment provided necessary directions for further improvements in achieving higher detection accuracy for late-season waterhemp escapes as well as improving RPAAS spray coverage.

Postemergence Herbicides Screening for Tolerance in Lettuce. S Vemula*[1], D Odero[2], GV Sandoya[2], R Kanissery[3], G MacDonald[4], HS Sandhu[2]; [1]University of Florida, Agronomy Department, Gainesville, FL, [2]University of Florida, Belle Glade, FL, [3]University of Florida/Institute of Food and Agricultural Sciences-Southwest Florida Research and Education Center, Immokalee, FL, [4]University of Florida, Gainesville, FL (194)

Lettuce (Lactuca sativa L.) production on organic soils in the Everglades Agricultural Area in southern Florida is hindered by lack of effective weed management programs, particularly chemical control due to limited number of herbicides available for weed control. The objective of this study was to screen broad-spectrum postemergence herbicides to identify lettuce lines with tolerance. Fifteen lettuce lines, which had shown tolerance in a preliminary study were evaluated for tolerance to 10 herbicides (imazethapyr, flumetsulam, imazamox, imazapic, rimsulfuron, glyphosate, topramezone, linuron, saflufenacil, metribuzin) under greenhouse conditions. The experiment was a randomized complete block design with a factorial arrangement and four replications. Variation among lettuce lines to herbicide tolerance, measured as percentage of visual injury at 28 d after treatment showed significant herbicide effect. Glyphosate, topramezone, linuron, saflufenacil, and metribuzin caused the greatest injury (>80%). Imazamox and flumetsulam also caused significant injury (<60%) while imazethapyr and imazapic caused the least injury (<25%). The lines were more tolerant to the acetolactate synthase inhibiting herbicides suggesting that target-site mutations are most probably responsible for the tolerance rather than nontarget site mechanisms. Botavia (commercial cultivar), 45060 (UF breeding line), and Azer16-50848 (wild type) showed less injury (<50%) compared to other lines indicating that they exhibited more tolerance to the herbicides. The lettuce lines showing herbicide tolerance can be subjected to chemical mutagenesis to help isolate herbicide resistant mutants which can be used in lettuce breeding programs to develop cultivars with herbicide tolerance to enable efficacious weed control in the crop.

Tolerance of Loblolly Pine Seedlings to Increased Rates of Aminopyralid + Florpyrauxifen. JE Ezell*[1], AB Self[2], AW Ezell[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Grenada, MS (195)

Crop tolerance is a concern in any application of a new material or when utilizing increased rates of an existing product. As part of a larger site preparation study, Terravue was applied at the current approved rate and a 2X rate to compare loblolly pine survival and growth on seedlings planted in those plots. Results for survival and seedling development after one growing season will be presented.

Old-Field Planted Longleaf Pine (*Pinus palustris*) Survival and Growth Response to Various Herbaceous Weed Control Herbicides and Application Timings After Eleven Years. ED Dickens*; University of Georgia, Athens, GA (196)

Chemical herbaceous weed control (HWC) is frequently used to improve the early survival and growth of planted longleaf pine (*Pinus palustris*). Reports on long-term survival and growth response of longleaf pine to commonly used HWC herbicides and spring first year application timings are limited. The objectives of this study were (1) evaluate survival and growth of longleaf pine in response to three common herbicides and (2) evaluate three HWC application timings to the banded overtop herbicide treatments. Three study areas (former old-field sites) were installed as randomized complete block designs in Treutlen and Laurens County, Georgia, USA. Imazapyr (Arsenal® Applicators Concentrate (AC)) (A4 treatment) was applied overtop of seedlings during late March, mid-April, and mid-May of the first growing season, and a premixed blend of hexazinone and sulfometuron methyl (Oustar®) (10OS treatment) was applied on the same dates. The last treatment was a split application of sulfometuron methyl (Oust XP®) and imazapyr (2OA4 treatment). No herbicide treatment plots served as controls. The late March 10OS and A4 application timing resulted in significantly lower survival than mid-April or mid-May applications. The 11 year main study findings were (a) longleaf survival was poor at 62 and 65 percent when applied within two months of planting (late Jan and mid-Feb planting and late-March herbicide timing) using the 10OS and A4 treatments, respectively. Survival was improved by 23 and 21 percentage points by waiting at least two months (mid-April treatment with 85 and 86 percent survival, respectively) after planting, (b) the 10OS treatment applied in mid-April on these old-field Coastal Plain sites grew an average of 9 tons per acre more wood than the control and 8.5 tons per acre more wood than the mid-April and mid-May A4 treatments, and (c) the mid-April and mid-May A4 treatments averaged 0.35 tons per acre more wood than the control after 11 years, making this treatment one that would not be recommended based on these study results.

Early Pine Control Response to July Applications of Different Glufosinate Products. AW Ezell*[1], AB Self[2], JE Ezell[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Grenada, MS (197)

Control of natural pines in forestry site preparation has been a major concern for many years. Due to growing concerns over the use of glyphosate, many forest managers are seeking a cost-effective material to be used for pine control during site preparation.. Glufosinate has demonstrated potential for such applications. A total of 15 treatments using different glufosinate products were applied to an area which had loblolly pines 0.2-2.0m tall with the majority being less than 0.67m tall. Treatments were applied in July and both the early response in pine control and July timing efficacy will be reported.

Evaluation of Two Application Timings of Choline Triclopyr, Fluroxypyr, and GF-3886 as Replacements for Glyphosate in the Control of Volunteer Pine in Forestry. DC Clabo*[1], ED Dickens[2]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (198)

Loblolly pine (*Pinus taeda*) and Virginia pine (*Pinus virginiana*) have regular bumper seed crops and seedlings and saplings can be difficult to control without using prescribed fire as a component of forestry site preparation. The primary site preparation herbicide that offers good to excellent control of volunteer pines are glyphosate and saflufenacil, but alternatives to glyphosate usage in forestry are being explored. In forestry site preparations situations where prescribed burning and/or glyphosate usage are not practical or available for volunteer pine control, alternative herbicides would be required. The objective of this study was to determine if acceptable volunteer pine control can be achieved with tank mixes of imazapyr with choline triclopyr, fluroxypyr, and GF-3886 without the addition of glyphosate. A field trial was installed in a recently clearcut loblolly pine stand with no recent history of prescribed burning in Dooly County, Georgia during summer 2019. This stand had a heavy understory of natural loblolly pine regeneration (averaged ˜38,800 seedlings and saplings per hectare). Two application timings (July and September) were tested with eight herbicide treatments including a control. Imazapyr was included in all herbicide tank mixes. Herbicide treatments simulated a light ground application with a total spray solution of 187.1 l ha^{-1}, and 0.25% v/v methylated seed oil was added to all tank mixes. Experimental units were 9.1 x 9.1 m with an internal 18.6 m^2 measurement plot. Heights and stem counts were recorded for all volunteer loblolly pine seedlings and saplings prior to treatment application as well as 60 and 120-days post-treatment. Height of seedlings in herbicide plots was determined using a cut test to pinpoint the height where living cambium ended for partially top-killed stems. Data were analyzed using analysis of variance as a randomized complete block design with repeated measures using PROC Mixed in SAS, and differences among treatment means were separated using Tukey'(P=0.05). Dependent variables included average height, stems per hectare, and percent loblolly pine seedling and sapling control (1-cumulative height growth pre-treatment/cumulative height growth one-year post-treatment x 100). Volunteer loblolly pine height analyses revealed significant treatment x date (P<0.001) and assessment date x application timing (P<0.001) interactions. The two tank mixes that contained glyphosate had the shortest average heights after 120 days but they were statistically similar to all other treatments. After 120 days, the July application timing had significantly shorter volunteer pine stems than the September application timing. The stem density analyses indicated significant treatment x date (P<0.001) and assessment date x application timing (P<0.001) interactions. The two treatments that contained glyphosate had significantly fewer stems per acre after 120 days compared to the control, while the choline triclopyr, fluroxypyr and GF-3886 treatments were all similar to the control. One-hundred and twenty-days post-treatment, the July application timing had significantly fewer stems per hectare than the September application timing. Percent control from time zero (pre-treatment) to 120-days post-treatment revealed significant treatment differences (P<0.001), but application timing was not significant (P=0.321). The two tank mixes that contained glyphosate had 87.5% and 88.6% control, respectively, while the tank mix of imazapyr and highest rate of choline triclopyr had the third greatest percent control at 52.6%. Overall, July applications tended to offer better control than September applications, and tank mixes containing glyphosate resulted in better control (percent control and stems per hectare) of volunteer loblolly pine than choline triclopyr, fluroxypyr, and GF-3886.

Loblolly Pine Seedling Growth Following HWC Applications Using Oust XP, Arsenal AC, Arsenal, Velpar L, and Esplanade SC. AW Ezell*[1], AB Self[2], JE Ezell[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Grenada, MS (199)

For more than 30 years , herbaceous weed control (HWC) has been a standard procedure in the establishment of pine plantations in the South. Currently, a combination of sulfometuron methyl and imazapyr is the most widely used application for loblolly pine seedlings. Indaziflam has demonstrated efficacy in tank mixtures with imazapyr for such applications and there is some evidence this material may provide residual weed control into the following growing season. This study evaluated the three-year growth of loblolly seedlings in replicated plots utilizing 10 HWC treatments designed to compare indaziflam mixtures to others more commonly used currently.

Middle and Late Summer Forestry Site Preparation Tank Mix Evaluations of Imazapyr with Choline Triclopyr or Fluroxypyr Applied as Two Spray Solutions. DC Clabo*[1], ED Dickens[2]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (200)

Imazapyr is the primary herbicide used for forestry site preparation in the Southeast due to its broad control spectrum of a variety of woody, broadleaf and grass species. Vegetation control spectrum of imazapyr site preparation can be improved by using tank mixes with other forestry herbicides. Recently a new choline triclopyr formulation was labeled for forestry site preparation, yet compatibility and any improved vegetation control of choline triclopyr and imazapyr tank mixes is unknown. Fluroxypyr has the same mode of action as choline triclopyr but only has a label for brush control. In addition, its label does not report that it can be tank mixed with imazapyr. The objectives of this study were (1) to determine if tank mixes of imazapyr and choline triclopyr improve control of common southeastern Coastal Plain hardwood species over either herbicide alone, and (2) is hardwood control reduced or improved when fluroxypyr is tank mixed with imazapyr for forestry site preparation applications? A field trial was established in Dooly County, Georgia during summer 2019. Two application timings (July and September) were tested with nine herbicide treatments including a control. For both application timings, five of the nine treatments imitated an aerial foliar application using a total spray solution of 140.3 l ha^{-1}, while three treatment received a low volume foliar application simulating a ground application using a total spray solution of 374.1 l ha^{-1}. Experimental units were 9.1 x 9.1 m with an internal 18.6 m^2 measurement plot. Heights, stem counts per acre, and species information were recorded for all woody seedlings and seedling sprouts prior to treatment application, 60, 120, and 365 days post-treatment. Height of seedlings in herbicide plots was determined using a cut test to pinpoint the height where living cambium ended for partially top-killed stems. Data were analyzed using analysis of variance as a randomized complete block design with repeated measures using PROC Mixed in SAS, and differences among treatment means were separated using Tukey's mean separation (P<0.1). Dependent variables included average height, stems per hectare (species combined) and percent control (1-cumulative height growth pre-treatment/cumulative height growth one-year post-treatment x 100) for the five most commonly observed woody species at the study area. Species included water oak (*Quercus nigra*), sweetgum (*Liquidambar styraciflua*), sumac (*Rhus* spp.), black cherry (*Prunus serotina*) and American beautyberry (*Callicarpa americana*) in the percent control analysis. Average woody vegetation height results indicated significant treatment x assessment date (P=0.019) and treatment x application timing (P=0.007) interactions. The imazapyr and choline triclopyr tank mix had significantly shorter woody stems after one-year compared to the control, but the tank mix was statistically similar to the seven other herbicide treatments. For the woody stem count per acre analysis, the treatment main effect (P<0.001) and the application date x application (P<0.001) timing interaction were significant. The imazapyr and choline triclopyr low volume foliar treatment had significantly fewer stems per acre than the control and three of seven other herbicide treatments but was statistically similar to the other four herbicide treatments. No treatment, timing, or interaction differences were observed for percent control. For the July application timing one-year post-treatment percent control, values ranged from -79 percent (vegetation ingrowth) in the foliar fluroxypyr-only treatment to 94.7% control in the low volume foliar imazapyr plus choline triclopyr tank mix. For the September application, percent control ranged from -14.8% in the low volume foliar imazapyr plus amine triclopyr treatment to 38% control in the low volume imazapyr treatment. Overall, the September application timing showed poor control compared to July, which may be attributable to a severe drought that occurred in the region during August and September 2019. No signs of antagonism or decreased control were observed with imazapyr and choline triclopyr tank mixes compared to other tested treatments. Fluroxypyr does not appear to improve control of the primary woody species found on this site, but no direct antagonism with imazapyr in tank mixes was observed as control was similar to other treatments with the fluroxypyr and imazapyr tank mix.

Site Preparation with Mixtures Using Triclopyr, Imazapyr, Triclopyr Choline, Fluroxypyr, and Aminopyralid + Florpyrauxifen. AB Self*[1], AW Ezell[2], JE Ezell[3]; [1]Mississippi State University, Grenada, MS, [2]Mississippi State Univ. - Retired, Mississippi State, MS, [3]Mississippi State University, Mississippi State, MS (201)

Improved control of woody species in forestry site preparation applications continues to be the primary emphasis in product development across the South. Prescriptions evolve in response to changes in product availability, formulation, and available mixtures. Seven treatments were used in a study testing efficacy of triclopyr, imazapyr, triclopyr choline, fluroxypyr, aminopyralid, and florpyrauxifen for control of woody species in site preparation. This study was established on a clearcut forestry site in northeast Mississippi in September, 2020. Natural pine and hardwood stems were recorded by species and height prior to treatment applications. Natural pine brownout was evaluated 60DAT and hardwood control was evaluated 1YAT. Treatment efficacy results will be given.

Florpyrauxifen-benzyl Containing Herbicide Effects on Hayfield Sward Composition. WC Greene*, ML Flessner, MP Spoth, KW Bamber, C Sias; Virginia Tech, Blacksburg, VA (202)

Effective weed control in hayfields is necessary to ensure maximum forage production. Broadleaf weed control is typically achieved through the use of synthetic auxin herbicides, however these herbicides are also active on desirable broadleaf species, such as forage legumes including white clover. Commonly used hayfield herbicides often lead to severe injury and even elimination of white clover, making it difficult to maintain legumes in mixed grass-legume swards. Florpyrauxifen-benzyl + 2,4-D is a new synthetic auxin herbicide combination which is reported to control broadleaf weeds while preserving established white clover. Field trials were conducted in Virginia to evaluate the effect of florpyrauxifen-benzyl-containing herbicides on hayfield sward composition when applied via foliar spray, as well as applied through impregnated fertilizer in separate studies. Herbicide treatments were applied early in the growing season and species composition and biomass were measured throughout the growing season. Herbicides evaluated included combinations of florpyrauxifen-benzyl + 2,4-D, florpyrauxifen-benzyl + aminopyralid, and other commonly used herbicides in hayfields. Species were placed into four groups: 1) forage grasses, (2) forage legumes, (3) weedy grasses, and (4) broadleaf weeds. There were no differences in early season forage grass biomass in the sprayed application study, while all herbicide treatments resulted in greater late season forage grass biomass compared to the nontreated control. Florpyrauxifen-benzyl + 2,4-D resulted in the greatest forage legume biomass of any herbicide treatment, but reduced biomass relative to the nontreated. All herbicides except for metsulfuron decreased broadleaf weed biomass. For the fertilizer impregnation study, florpyrauxifen-benzyl + 2,4-D did not increase forage grass biomass or reduce broadleaf weed biomass, however florpyrauxifen-benzyl + aminopyralid did increase forage grass biomass and reduced broadleaf weed biomass. Our research suggests that florpyrauxifen-benzyl + 2,4-D is a viable control option for broadleaf weeds when spray applied, while also preserving established white clover. Aminopyralid-containing herbicides were most effective when applied via impregnated fertilizer.

What We've Learned About Foxtail (*Setaria ssp.*) Management in Forages: A Multiyear Review. DP Russell*[1], JD Byrd, Jr.[2], M Zaccaro-Gruener[3], H Quick[2]; [1]Auburn University, Madison, AL, [2]Mississippi State University, Mississippi State, MS, [3]University of Arkansas, Fayetteville, AR (203)

At least nine replicated field trials were conducted between 2014 and 2021 across Alabama and Mississippi with the goal of controlling weedy foxtail species in forage production. Thirteen herbicide active ingredients or premix combinations were evaluated on their effectiveness to control yellow foxtail (*Setaria pumila*) or knotroot foxtail (*Setaria parviflora*) in bermudagrass, bahiagrass, dallisgrass, or tall fescue pastures and hayfields. All treatments were broadcast applied either preemergence or postemergence at 140 L/ha with a CO2 pressurized sprayer. Qualitative (visual estimates) and quantitative (square meter counts) evaluations were conducted between 1 – 7.5 months after initial herbicide applications. In respective studies where pendimethalin and indaziflam were superior preemergence treatments, foxtail control averaged 82-85% while coverage was reduced to 6-19%. The postemergence treatments most effective in foxtail control were nicosulfuron + metsulfuron, hexazinone, quinclorac, imazapic, and glyphosate. In respective studies where these active ingredients provided superior performance, hexazinone and quinclorac controlled foxtail at least 79% and reduced coverage at least 20%. Combinations of nicosulfuron + metsulfuron controlled foxtail 64-75% and reduced coverage at least 18%. Glyphosate and imazapic applied alone reduced foxtail coverage to 5% and 43% respectively. These data suggest seasonal suppression of foxtail species is possible, but success is highly dependent upon competitive forage, timely application, and adequate soil moisture.

Weed Control in Specialty Crops Using Bicyclopyrone. P Eure[1], TH Beckett[1], JW Gordy*[2]; [1]Syngenta Crop Protection, Greensboro, NC, [2]Syngenta Crop Protection, Pearland, TX (204)

Bicyclopyrone is an HPPD-inhibitor (Group 27) herbicide and is one of the active ingredients in Acuron® and Acuron GT herbicides. Syngenta is pursuing registrations in sixteen minor use crops: banana, plantain, papaya, pineapple, rosemary, lemongrass, broccoli, garlic, hops, horseradish, sweet potato, bulb onion, green onion, timothy grown for seed, strawberry, and watermelon. Bicyclopyrone offers flexibility in application methods including preplant, preemergence, pre-transplant, row middle, post-directed, and postemergence, depending on crop. Crop tolerance to bicyclopyrone varies by crop, application rate, and application method. Directions for use include not exceeding 50 g ai ha^{-1} bicyclopyrone per acre per crop year, not exceeding one application per year. Soil applications will provide 3-4 weeks of residual control or partial control of annual grass and broadleaf weeds. Bicyclopyrone will provide an additional active ingredient, and in some cases, a new site of action for managing herbicide-resistant weeds in specialty crops with limited weed control options. Important: Always read and follow label instructions. Some products may not be registered for sale or use in all states or counties. Please check with your local extension service to ensure registration status. Acuron and Acuron GT are not registered for sale or use on banana, plantain, papaya, pineapple, rosemary, lemongrass, broccoli, garlic, hops, horseradish, sweet potato, bulb onion, green onion, timothy grown for seed, strawberry, and watermelon and are not being offered for sale. Acuron is a Restricted Use Pesticide. Acuron® and the Syngenta logo are trademarks of a Syngenta Group Company.

Influence of Planting Interval, Tillage, and Irrigation on the Residual Activity of Glyphosate in Bareground Squash. TM Randell*[1], JC Vance[1], LC Hand[1], HE Wright[2], A Culpepper[1]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (206)

Fresh-market squash (Cucurbita pepo L.) production has increased substantially over the last 5 years in Georgia. To plant into weed-free fields, growers utilize preplant burndown applications of glyphosate to control troublesome weeds. However, recent research indicates residual activity from the herbicide can result in significant cucurbit crop injury, when transplants are planted into sandy soils with low organic matter. Two experiments were each conducted twice from 2018-2021 in a bareground production system (90% sand, 0.9% OM), to determine the tolerance of transplanted squash to preplant applications of glyphosate, and if applicable, determine if cultural practices could help mitigate injury. *Application Interval Experiment*. Glyphosate was applied preplant (0, 1.54, 3.08, and 4.62 kg ai ha^{-1}) either 7, 4, or 1 day before planting (DBP) into a bareground non-mulched system. Combined across locations, glyphosate applied 7 or 4 DBP at the two highest rates injured squash 11-38% and reduced fresh-weight biomass 14-69%; at the lowest application rate squash was not impacted regardless of application timing. When applied 1 DBP, squash was injured 13-53%, and biomass was reduced 23-79% regardless of application rate. Combined across application interval, squash fruit weights from 30 cumulative harvests were reduced 31% to 55% from applications at the two highest rates; combined across application rate, yield was reduced 21% to 41% at all three application intervals. *Cultural Practices Experiment*. To determine if crop injury could be mitigated through cultural practices, experiment two included glyphosate at three rates (0, 3.08, and 6.17 kg ai ha^{-1}) applied 1 DBP, and followed by either 1) overhead irrigation of 0.5 cm, 2) light tillage with a roto-tiller, 3) irrigation plus tillage, or 4) no irrigation and no tillage. Both tillage and herbicide rate influenced results while irrigation had no impact. Combined across locations, glyphosate injured squash 21-49%, reduced biomass 26-51%, and reduced yield 18-42% when no tillage followed preplant glyphosate applications. Implementing tillage eliminated damages from glyphosate, while irrigation of 0.5 cm alone did not influence squash response. Previous research has shown 1 cm of overhead irrigation can reduce glyphosate residual activity thus further research on irrigation and glyphosate residual activity is warranted.

Integrated Weed Management Using Flaming, Cultivation, and Hand Weeding in Organic Carrot Production Systems with Different Fertilizer Types. PJ Dittmar*[1], DD Treadwell[1], G Maltais-Landry[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Soil and Water Sciences Department, Gainesville, FL (207)

Integrated weed management is important for weed control in organic carrot production. Labor is the most common method, however, the quantity of labor and expense can be limiting factors. Flaming and cultivation can provide additional weed control in this system. The objective of this research is to develop an organic weed control program that includes flaming, cultivation, and hand rogueing. The study of conducted in an organic certified field at the North Florida Research and Education Center Suwanee County, Live Oak, FL. The treatments were a factorial design with 5 weed management programs and 2 fertilizer types. The weed management programs were (1) flaming preseeding + weekly cultivation, (2) flaming preseeding + weekly cultivation + 1 handweeding event, (3) flaming preseeding + flaming preemergence + weekly cultivation (4) flaming preseeding + flaming preemergence + weekly cultivation + 1 handweeding event, (5) flaming preseeding + flaming preemergence + weekly cultivation + 2 handweeding events. The two fertilizer types are pelleted poultry litter and 50% feather meal + 50% poultry litter. Carrot 'Uppercut' were seeded on December 3, 2020 and were harvested on May 3, 2021. The fertilizer treatments were applied immediately after seeding. Weed plants were counted by species in two quadrats measuring 0.5 m^2 prior to each cultivation using a basket cultivation between rows on the bed top. The carrots were cultivated 6 times before the plants were too big and would be injured. No differences were measured between the two fertilizer types. Cutleaf evening primrose (*Oenothera laciniata*) was the only weed species in the plots from the beginning of the trial through harvest. The inclusion of flaming preplant and preemergence delayed the emergence of evening primrose, however at 6 weeks after planting all the treatments were similar. Other weed species during December and January, included henbit (*Lamium amplexicaule*) and common chickweed (*Stellaria media*), however, as the temperatures warmed into March and April these species were less common and purple toadflax (*Linaria purpurea*) and old world diamond flower (*Oldenlandia corymbosa*) were the most common. The single handweeding event had excellent control of the cool season weeds, but the two handweeding events controlled both the cool and warm season weeds. Flaming is important for early weed control in carrot. The cultivation provided excellent weed control of weeds between the crop rows. Carrot's long growing season requires a late season postemergence weed control method and in organic weed control that would have to be completed with handweeding.

The Ninth Circuit Court, "Thoughts of a Weed Scientist". TA Baughman*; Oklahoma State University, Ardmore, OK (208)

The United States Courts for the Ninth Circuit consists of the Ninth Circuit Court of Appeals along with district and bankruptcy courts in the fifteen federal judicial districts. It encompasses the states of Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Washington along with Guam and the Northern Mariana Islands. The Ninth Circuit court vacated the registration of Engenia and Xtendimax in 2020. Not only did they vacate these herbicide labels, but it occurred in the middle of the cotton and soybean growing season. This was after producers has planted Xtend cotton and soybean, made herbicide purchases, and initial applications in some cases. This occurred even though no Xtend soybean were planted, and less than 100,000 acres of cotton were planted in the states comprising the Ninth Circuit. This brought to light the ability the courts have to disrupt an entire industry. There are over 600 district court judgeships across the country. Any one of these judges can issue a nationwide injunction against federal action. District court judges have increasingly issued nationwide injunctions, especially in the last decade. District courts issued approximately twenty from 2009-2017 while that number increased to almost forty in just the 2-year period of 2017-2019. While these injunctions can be appealed these appeals are often lengthy in time, and in the dicamba example relief came after the current growing season was completed. In fact, Supreme Court Justice Clarence Thomas stated that no statute expressly grants district courts the power to issue universal injunctions. He went further to say that if their popularity continues the Court must address their legality. Additionally, most of the judges making these rulings have little or no background in science. Thus, making these ruling of even more of concern.

A Global Look at Herbicide-Resistant Rice Technology and Weedy Rice. N Roma-Burgos*; University of Arkansas, Fayetteville, AR (209)

Weedy rice (*Oryza* spp.) remains to be the greatest challenge for the development of herbicide technology in rice production. Weedy rice arises via dedomestication, intervarietal hybridization, wild relative descent, and crop-wild relative hybridization. Today weedy rice is a problem in all regions where rice is produced. Modern varieties are more competitive with weedy rice than old ones, but yield loss could still be close to 50% apart from loss of grain quality from grain contamination. The herbicide-resistant (HR) rice technology was developed primarily for weedy rice management. The transgenic Liberty Link® rice technology was first in this endeavor, but was rejected by consumers. Thus, we have the non-transgenic HR rice technology (Clearfield®, Provisia®, Fullpage®). From its commercialization in 2002, the ALS-resistant Clearfield® rice is going on its 20th year and still constitutes a substantial market share of rice varieties. However, the incidence of HR-resistant weedy rice has increased. The main avenue is gene flow via pollen or seed, but selection for HR trait from standing variation among weed populations has also occurred. This is true wherever HR rice is grown – in the Americas, Asia, and Europe. The stewardship guideline for Clearfield® rice is solid, but multifaceted factors could crack this armor. The incidence of HR weedy rice is greater in the tropics where at least two rice crops are grown per year, there is a dearth of technical support for farmers, and the overall seed system structure is weak. Gene flow between HR rice and weedy rice, and the succeeding selection of HR outcrosses has altered the weedy rice population structure. Modern weedy rice populations are more diverse morphologically, phenologically, and biologically than ancestral populations. The ACCase-resistant rice (Provisia®, Fullpage®) technology is a new tool to help manage ALS-resistant weedy rice. The principle of gene flow and selection of standing variation in resistance trait among weed populations still stands. The new HR technology has to be used with even greater discretion and technical support as several modern weedy rice populations now carry the ALS-resistance trait. Some outcrosses are more crop-like and, therefore, are less weedy and will not persist. Yet this does not negate the weedy outcrosses harboring 'hybrid vigor' and the resistance gene. The outcrosses can serve as bridge for gene flow to other weedy rice populations. It is easier to manage weedy rice now with two HR rice traits, but it also carries the risk of evolving multiple-resistant weedy rice.

A Decision-Support Tool to Facilitate Herbicide Mode of Action Diversity for Annual Bluegrass (*Poa Annua*) Control in Turfgrass Systems. V Kankarla*[1], EB De Castro[2], D Hathcoat[3], R Grubbs[4], JD McCurdy[2]; [1]Texas A & M University, College Station, TX, [2]Mississippi State University, Mississippi State, MS, [3]Texas A&M AgriLife Research, College Station, TX, [4]Texas A & M University, Dallas, TX (210)

Turfgrass is one of the most widely grown and economically important specialty crops in the United States, spanning across approximately 50 million acres. Major industry sectors include golf courses, athletic/sports fields, sod production, and residential lawns. Annual bluegrass (*Poa annua* L.) is a troublesome weed across all industry sectors, costing many millions of dollars in control expenses, decreasing utility and playability, and contributing to lost aesthetic value. Herbicide resistant annual bluegrass is a serious concern. An important best management practice to avoid herbicide resistance is the use of diverse herbicide modes of action in rotation, sequence, and mixture. A web-based decision-support tool is being developed to facilitate the selection of diverse herbicide modes of action by turfgrass managers targeting annual bluegrass. This tool includes a database of different herbicide options available for controlling annual bluegrass in various turfgrass systems, their use rate, and control efficacies. A risk model evaluates the risk of weed resistance to the herbicide program selected by the user and provides appropriate feedback to facilitate the selection of robust management options. The model also considers herbicide use history and the potential of suspected or confirmed herbicide resistance in a given population. The tool will educate stakeholders and support decisions regarding best management practices.

The Use of Computer Vision for Weed Detection in Turfgrass. J Yu*, MV Bagavathiannan; Texas A&M University, College Station, TX (211)

Intelligent spot-spraying herbicide can substantially reduce herbicide input and weed control cost in turf management system. Previous research works evaluated various object detection and image classification deep learning architectures for weed detection in various turfgrasses. Object detection neural networks, such as CenterNet, DetectNet, You Only Look Once (YOLO) Version 3, and YOLO-tiny, demonstrated an excellent performance for real-time detection of annual bluegrass (*Poa annua* L.) and various broadleaf weeds growing in dormant turfgrass. Image classification architectures including AlexNet, DenseNet, EfficientNetV2, GoogLeNet, VGGNet, and ResNet demonstrated a remarkable capability for detection of grassy weeds. A single image classification neural network achieved high (>0.99) precision and recall values to reliably detect various broadleaf and grass weeds in actively growing turfgrasses. However, the training of image classification neural network for detection of weeds growing in turf is not merely predicting the input images containing weeds but also is a process of creating a plant identification map and determining which map cells contain weeds and consequently the machine vision subsystem can make correct predication to precisely apply herbicide into individual map cells.

Turfgrass and Weed Response to Flame Duration. CG Goncalves*, S Askew; Virginia Tech, Blacksburg, VA (212)

Only one preliminary report of a non-repeated study could be found regarding flame weed control in ornamental turf ('Patriot' hybrid bermudagrass). Studies conducted in rangeland and prairie ecosystems suggest that evolved selectivity to fire could be a viable weed control option for turfgrass systems. From a meta-analysis of 500 search returns via google and google scholar, we found that flaming had a high likelihood of occurring in consumer searches for organic weed control options in ornamental turf. Based on the paucity of scientific evidence to support Internet trends for flame weed control topics in ornamental turfgrass, we conducted studies to assess the response of different cool-season and warm-season turfgrass species and weeds to duration of flame exposure. Field trials were conducted during the 2020 and 2021 growing season at Virginia Tech's Glade Road Research Facility in Blacksburg, VA, to examine the efficacy of duration of flame exposure for weed control in tall fescue (*Festuca arundinacea*), Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*), hard fescue (*Festuca* spp.) bermudagrass (*Cynodon dactylon*) and zoysiagrass (*Zoysia* sp.). Treatments included uniform flaming of 6 ft^2 turf plots for 1, 2, 3, and 4 minutes at approximate speeds of 0.4, 0.2, 0.1, and 0.05 mph, respectively using a propane torch with a 4-inch diameter head. A nontreated check was included for comparison. Data on weed control and turfgrass recovery were collected and analyzed. Almost all vegetation was incinerated by flame exposure regardless of exposure level. Bermudagrass, tall fescue and Kentucky bluegrass recovered from flame treatments quickly with acceptable turf cover reestablished in under four weeks. However, zoysiagrass, perennial ryegrass and hard fescue recovery were flame-duration dependent and generally unacceptable. Corn speedwell and common chickweed were completely controlled regardless of flame duration. Annual bluegrass and white clover were controlled up to 85% depending on flame duration. Common dandelion, buckhorn plantain, horseweed, and broadleaf dock were initially burned back by flaming, but recovered by 49 DAT regardless of flame duration.

Dynamics of Foliar-and Soil-applied Pronamide Within Resistant *Poa annua*. MJ Ignes*; Mississippi State University, Starkville, MS (213)

Annual bluegrass (*Poa annua* L.) is a problematic turfgrass weed that has evolved resistance to ten different herbicide sites of action, more than any other turfgrass weed. The mitotic inhibiting herbicide pronamide has both pre-and post-emergence activity on susceptible (S) annual bluegrass populations, but on certain resistant (R) populations, postemergence activity is hypothetically compromised due to lack of root uptake or due to an unknown foliar resistance mechanism. Greenhouse experiments were conducted to determine the potential mechanism(s) of pronamide resistance in three pronamide resistant annual bluegrass biotypes from Mississippi. The study was replicated twice in time. Pronamide within roots, shoots, and leaf-wash collected 8, 24, 72, and 168 hours after treatment (HAT) was quantified using high-performance liquid chromatography (HPLC). Pronamide absorption and translocation was compared between two S and three R biotypes after a foliar-only and a soil-only application. A commercial rate (1.16 kg ai ha^{-1}) was applied using a research track-sprayer (400 µm average droplet size). In the foliar-only application, the soil surface of the pots was covered with aluminum foil before the application to prevent the herbicide from contacting the soil, and pronamide residue on the surface of the shoots was washed off using 10% ethanol. Methanol was used as the extractant for the root and shoot samples. Results will be discussed and summarized.

Late Season Control of Goosegrass and Kyllinga. A Gore*[1], LB McCarty[2], T Stoudemayer[2]; [1]Clemson University, Abbeville, SC, [2]Clemson University, Clemson, SC (215)

Goosegrass (*Eleusine indica* L.) is one of the most problematic warm-season weeds in turf due to its ability to grow in compacted soils, prostrate growth habit, and prolific late-season seed production in addition to decreasing control options in hybrid bermudagrass (*Cynodon dactylon* (L.) Pers. X *C. transvaalensis* Burt-Davy). In this study, mature goosegrass was treated on November 8, 2021 with individual products and combinations of Sencor 75DF (metribuzin), Pylex 2.8SC (topramezone), Dismiss 4F (sulfentrazone), Speedzone 2.2EW (carfentrazone + 2,4-D + mecoprop + dicamba), and Manuscript 0.42EC (pinoxaden) with and without the addition of chelated iron. Goosegrass control and phytotoxicity were measured every 7 days for 42 days after application. Treatments of Sencor (420.32 g/ha) + Pylex (18.27 mL/ha), Sencor (420.32 g/ha) + Pylex (18.27 mL/ha) + chelated iron (51.45 L/ha), Pylex (36.54 mL/ha), and Sencor (420.32 g/ha) + Dismiss (18.27 mL/ha) all provided >75% control at 14 days after initial treatment (DAIT). However, at the conclusion of the study, no treatment provided this level of control. Cockscomb kyllinga (*Cyperus metzii* (Hochst. Ex Steud.) Mattf. & Kukenth.) is a warm-season member of the sedge family with the potential to overwinter as a perennial and is often associated with moist to wet environments. In this study, mature kyllinga was treated on September 23, 2021 with Celero 75WDG (imazosulfuron), Monument 75WG (trifloxysulfuron), Certainty 75WDG (sulfosulfuron), Sedgehammer 75WDG (halosulfuron), Basagran T&O 4SL (bentazon), MSMA, Dismiss 4F (sulfentrazone), and Dismiss South 4F (sulfentrazone + imazethapyr). Phytotoxicity was measured 7 days after initial treatment and control of cockscomb kyllinga was measured weekly from 14 DAIT through 49 DAIT. Celero (311.85 g/ha), Monument (11.34 g/ha), Certainty (34.02 g/ha), and Sedgehammer (36.85 g/ha) all had acceptable levels of phytotoxicity (<10%) at 7 DAIT. All treatments, with the exception of Celero, provided excellent control (>90%) 49 days after treatment.

A New Turfgrass Herbicide from Bayer to Meet Customer Needs. DE Carroll*[1], B Spesard[2], JW Hempfling[3], S Wells[4], J Michel[3], P Burgess[5]; [1]The University of Tennessee, Knoxville, TN, [2]Bayer Environmental Science, A Division of Bayer CropScience, Cary, NC, [3]Bayer Environmental Science, Cary, NC, [4]Bayer Crop Sciences, Milledgeville, GA, [5]Bayer R&D Services, Na, NJ (216)

Employee attrition is something all lawn care operators (LCOs) are facing in today's economic landscape. Eliminating the need to educate employees about tank mixing products to address broadleaf weed and sedge concerns allows more lawns to be treated and done so without error. As a solution to remove risk from the mix, Bayer Environmental Science recently introduced Celsius® XTRA (CX) – an all-in-one broadleaf weed and sedge control herbicide. CX is a novel, pre-mixed herbicide containing three acetolactate synthase (ALS) inhibiting (WSSA Group 2 [HRAC legacy Group B]) active ingredients: thiencarbazone-methyl + iodosulfuron-methyl-sodium, which are proprietary Bayer chemistries, + halosulfuron-methyl. CX received registration with the Environmental Protection Agency in March of 2021 and was released to customers in August of 2021. The product is currently registered in 37 states for use by commercial applicators on warm-season turfgrasses including bermudagrass (*Cynodon* spp.), St. Augustinegrass [S*tenotaphrum secundatum* (Walter) Kuntze), zoysiagrass (*Zoysia* spp.), and centipedegras [*Eremochloa ophiuroides* (Munro) Hack.]. Applications of CX may be made to institutional, commercial, industrial, sports, and residential turfgrass sites in addition to sod farms. CX is labeled for post-emergence (POST) control of 106 broadleaf, sedge, and kyllinga species including troublesome weeds such as ground ivy (*Glechoma hederacea* L.), dandelion (*Taraxacum officinale* Weber x Wiggers), white clover (*Trifolium repens* L.), yellow nutsedge (*Cyperus esculentus* L.), and green kyllinga (*Kyllinga brevifolia* Rottb.). The "Caution" signal word labeling of CX offers customers operational flexibility enhanced by the herbicide's minimal odor and low PPE requirements. Additionally, the non-phenoxy chemistry of CX provides broadleaf weed control with limited herbicide drift concerns. CX is formulated as a water-dispersible granule (WDG) with a recommended rate structure of 525 g CX ha^{-1} (7.5 oz $acre^{-1}$) with a sequential application at 525 g CX ha^{-1} (7.5 oz $acre^{-1}$) at a 6- to 8-week interval, which is a typical customer visit interval for LCOs. The annual maximum application rate is 159.5 g ai ha^{-1} (15 oz CX $acre^{-1}$), aligned with the low-use rates typical of ALS inhibiting herbicides. As a new, all-in-one POST herbicide mixture, CX meets customer needs by providing wide-spectrum weed control in warm-season turfgrass systems with less risk of turf injury stemming tank mixing errors.

Late Season Dallisgrass and Lespedeza Control in 'Tifway' Bermudagrass. T Stoudemayer*, LB McCarty; Clemson University, Clemson, SC (217)

Late season post-emergence (POST) management of broadleaf and grassy weeds can be difficult for turfgrass managers. As summer transitions into fall, many summer annual and warm-season perennial weeds mature and become difficult to control with herbicides prior to a frost event. Two of these weeds are Common Lespedeza (*Kummerowia striata* (Thunb.) Schindl.) [*Lespedeza striata* (Thunb.) Hook. & Arn.] and Dallisgrass (*Paspalum dilatatum* Poir.). In bermudagrass (*Cynodon* spp.), both weeds can quickly establish a thick canopy, out competing bermudagrass in the immediate vicinity of growth. Common lespedeza (CL) becomes woody as it matures, allowing it to tolerate POST herbicides that probably would have control at first emergence. Dallisgrass (DG) is a coarse, rhizomatous, warm-season, perennial, grassy weed that is commonly found in turfgrass systems. Dallisgrass can be difficult to control from emergence, thus making it more challenging as it matures. Therefore, with these issues in mind, two late-season POST trials were initiated in 2021 at Legacy Pines Golf Club in Greenville, SC. CL trial had three treatments, including Metsulfuron (Manor 60DF @ 0.5 oz ai/A) + non-ionic surfactant (NIS) at 0.25% v/v, Trimec Classic 3.32L (4 pts/A) and Spotlight 1.5SL (2.66 pts/A) + NIS @ 0.25% v/v which provided 100% control into the first killing frost event after 42 days after initial treatment (DAIT). DG trial included 8 treatments: Dismiss South 4F (9.5 fl oz/A) + Revolver 0.19L (10 fl oz/A), Dismiss South 4F (9.5 fl oz/A) + Revolver 0.19L (17 fl oz/A), Tribute Total 61WDG (3.2 oz/A), Monument 75DF (0.56 oz/A), MSMA (Target 6 @ 1.5 lb ai/A), Manuscript 0.42L (9.6 fl oz/A), Revolver 0.19L (17 fl oz/A), and Revolver 0.19L (27 fl oz/A). All treatments in DG trial were applied with NIS @ 0.25% v/v except MSMA. Dismiss South + Revolver at low and high rate provided >80% control at 28 DAIT. DG trial will continue to be rated in the spring to determine year-long control as it re-emerges.

Influence of Post-treatment Irrigation Timings and Herbicide Placement on Bermudagrass and Goosegrass Response to Topramezone and Metribuzin Programs. S Askew*, J Brewer; Virginia Tech, Blacksburg, VA (218)

Immediate, post-treatment irrigation has been proposed as a method to reduce bermudagrass phytotoxicity from topramezone. Immediate irrigation is impractical as it does not allow time for applying herbicide. There is also insufficient evidence regarding how post-treatment irrigation, immediate or otherwise, influences mature goosegrass [*Eleusine indica* (L.) Gaertn.] control from topramezone or low-dose topramezone plus metribuzin programs. We sought to investigate bermudagrass turf and *E. indica* response to immediate, 15-minute, and 30-minute post-treatment irrigation compared to no irrigation following topramezone at 12.3 g ae ha^{-1}, the lowest labeled rate, or topramezone at 6.1 g ha^{-1} plus metribuzin at 210 g ai ha^{-1}. We also evaluated placement of each herbicide and the combination on soil, foliage, and soil plus foliage in an attempt to elucidate the mechanisms involved in differential responses between species and herbicide mixtures. Responses were largely dependent on trial due to bermudagrass injury from high-dose topramezone being nearly eliminated by immediate irrigation in one trial and only slightly affected in another. When post-treatment irrigation was postponed for 15 or 30 minutes, topramezone alone injured bermudagrass unacceptably in both trials. Bermudagrass was injured less by low-dose topramezone plus metribuzin than by high-dose topramezone and the former's impact on bermudagrass was dramatically reduced by irrigation. All post-treatment irrigation timings reduced *E. indica* control compared to no post-treatment irrigation. The herbicide placement study suggested that topramezone control of *E. indica* is highly dependent on foliar uptake and phytotoxicity of both bermudagrass and *E. indica* is greater from topramezone than from metribuzin. Thus, post-treatment irrigation likely reduces topramezone rate load with a concomitant effect on plant phytotoxicity of both species. Metribuzin was shown to reduce 21-d cumulative clipping weight and tiller production of plants, and this may be a mechanism by which it reduces foliar white discoloration when mixed with topramezone.

Pre- and Post-emergence *Poa annua* and Broadleaf Control in Bermudagrass. JW Taylor*, LB McCarty, T Stoudemayer; Clemson University, Clemson, SC (219)

A field study was conducted at Clemson University to evaluate the effectiveness of different herbicides for PRE- and POST-emergence control of *Poa annua* in Tifway bermudagrass (*Cynodon dactylon* x *C. traansvalensis germplasma*). This study included 8 different treatments assessed visually for *Poa* control. Treatments consisted of an untreated control, Specticle FLO applied at the rates of 6.5 oz/a and 9 oz/a on September 15, 2020, Specticle FLO (6 oz/a) + Celsius (4 oz/a) + Princep 4L (32 oz/a), Specticle FLO (6 oz/a) + Tribute Total (1 oz/a) + Princep 4L (32 oz/a), Specticle FLO (3 oz/a) + Tribute Total (1 oz/a) + Princep 4L (32 oz/a) followed by Specticle FLO (3 oz/a) + Princep 4L (32 oz/a), Barricade 4FL (32 oz/a) + Monument (0.53 oz/a) + Princep 4L (32 oz/a), and Coastal Herbicide (64 oz/a) applied on November 16, 2020. Also included was a general broadleaf control rating. Broadleaf weeds included white clover (*Trifolium repens*), sticky chickweed (*Cerastium glomeratum*) and several dandelions (*Taraxacum officinale* and *Pyrrhopappus carolinianus*). Overall, treatments applied November 16, 2020, provided good to excellent control of *Poa* and broadleaf weeds through study termination in early May 2021 whereas control from traditional PRE treatments, applied September 15, 2020 was reduced by spring 2021. Results of this trial support the recommendation of applying such treatments in mid-fall with a combination of PRE and POST products for *Poa* control in warm-season turf.

Regional Response of Zoysiagrass Turf to Glyphosate and Glufosinate Applied Based on Accumulated Heat Units. S Askew*[1], JM Craft[1], JD McCurdy[2]; [1]Virginia Tech, Blacksburg, VA, [2]Mississippi State University, Mississippi State, MS (220)

Zoysiagrass (*Zoysia* spp.) is utilized as a warm-season turfgrass because of its density, visual quality, stress tolerance, and reduced input requirements. Turf managers often exploit winter dormancy in warm-season turfgrass to apply nonselective herbicides such as glyphosate and glufosinate to control winter annual weeds. Although this weed control strategy is common in bermudagrass (*Cynodon* spp.), it has been less adopted in zoysiagrass due to unexplainable turf injury. Many university extension publications recommend against applying nonselective herbicides to dormant zoysiagrass despite promotional language found in a few peer-reviewed publications and product labels. Previous researchers have used vague terminology such as "applied to dormant zoysiagrass" or "applied prior to zoysiagrass green-up" to describe herbicide application timings. These ambiguous terms have led to confusion since zoysiagrass typically has subcanopy green leaves and stems throughout the winter dormancy period. No research has sought to explain why some turfgrass managers are observing zoysiagrass injury when the literature only offers evidence that nonselective herbicides do not injure dormant zoysiagrass. We sought to explore various herbicides, prevailing temperatures surrounding application, and heat unit based application timings as possible contributors to zoysiagrass injury. The results indicated that a wide range of herbicides may be safely used in dormant zoysiagrass. However, as zoysiagrass begins to produce more green leaves, herbicides such as metsulfuron, glyphosate, glufosinate, flumioxazin, and diquat become too injurious. Glufosinate was consistently more injurious regardless of application timing than glyphosate and other herbicides. When temperatures were 10 °C for 7 d following treatment, a delayed effect of glyphosate and glufosinate on digitally-assessed green cover loss was noted on zoysiagrass sprigs. In subsequent studies on turf plugs, a 14-d incubation period at 10 °C reduced glyphosate but not glufosinate effects on turf green color reduction. Glyphosate applied at 125 and 200 GDD_{5C} can safely be applied to zoysiagrass while glufosinate applied at the same timings caused inconsistent and often unacceptable zoysiagrass injury in field studies conducted at Blacksburg, VA, Starkville, MS, and Virginia Beach, VA. Zoysiagrass green leaf density was described as a function of accumulated heat units consistently across years and locations but variably by turf mowing height. Turf normalized difference vegetative index was primarily governed by green turf cover but reduced by herbicide treatments, especially when applied at greater than 200 GDD_{5C}.

Compatibility of Methiozolin and Several Plant Growth Regulators. JM Peppers*, S Askew; Virginia Tech, Blacksburg, VA (221)

Control of goosegrass and smooth crabgrass in creeping bentgrass putting greens is difficult due to a lack of selective herbicides that safely offer control of these grasses. Methiozolin is a newly registered herbicide that is primarily used to selectively control annual bluegrass in creeping bentgrass putting greens. Preliminary research has indicated that methiozolin may be an effective control option when frequently applied at low doses as a preemergent. Research has also indicated that early-GA-inhibiting plant growth regulators (PGRs) can control smooth crabgrass and goosegrass in creeping bentgrass putting greens. Our objectives with this research were to evaluate: the response of goosegrass and smooth crabgrass when exposed to PGRs, the preemergence efficacy of methiozolin on goosegrass and smooth crabgrass, and if the addition of PGRs to methiozolin can reduce the needed rate of methiozolin required to control goosegrass and smooth crabgrass. Three greenhouse studies were established to meet these objectives. The first study evaluated goosegrass and smooth crabgrass response to methiozolin applied alone as a preemergence herbicide. Methiozolin was applied at 125, 250, 500, 1000, and 2000 g ai ha^{-1} preemergence. The second study evaluated the response of goosegrass and smooth crabgrass to PGR programs. Four PGRs were applied either PRE only or PRE plus POST. The PGRs evaluated were flurprimidol (0.28 g ai ha^{-1}), paclobutrazol (0.28 g ai ha^{-1}), trinexapac-ethyl (0.05 g ai ha^{-1}), and prohexadione-calcium (0.14 g ai ha^{-1}). The final study evaluated methiozolin applied in conjunction with PGRs for preemergence control of goosegrass and smooth crabgrass. Methiozolin was applied at 0, 31.25, 62.5, 125, and 250 g ai ha^{-1} alone and in conjunction with flurprimidol (0.28 g ai ha^{-1}), paclobutrazol (0.28 g ai ha^{-1}), and trinexapac-ethyl (0.05 g ai ha^{-1}). Single and sequential applications of flurprimidol and paclobutrazol significantly reduced smooth crabgrass germination compared to the nontreated. Neither trinexapac-ethyl nor prohexadione-calcium reduced the germination of smooth crabgrass. Although numerical trends were similar for goosegrass, statistically there were no differences in treatment. Single and sequential applications of flurprimidol and paclobutrazol significantly reduced goosegrass and smooth crabgrass root biomass compared to the nontreated, trinexapac-ethyl and prohexadione-calcium treatments. Results from the methiozolin-alone study indicates that methiozolin can be an effective preemergence herbicide for goosegrass at rates of 125 g ai ha^{-1} and higher. These rates also controlled smooth crabgrass PRE >80%. Future research from these studies will be focused on creating a cost-effective program approach to using methiozolin and PGRs for goosegrass and smooth crabgrass control in putting greens.

Update on Herbicide-Resistant Goosegrass (*Eleusine indica*) Screening and Identification. JS McElroy*[1], J Harris[1], J Patel[1], BC Johnson[1], C Rutland[1], B Spesard[2]; [1]Auburn University, Auburn, AL, [2]Bayer Environmental Science, A Division of Bayer CropScience, Cary, NC (222)

Goosegrass *(Eleusine indica* L.) is one of the most problematic weeds in turfgrass and cropping systems. Oxadiazon, a protoporphyrinogen oxidase (PPO) inhibiting herbicides, is an effective preemergence treatment for goosegrass control and eventual resistance has developed. An A212T substitution in PPO1 was recently identified as a causal mechanism of oxadiazon resistance in goosegrass. Research was conducted to evaluate new populations for resistance to oxadiazon, determine if resistance can be detected using chlorophyll florescence, and develop a dCAPs assay for detecting the A212T mutation. 21 new suspected resistant populations were submitted to the Herbicide Resistance Diagnostic Lab at Auburn University with suspected resistance to oxadiazon. Plants treated with oxadiazon 1.12 kg ha^{-1} were rated on a binary scale of resistant (R) or susceptible (S) in comparison to previously diagnosed R and S biotypes. Nine of the 21 suspected R biotypes were diagnosed as R based on postemergence screen all of which encoded a nonsynonymous SNP resulting in A212T amino acid substitution in PPO1. A dCAPs primer effectively detected the A212T mutation of all populations containing the mutation without sequencing. F_v/F_m was evaluated as a diagnostic tool for fast detecting oxadiazon resistance. I_{50} values of F_v/F_m at 72 h after treatment were 0.62, 9.15 and 3.33 kg ha^{-1} oxadiazon for PBU (known susceptible), RB (known resistant) and Currituck (suspected resistant), respectively, indicating the newly diagnosed resistant population Currituck could be diagnosed with chlorophyll florescence; however, unknown variation exists between the two resistant populations. No other reported mutations occurred either in PPO1 or PPO2 of any populations. The target-site mutation A212T in PPO1 have been further substantiated as the primary mechanism of oxadiazon resistance.

Dicamba and 2,4-D Residues in Palmer Amaranth: When Were the Herbicides Applied? JK Norsworthy*[1], M Zaccaro-Gruener[1], LB Piveta[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (224)

Off-target movement of 2,4-D and dicamba are sometimes blamed on the cause of symptoms observed on weeds growing in cotton and soybean fields in Arkansas. Additionally, the Arkansas State Plant Board routinely collects tissue samples of weeds, predominantly Palmer amaranth, from fields being investigated for potential illegal use of auxin herbicides. For these reasons, research was conducted to understand the concentrations of dicamba and 2,4-D that could be expected in Palmer amaranth plant tissue over a one-month period following exposure to either herbicide. Palmer amaranth was treated at three sizes (3- to 6-, 8- to 12-, and 14- to 20-inch height) with four rates of each herbicide (1X, 0.1X, 0.01X, and 0.001X). A 1X rate of dicamba and 2,4-D was assumed to be 0.5 lb and 0.95 lb ae/A, respectively. Growth stage at application did not significantly affect the detection of either dicamba or 2,4-D in Palmer amaranth. For both herbicides, the concentration detected declined rapidly following the date of exposure. Dicamba applied at 0.01X was never detected in Palmer amaranth plants from 10 days and beyond in 2019 and 12 days and beyond in 2020. Failure to detect dicamba occurred even sooner when the herbicide was applied at 0.001X. In general, the ability to detect 2,4-D in Palmer amaranth followed similar trends as that of dicamba. For both herbicides, symptomology on Palmer amaranth, regardless of size, was seldom observed at rate of 0.01 or 0.001X. For this reason, dicamba or 2,4-D residues in Palmer amaranth plants collected during investigations along with presence of symptoms present on plants would strongly indicate an earlier direct application of the auxin herbicide rather than off-target movement being the cause of detection.

Aquatic Herbicide Spray Loss: Best Management Practices and Implications. BP Sperry*; US Army Corps of Engineers, Gainesville, FL (225)

Foliar herbicide applications for emergent/floating aquatic plant management has been controversial in certain regions of the US for decades. Although only registered herbicides are used in public aquatic systems, there is still often a high level of skepticism by unfamiliar public stakeholders and some natural resource managers. In particular, the amount of herbicide solution that is not retained on plant foliage which enters the water column (termed "spray loss") has been questioned and is widely unknown. Consequently, research at the US Army Engineer Research and Development Center has aimed to investigate this application component, best management practices to reduce spray loss, and implications of spray loss which will be discussed in the presentation.

Refining Triclopyr Use Patterns to Minimize Non-target Injury in Natural Areas. J Glueckert[1], CA Oberweger[2], SF Enloe*[3]; [1]University of Florida, Boynton Beach, FL, [2]Center for Aquatic and Invasive Plants - University of Florida, Gainesville, FL, [3]University of Florida, Gainesville, FL (226)

Triclopyr is an auxin type herbicide widely used for invasive plant management in natural areas. Although primarily used for basal bark treatment of woody invasive plants, there has been increasing interest in developing foliar use patterns for vines such as *Lygodium microphyllum*, as an alternative to glyphosate. However, some concerns for triclopyr non-target injury have been expressed for many wetland native plants. To address this, field studies were conducted to evaluate non-target injury via direct foliar application to several native plants at three wetland sites in south Florida. Treatments included an untreated control, triclopyr applied at spot treatment concentrations of 5.2, and 10.4 g L^{-1} and glyphosate applied at 14.4 g L^{-1}. Treatments were applied to four replicate five by five meter plots each with a single nozzle backpack sprayer at an application volume of 374 L ha^{-1}. Treatments were applied in the late winter and spring of 2021 during the dry season when target plants were actively growing. Percent visual evaluations of live green cover of each species were evaluated at multiple times up to 180 days after treatment. Results indicated significant variation in species response to triclopyr concentration and glyphosate. In general, plants exhibited less injury or more rapid recovery to the lower concentration of triclopyr compared to glyphosate. This pattern was exhibited across multiple native ferns including *Blechnum serrulatum, Pteridium aquilinum, Woodwardia virginica, Acrostichum danaeifolium* and also sawgrass (*Cladium jamaicense*). These results indicate that triclopyr may be an acceptable alternative to glyphosate and may provide increased safety for several non-target herbaceous plants. These results will assist land managers in improving herbicide stewardship for invasive plant control.

Meso-scale and Field Evaluations of Cuban Bulrush Response to Select Herbicide Treatments. G Turnage*, A McLeod; Mississippi State University, Mississippi State, MS (227)

Cuban bulrush (*Oxycaryum cubense*) is an invasive aquatic plant species native to South America that is spreading across the Southeastern U.S. Cuban bulrush is a perennial floating species that can completely cover a waterbody and disrupt ecological and biological processes as well as hamper human uses of water resources. In the early stages of invasion, Cuban bulrush survives as an epiphytic plant on other floating objects (other plants, logs, etc.) but in later stages the plant traps sediment in its root system and forms a floating island (tussock) that reduces the need for an underlying substrate for survival. Tussocks can be hundreds of acres in size and portions of them can break away, drift to new locations, and establish new colonies. To date, there is limited literature regarding chemical control of Cuban bulrush. The purpose of this work was to 1) determine potential herbicides for control of Cuban bulrush with meso-scale screenings and 2) validate meso-scale results on field populations. Preliminary work in 2017 and 2018 along with literature reviews identified diquat, flumioxazin, penoxsulam, glyphosate, 2,4-D, triclopyr, and florpyrauxifen-benzyl (FPB) as suitable candidates for two meso-scale research screenings in 2020. In the first meso-scale screening, 2,4-D (4.2 kg ai/ha [3.8 lb. ai/ac]), triclopyr (1.67 kg ai/ha [1.49 lb. ai/ac]), and diquat (1.1 kg ai/ha [0.99 lb. ai/ac]) provided >99% biomass reduction of Cuban bulrush one year after treatment. In the second screening, FPB (0.029 kg ai/ha [0.026 lb. ai/ac]) mixed with flumioxazin (2.07 kg ai/ha [1.85 lb. ai/ac]) provided 100% biomass reduction one year after treatment. In 2021, two field trials were implemented: one in Mississippi and the other in Florida. The Mississippi trial found that diquat (1.1 kg ai/ha [0.99 lb. ai/ac]), 2,4-D (4.2 kg ai/ha [3.8 lb. ai/ac]), and triclopyr (1.67 kg ai/ha [1.49 lb. ai/ac]) provided better control (>94% biomass reduction) of Cuban bulrush than FPB (0.029 kg ai/ha [0.026 lb. ai/ac]; 60% reduction) 12 weeks after treatment. In Florida, diquat (1.68 kg ai/ha [1.5 lb. ai/ac]) or triclopyr (5.04 kg ai/ha [4.5 lb. ai/ac]) applications resulted in >90% biomass reduction eight weeks after treatment while FPB achieved 80% reduction (0.029 kg ai/ha [0.026 lb. ai/ac]). Samples will be collected from field plots one year after treatment (summer 2022) to determine if the herbicide rates tested will deliver long term control of Cuban bulrush. Final results of field trials will be used to make recommendations for resource managers engaged in operational control of Cuban bulrush.

Metabolism of Aryloxyphenoxypropionic Acid Herbicides by Resistant Barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.]. J Hwang*[1], JK Norsworthy[1], LB Piveta[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (228)

The occurrence of barnyardgrass with resistance to acetyl-CoA carboxylase (ACCase)-inhibiting herbicides increases consistently. A dose-response experiment was conducted on barnyardgrass biotypes resistant (R) and susceptible (S) to two aryloxyphenoxypropionate herbicides cyhalofop-butyl (CyB) and quizalofop-ethyl (QuE) along with investigations into the potential resistance mechanism of these biotypes. The tested R barnyardgrass biotypes had strong resistance to CyB (resistant/susceptible ratio: 7.9-14.4) but weak resistance to QuE (resistant/susceptible ratio: 2.4-3.1). Insignificant differences in absorption, translocation, and total metabolism of CyB and QuE were observed among S and R barnyardgrass biotypes. However, differences between S and R barnyardgrass were observed in production of active acid forms of CyB and QuE. Production of cyhalofop-acid was >1.6-fold less in R barnyardgrass (3-8%) for 24 h after herbicide application than in the S barnyardgrass (8-16%), and that of quizalofop-acid was less in R barnyardgrass (3-22%) throughout the study period than in the S barnyardgrass (0-14%). In conclusion, a non-target-site resistance mechanism reducing the production of active herbicide forms may at least partly contributes to resistance of the evaluated barnyardgrass biotypes to CyB and QuE, but other mechanisms would likely be needed to account for the level of resistance observed.

Summer Cover Crop Mixes for Post-harvest Weed Suppression in Southeast Texas. JM McVane*, MV Bagavathiannan; Texas A&M University, College Station, TX (229)

Cover crops can play a vital role in developing resilient farms. They help with weed suppression, erosion control and build healthy soils. Moreover, single cover crops and mixes can be an important addition to less diverse row crop systems, while enhancing the provision of ecosystem services. Given the long growing seasons in south Texas, weeds that emerge after the harvest of corn/grain sorghum can produce ample seed prior to frost and contribute to future weed problems. The availability of a long growing season also presents an opportunity to plant summer covers to obtain multitude of benefits, including weed suppression. In particular, mixes of cover crops with various functional traits are considered to be superior over single species covers. Experiments are being conducted at Texas A&M University, College Station to evaluate various summer cover crop mixes for biomass production and weed suppression potential. A total of four cover crop mixes are being evaluated in a randomized complete block design with four replications. The four mixes are: 1) all grasses (sorghum-sudangrass, pearl millet, German millet and prosomillet), 2) two grasses+ 2 broadleaves (1 legume +1 non-legume) (sorghum-sudangrass, pearl millet, cowpea and buckwheat), 3) two grasses + 2 leguminous broadleaves (sorghum-sudangrass, pearl millet, cowpea and sunn-hemp), and 4) all broadleaves (2 legumes + 2 non-legumes) (sesame, buckwheat, cowpea, sunn-hemp). The covers were planted on Sep 1, 2020 and Oct 4, 2021, and were terminated naturally by the first killing frost. The observations include cover crop biomass, ground cover, phenological growth stage of the covers at termination, weed biomass (grass vs broadleaves), and cover crop decomposition rate following termination. Preliminary results show that mixes containing grass species, particularly sorghum-sudangrass and pearl millet provided the best weed suppression compared to the other mixes evaluated in College Station, TX. This research offers valuable information for developing suitable cover crop mixes for the Southeast Texas region and other comparable geographies.

Effect of Rye Biomass and Herbicide Program for Weed Control in Cotton. YR Upadhyaya*[1], P Devkota[2], N Singh[2], MJ Mulvaney[3], W Hammond[1], H Bayabil[1]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL, [3]Mississippi State University, Mississippi State, MS (230)

Cover crop biomass is critical in controlling weed emergence and growth. Due to the fast-growing and high biomass-producing nature of rye, it is often used for weed management in the row cropping system. Although rye biomass plays a significant role in weed management it is unlikely to get different biomass levels by increasing the seeding rate. An experiment was conducted at the West Florida Research and Education Center, Jay, Florida in 2020 to study the effect of different nitrogen rates for different levels of biomass production. A randomized complete block design with a split-plot restriction on randomization with four replications was used. The main plot factors were cover crop residue levels: weed-free fallow (no cover crop and no weed), cereal rye + 0lbsN/ac, cereal rye + 20lbsN/ac, cereal rye + 40lbsN/ac, cereal rye + 60lbsN/ac, and weedy fallow (now cover crop and with weeds). The sub-plot factor were PRE-herbicides (no-herbicide, Cotoran 4L, and Cotoran 4L+Reflex. The area between the middle two rows was used for data collection. The results revealed that the rye biomass was increased with increasing nitrogen rates. The Cotoran 4L+Reflex herbicide mixture was effective in controlling Sicklepod, Spiderwort, and Texas panicum compared to Cotoran 4L alone.

Rye Cover Crop Termination Timing Effects on Weed Suppression in No-till Corn. P Aryal*[1], CA Chase[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Horticultural Sciences Department, Gainesville, FL (231)

Cereal rye (*Secale cereale* L.) is an excellent cool-season cover crop for weed suppression in no-till production systems. Termination of a cover crop 2-3 weeks prior to main crop planting is usually recommended in the southern US. Although cover crop termination timing can be site and situation specific, a major consideration is achieving optimal cover crop biomass and weed suppression without a negative impact on the subsequent cash crop. The objective of this trial was to evaluate the effect of rye termination timing on cover crop biomass accumulation, weed suppression, and growth and yield of corn (*Zea mays* L.) in Florida. Following soybean (*Glycine max* [L.] Merr.) harvest, 'Wrens Abruzzi' cereal rye was no-till drilled at 90 kg ha^{-1} in fall 2020 and terminated using glyphosate in spring 2021. Three rye termination timing treatments and a no cover crop, weed-free control were arranged in a randomized complete block design with four replications in central Florida. Relative to corn planting, rye was terminated early (21 days before), late (7 days before), and post-planting (5 days after corn planting). After termination no further herbicides were applied until after weed assessment at the V5 stage of corn. Rye shoot biomass, weed density, and weed biomass were assessed at each termination timing. Weed density and biomass were also determined at the V5 stage of corn. While rye biomass was the highest and weed density was the lowest for post-planting termination compared to early and late pre-planting termination, weed biomass did not differ among the three termination timings. At the V5 stage of corn, weed density and biomass were not significantly different among all treatments including the control. However, at the V3 stage, corn stands with the cover crop treatments were lower than with the no cover crop control. Corn grain yield was 172 bushels per acre (bu/A) with the control, which was higher than the 112 bu/A with early rye termination but not significantly different from the 138 bu/A with both the late and post-planting termination of rye. The study was part of a multistate experiment and will be repeated in 2022 and 2023 to develop an effective termination timing for maximizing rye cover crop benefits.

Ryegrass Burndown Evaluations for Minimum Tillage Systems. L Pereira*, S Li, RD Langemeier, JT McCaghren; Auburn University, Auburn, AL (232)

In minimum tillage systems herbicides are heavily relied upon to provide weed control. However, as result of intensive use, glyphosate resistant populations of annual ryegrass (*Lolium multiflorum*) are increasing in prevalence across the southeastern United States. Antagonism occurs between synthetic auxins and glyphosate. Water conditioner such as ammonium sulfate (AMS) can help overcome this antagonism; however, options are limited for the Xtend weed control system due to volatilization concerns of AMS. Two studies were conducted with the following objectives. (1) to evaluate ryegrass burndown of dicamba or 2,4-D plus glyphosate tank mixes with alternative water conditioning agents, and (2) to evaluate ryegrass burndown efficacy without glyphosate for areas where glyphosate resistant ryegrass is present. Both experiments were conducted at Baldwin and Henry Counties, Alabama in minimum tillage systems in 2021. In Baldwin County the application was on April 5th of 2021 and in Henry County on March 22nd of the same year. Percentage control was recorded 14 and 28 days after treatment (DAT). In experiment 1, the 14 DAT rating in Baldwin County showed that the addition of dicamba to the tank mix significantly reduced control. Addition of AMS to glyphosate and 2,4-D tank mixtures increased control significantly when compared to similar treatments without AMS. No water conditioners were able to overcome dicamba antagonism of glyphosate, but AMS was able to overcome 2,4-D antagonism of glyphosate. In Experiment 2 treatments with repeated applications (clethodim or paraquat followed by paraquat approximately 10 days after initial applications) or clethodim and paraquat tank mixtures had the best control for both 14 and 28 DAT at both sites.

The Effect of GWN10598 Seed Treatment on Rice Response to Pre-emergence Herbicides in Two Soil Types. S Karaikal*, IS Werle, M Machado Noguera, N Roma-Burgos; University of Arkansas, Fayetteville, AR (233)

The effect of GWN10598 seed treatment on rice response to pre-emergence herbicides in two soil typesS.K. Karaikal*1, M. Noguera1, I. Werle1, N Roma-Burgos1 - Dept. of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR. The greatest biological constraint to rice yield is weeds infestation. Herbicides are the principal tools for rice weed control. Soil-applied herbicides provide the first line of defense against weeds, but these herbicides (i.e. clomazone, thiobencarb, quinclorac and others) can cause up to 15% rice injury. This injury may or may not affect yield and contributes to fluctuations in rice yield across space and time. We tested GWN10598 as a seed treatment for 'RT-7321-FP" rice to determine if this growth regulator-type compound can minimize the risk of injury from pre-emergence herbicides and stabilize rice yield. Greenhouse and field experiments were conducted in 2021 with treatments arranged in a split-plot experimental design with four replications. The main plot was herbicide (Facet+ Bolero, Facet + Prowl H2O, Facet + Command), and the subplot was GWN10598 concentrations. In the greenhouse, the concentrations tested were 0, 0.5, 1, 1.5, 2, 2.5, and 3 ml/kg seed. Seeds (5) were planted in flats filled with 1.32 lbs of silt loam soil. Herbicides were applied immediately after planting at 187 L ha^{-1} in a spray chamber. Rice injury data were obtained at 2, 4, and 6 weeks after treatment (WAT); biomass data were obtained at 6 WAT. In this paper, only the biomass data will be presented. GWN concentrations did not affect the biomass, but the herbicide effect was significant. The interaction between herbicide and GWN concentrations were not significant. Among the three herbicide combinations, Facet + Bolero caused almost 50% biomass reduction, but the rest of the treatments had no effect. The field experiments were conducted at the Southeast Research and Extension Center, Rohwer, Arkansas, in silt loam and clay loam soil. The same herbicides were tested. GWN10598 concentrations tested in the field were 0, 0.375, 0.75, 1.5, and 3.0 ml/kg. Among the data collected were number of tillers and yield. In the silt loam soil, the main effects of herbicide and GWN concentrations, and the interaction effect of these two factors on tillering were significant. Rice produced the highest number of tillers when treated with Facet + Prowl H2O with 0.375 ml/kg of GWN10598 seed treatment. These treatments did not affect yield. In the clay loam soil, the herbicide effect was significant on tillers but not the GWN10598 concentrations nor the interaction between these two factors. The treatments did not affect yield. Overall, the numerically highest yield 12660.18 kg/ha was produced at 0.75 ml/kg of GWN10598 seed treatment in both the soil types while the nontreated rice produced 12268.35 kg/ha.

Rice Cultivar Tolerance to Microencapsulated Acetochlor and a Fenclorim Seed Treatment. TH Avent*[1], JK Norsworthy[1], JA Fleming[1], M Zaccaro-Gruener[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (234)

Rice producers across the mid-southern US need new herbicide sites of action to control problematic weeds in rice. Chloroacetamide herbicides have been widely used in Asian rice production systems; however, in US drill-seeded systems, undesirable injury may occur. To help mitigate the injury, the inclusion of fenclorim as a seed treatment has demonstrated safening potential to 'Diamond' rice for microencapsulated (ME) acetochlor. Rice cultivar response to both acetochlor and fenclorim is unknown; thus, experiments were conducted to screen 16 cultivars with and without ME acetochlor (1,260 g ai ha^{-1}) and with and without a fenclorim seed treatment (2.5 g kg $seed^{-1}$). The experiment was initiated at the Pine Tree Research Station near Colt, AR, on April 19, 2021, and all acetochlor applications were applied delayed-preemergence. Acetochlor applied to all cultivars without fenclorim elicited >40% injury at 28 days after emergence (DAE). The fenclorim seed treatment reduced injury for all cultivars, and at 28 DAE, all cultivars demonstrated commercial tolerance. Yield reductions from ME acetochlor alone were observed for 9 of 16 cultivars, while the ME acetochlor and fenclorim seed treatment never reduced yield. These findings demonstrated that ME acetochlor applied delayed-preemergence to rice having a fenclorim seed treatment has a high potential for success, regardless of cultivar. Still, additional research over multiple site years is needed to confirm or refute these findings.

Coating Florpyrauxifen-benzyl on Urea for Control of Key Weeds in Rice. B Cotter*[1], JK Norsworthy[1], CH Arnold[1], TH Avent[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (235)

Off-target movement of aerially-applied florpyrauxifen-benzyl to soybean [*Glycine max* (L.) Merr.] became a major concern following commercial launch of the herbicide in 2018 in rice [*Oryza sativa* (L.)]. A small-plot field trial was initiated in the spring of 2020 and 2021 at the Milo J. Shult Agricultural Research and Extension Center in Fayetteville, AR that evaluated control of key rice weeds, specifically barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], yellow nutsedge (*Cyperus esculentus* L.), and hemp sesbania [*Sesbania herbacea* (Mill.) McVaugh], using florpyrauxifen-benzyl coated on urea fertilizer in an attempt to reduce off-target movement of the herbicide. Applications of florpyrauxifen-benzyl and florpyrauxifen-benzyl + penoxsulam, foliar spray and coated on urea, were made to three weed species and results were analyzed as a two-factor (herbicide and application method) completely randomized design. At 28 days after treatment (DAT) both years, yellow nutsedge and hemp sesbania were effectively controlled by all herbicide treatments and application methods with control ratings being greater than 97% for either weed species. Conversely, at 28 DAT, barnyardgrass was not effectively controlled by florpyrauxifen-benzyl alone coated on urea. Florpyrauxifen-benzyl coated on urea only controlled barnyardgrass 34% and 23% in 2020 and 2021, respectively. Likewise, florpyrauxifen-benzyl impregnated on urea produced a mortality rate of 38% and 29% in 2020 and 2021, respectively. Overall, florpyrauxifen-benzyl alone effectively controlled yellow nutsedge and hemp sesbania regardless of application method. The addition of penoxsulam to florpyrauxifen-benzyl, as a pre-mix, aid control of barnyardgrass using both application methods.

Barnyardgrass and Weedy Rice Control in Response to Warrant Rate and Application Timing. SC Noe*[1], JK Norsworthy[2], TH Avent[2], MM Houston[2], TR Butts[3]; [1]University of Arkansas, Fayetteville, KY, [2]University of Arkansas, Fayetteville, AR, [3]University of Arkansas System Division of Agriculture, Lonoke, AR (236)

Weed control in rice has become more complicated as problematic weeds such as barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] and weedy rice (*Orzya sativa* L.) have developed resistance to commonly used herbicides. Acetochlor has shown effective control of barnyardgrass and weedy rice. Microencapsulated acetochlor (Warrant) is a residual chloroacetamide herbicide that is labeled in corn, cotton, and soybean within the United States. Fenclorim is a herbicide safener that was first utilized in water-seeded rice with pretilachlor (another chloroacetamide) in Asia and was shown to reduce herbicide injury caused by pretilachlor. The effectiveness of acetochlor with and without fenclorim applied as a seed treatment must be evaluated for its control of barnyardgrass and weedy rice and mitigation of rice injury. This experiment was a three-factor randomized complete block design initiated in the Spring of 2021 with or without fenclorim (0 and 2.5 g ai/kg seed) and acetochlor applied at three timings (preemergence, delayed-preemergence, spiking, and 1-leaf) and herbicide rate (630, 1,260, and 1,890 g ai ha^{-1} of acetochlor). Data were collected at three intervals after each application (+/- 3 days) at 14, 21, and 28 days with emphasis placed on 21 days after application. As the application timing was delayed from preemergence to delayed-preemergence, herbicide injury was reduced when combined with the fenclorim seed treatment. Furthermore, as application timing was delayed weed control was also reduced. Although rice injury was reduced when fenclorim was used as a seed treatment, fenclorim did not have an impact on control of barnyardgrass or weedy rice. From this experiment, a delayed-preemergence application timing with acetochlor at 1,260 g ai ha^{-1} and a fenclorim seed treatment provided >90% barnyardgrass control and 62% weedy rice control with only 18% injury to rice.

Cultural Weed Management Strategies for Rice: Effects of Drill Spacing and Rice Cultivar. NH Reed*[1], TR Butts[2], JK Norsworthy[1], J Hardke[3], T Barber[2], JA Bond[4], A Poncet[1], BM Davis[5], M Sumner[5]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Stuttgart, AR, [4]Mississippi State University, Stoneville, MS, [5]University of Arkansas, Lonoke, AR (237)

Weeds cause problems like yield loss, price dockages, and harvest difficulties in rice production. With increased restrictions on herbicide applications, as well as fast evolving herbicide resistance in weeds, there is a need for diversified weed management strategies such as cultural approaches like manipulating drill width spacing and utilizing more competitive rice varieties. Past literature has shown that narrower drill spacing reduces weed biomass and produces a higher grain yield more consistently than wider drill spacing. With the high tillering capacity of hybrid rice and capabilities of today's precision planting equipment, rice production could shift to planting more hybrid rice instead of inbred rice in a less competitive drill width spacing. As a result, the objective of this research was to investigate the effect of drill spacing and rice cultivar on weed management and crop canopy development. A field experiment was conducted in the summer of 2021 at three locations (two in Arkansas and one in Mississippi) as a randomized complete block split-plot design. Four rice cultivars [medium-grain (CLM04), long-grain in-bred (CLL16), and two long-grain hybrids (RT7301 and RT7521 FP)] were drill-seeded in four drill widths (13-cm, 19-cm, 25-cm, and 38-cm). Weed density was assessed at the 5- to 6-leaf stage of rice (preflood) and preharvest. All data was analyzed using JMP Pro 16.0 subjected to an ANOVA table using Fisher's Projected LSD (P=0.05). No interaction between drill width spacing and rice cultivar was observed regardless of the response variable. Greater control of barnyardgrass (Echinochloa crus-galli) and large crabgrass (Digitaria sanguinalis) was observed in the narrower drill spacings of 13-cm and 19-cm compared to 25-cm and 38-cm. No effect on weed control was present for the cultivars used in the experiment. Hybrid or inbred varieties may not have any effect on suppressing weed control, but a narrower drill spacing show a greater weed control than a wider approach.

Tolerance of Provisia and Max-Ace Rice to Quizalofop. N Godara*[1], JK Norsworthy[1], TH Avent[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (238)

Quizalofop-resistant rice technology is a non-transgenic, herbicide-resistant technology that allows for postemergence applications of quizalofop, an acetyl CoA carboxylase-inhibiting herbicide. Previous research reported that quizalofop could cause significant injury to quizalofop-resistant cultivars, and environmental conditions strongly influence the response of grass species to aryloxyphenoxypropionate herbicides. This research investigates the influence of early-season soil moisture or nitrogen applications on tolerance of quizalofop-resistant cultivars to sequential quizalofop applications. Experiments were conducted at Stuttgart and Colt, AR, in 2021 and implemented as a three-factor, randomized complete block design with the factors evaluated being cultivar (PVL02 and RTv7231 MA), sequential quizalofop rate (none, 1×, and 2×) applied at the 2-leaf and 5-leaf stages of rice, and soil moisture/nitrogen application (none, flush, ammonium sulfate followed by flush) at the 2-leaf quizalofop application timing. Sequential quizalofop applications were applied at 120 (1×) and 240 (2×) g ai/ha with 1% v/v crop-oil concentrate. At 21 days after the 5-leaf stage quizalofop application, no significant differences in injury from the initial quizalofop application followed by flush and followed by a flush with ammonium sulfate on both cultivars at any quizalofop rate was observed. In addition, no differences in relative groundcover occurred at 14 and 21 days after the 5-leaf quizalofop application at Colt and Stuttgart, AR, respectively, regardless of the quizalofop rate. In conclusion, growers may see injury from sequential applications of quizalofop, but the conditions under which these trials were conducted with not conducive for quizalofop to injure the quizalofop-resistant cultivars evaluated, and no heading delay or reduction in yield potential was observed at either location.

Evaluation of Benzobicyclon Rates for the Control of Amazon Sprangletop and Rice Flatsedge in a Flooded Environment. ZT Hill*[1], T Barber[2], RC Doherty[3], LM Collie[4], A Ross[5]; [1]University of Arkansas Cooperative Extension Service, Monticello, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [4]University of Arkansas, Lonoke, AR, [5]University of Arkansas Cooperative Extension Service, Ward, AR (240)

Evaluation of Benzobicyclon rates for the control of Amazon sprangletop and rice flatsedge in a flooded environment. Z.T. Hill, L.T. Barber, R.C. Doherty, L.M. Collie, and A. Ross, University of Arkansas, Division of Agriculture, Research and Extension Amazon sprangletop [*Leptochloa panicoides* (J. Presl) Hitchc.] and rice flatsedge (*Cyperus iria* L.) were listed among the top weeds of concern in Arkansas rice in a recent survey. Incorporating new herbicides into current rice herbicide programs may be beneficial in controlling problematic weeds in Midsouth rice acres. Benzobicyclon, a Group 27 (4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibiting post-flood herbicide, has shown to provide broad-spectrum control of many aquatics, broadleaves, grasses, and sedges. Two experiments were conducted at Tillar, AR, to determine an effective rate of benzobicyclon to control varying growth stages of Amazon sprangletop and rice flatsedge. These experiments were conducted in a randomized complete block design with four replications in a simulated flooded environment, with a silty-clay loam soil placed into a plastic tote. Specimens of both weed species were transplanted to the totes at the one to two leaf growth stage, and a moderate flood was added and maintained in each tote throughout the experiments. Treatments consisted of benzobicyclon applied at 123-, 246-, and 370- g ai ha^{-1} and tank-mixed with methylated seed oil concentrate at 1.0% v/v ratio. These treatments were applied to Amazon sprangletop at the 3- to 4-leaf, tillering, and heading growth stages and to rice flatsedge at 7.6- to 10.1-cm, 15.2- to 20.3-cm, and 30.5- to 45.7-cm heights. Herbicide efficacy was evaluated in both experiments for control of Amazon sprangletop and rice flatsedge. Regardless of the application timing, initial control of rice flatsedge was less than 64% from all benzobicyclon rates at 7 days after application (DAA). By 21 DAA, all rates of benzobicyclon provided greater than 81% control at the smallest growth stage. As rice flatsedge heights increased, control from all rates had diminished to less than 86% at the 15.2- to 20.3cm timing and less than 32% at the 30.5- to 45.7cm timing. At 41 DAA, all rates of benzobicyclon provided greater than 98% control of rice flatsedge at the smallest height. Benzobicyclon at 246- and 370- g ai ha^{-1} provided 98- and 96% control, respectively, when applied to 15.2- to 20.3cm rice flatsedge. In the second experiment, benzobicyclon at 123 g ai ha^{-1} failed to provide greater than 74% control of Amazon sprangletop when applied to any growth stage. As the benzobicyclon rate increased to 246 g ai ha^{-1}, greater than 90% control of sprangletop was observed when applied to 3- to 4-leaf sprangletop by 21 DAA and to tillering sprangletop by 41 DAA. Overall, greater control of Amazon sprangletop was observed from benzobicyclon at 370 g ai ha^{-1} when applied at the 3- to 4-leaf and tillering timings throughout the experiment. Regardless of the herbicide rate, less than 34% control of Amazon sprangletop was observed when applied at the heading application time; albeit, blanking of seed-heads was observed from benzobicyclon at 370 g ai ha^{-1}. Based on these data, the use of benzobicyclon can be effective in controlling Amazon sprangletop and rice flatsedge in flooded rice herbicide programs. Benzobicyclon at all rates was effective in controlling rice flatsedge when applied to 7.6- to 20.3cm in height. Regarding Amazon sprangletop, benzobicyclon was shown to be most effective when applied at 246- and 370 g ai ha^{-1} to the early postemergence and tillering growth stages.

Postemergence Herbicides for Broadleaf Weed Control in Sesame: the Good, the Bad, and the Ugly. J Ferguson*[1], ZA Carpenter[2], G De La Fuente[3], E Votava[4]; [1]Sesaco Corporation, Yukon, OK, [2]Oro Agri Inc., New Braunfels, TX, [3]Sesaco Corporation, San Antonio, TX, [4]Sesaco Corporation, Austin, TX (241)

Sesame (*Sesamum indicum* L) is an annual dicotylendous species grown across the cotton belt in the United States, comprising of approximately 500,000 hectares each year. Sesame hectares are primarily (over 85%) in Oklahoma, Texas, and Kansas with other production in the southwest, mid-south, and south-eastern United States. Weed management in sesame is difficult due to the few number of herbicides labeled for use. Current preemergence herbicides labeled for use include *S*-metolachlor, trifluralin, and ethalfluralin with labeled post-directed options of prometryn and carfentrazone. Grass weed control is aided with labeled herbicides clethodim, quizalofop p-ethyl, and sethoxydim. There are no labeled broadleaf weed control herbicides for postemergence use in sesame. Field studies from 2019 through 2021 assessed potential postemergence broadleaf herbicide use in sesame and found varying results. Group 7 photosystem II inhibiting herbicides appear the most promising for postemergence broadleaf weed control in sesame – if applied at the right crop growth stage. HPPD inhibiting herbicides resulted in little injury when applied preemergence, but near complete plant death when applied postemergence. PPO inhibiting herbicides varied from low observed injury to more than 40% visual injury on sesame. ALS inhibiting herbicides also varied, resulting in low observed injury to near total plant death. EPSP synthase and glutamine synthetase inhibiting herbicides cannot be applied broadcast postemergence over sesame, but glutamine synthetase inhibiting herbicides show promise when applied post-directed or layby to sesame. From the nearly 70 herbicide active ingredients tested, sesame showed good tolerance to a majority of them (60%), little tolerance to a quarter of them (25%), and no tolerance to the remaining 15%. Results from these studies will aid in the further selection and sought after labeling of the promising herbicides to aid sesame growers in reduced weed pressure especially from broadleaf weeds.

Volunteer Rapeseed Issues and Management. V Kumar*, V Singh; Virginia Tech, Painter, VA (242)

Cover crops have become an integral part of the cropping systems in the northeast US owing to their substantial benefits. The selection of cover crop depends on the amount of biomass production and ground coverage provided. Late termination of cover crops results in the high biomass accumulation and ground coverage. However, delay in termination timing leads to seed production in cover crops which can infest the cash crop as volunteers in the following season. A study was conducted at Painter, VA to evaluate biomass accumulation by four cover crop species (wheat, cereal rye, hairy vetch, rapeseed) under different termination timings. Among four cover crop species, hairy vetch accumulated higher biomass (4.23 t/ha), which was significantly higher than wheat (3.82 t/ha), cereal rye (3.47 t/ha) and rapeseed (1.99 t/ha). For termination timings, late termination resulted into highest biomass accumulation (5.19 t/ha) than mid-termination (2.24 t/ha) and early termination (0.94 t/ha). Volunteerism was not an issue across all termination timings when wheat, cereal rye and hairy vetch were planted in winter. However, late termination of rapeseed gave rise to volunteer rapeseed plants. To control volunteer rapeseeds, different PRE and POST herbicides were tested. Among pre-emergence treatments, mesotrione and metribuzin showed maximum control of volunteer rapeseed (99%) fb flumioxazin (97%), isoxaflutole (97%) and atrazine (96%). Rapeseed density in all of these PRE treatments was statistically similar and ranged from 3-6 plants m^{-2}. Among POST treatments, glyphosate and atrazine provided highest rapeseed control (99%), fb glufosinate (87%) and carfentrazone (83%). Topramezone provided only 9% control of rapeseed. The POST herbicides with higher control resulted in lower density of rapeseed i.e. glyphosate and atrazine had 2-4 plants/m2, fb glufosinate (14 plants/m2), carfentrazone (15 plants/m2), and topramezone (53 plants/m2) compared to non-treated control (78 plants/m2). The study results indicate that volunteerism is a concern only in case of rapeseed cover crop but that can be managed in-season utilizing Roundup ready OR Liberty Link crop technologies.

Evaluation of Reviton in Preplant Burndown Programs. LM Collie[1], T Barber[2], RC Doherty*[3], ZT Hill[4], A Ross[5]; [1]University of Arkansas, Lonoke, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [4]University of Arkansas Cooperative Extension Service, Monticello, AR, [5]University of Arkansas Cooperative Extension Service, Ward, AR (243)

Evaluation of Reviton in preplant burndown programs R.C. Doherty. T. Barber, L. Collie, Z.T. Hill, and A. Ross; University of Arkansas, Division of Agriculture, Research and Extension Weed control programs that provide complete control of winter weeds, such as ryegrass and horseweed, are essential in a weed-free cropping system. Arkansas growers are in constant need of new chemistry and improved methods for controlling troublesome herbicide resistant winter weeds. In 2021trials were established at Marianna, AR in a Loring silt loam soil and at Tillar, AR in a Herbert silt loam soil to evaluate Reviton preplant efficacy. Trials were arranged in a randomized complete block design with four replications. Preplant herbicides included in the burndown programs were Reviton at 1 and 2 oz/A, Sharpen at 1 and 2 oz/A, Valor EZ at 2 oz/A, Xtendimax at 8 oz/A, Enlist One at 24 oz/A, Select Max at 16 oz/A, Roundup PowerMax 2 at 32 oz/A, paraquat at 32 oz/A and metribuzin at 3 oz/A. Visual weed control ratings of ryegrass and horseweed were taken at 1, 2, and 3 weeks after application. At 23 days after preplant burndown, horseweed control at Marianna ranged from a low of 33 to a high of 99%. Sharpen at 1oz/A plus Roundup PowerMax 2 at 32 oz/A plus Enlist One at 16 oz/A plus MSO at 1% v/v and Sharpen at 1oz/A plus Roundup PowerMax 2 at 32 oz/A plus Xtendimax at 8 oz/A plus MSO at 1% v/v provided 99% control of horseweed. Horseweed control of 97% was provided by Sharpen at 2oz/A plus Roundup PowerMax 2 at 32 oz/A plus MSO at 1% v/v, Reviton at 1 oz/A plus Roundup PowerMax 2 at 32 oz/A plus Xtendimax at 8 oz/A plus MSO at 1% v/v, and Roundup PowerMax 2 at 32 oz/A plus Enlist One at 16 oz/A plus NIS at 0.25% v/v. Reviton at 2 oz/A plus Roundup PowerMax 2 at 32 oz/A plus MSO did increase horseweed control by 21% over Reviton at 1 oz/A plus Roundup PowerMax 2 at 32 oz/A plus MSO. At the Marianna location Reviton and Sharpen programs provided equal horseweed control 23 days after application. At 29 days after preplant burndown, ryegrass control at Tillar ranged from a low of 50 to a high of 98%. Reviton at 1 oz/a plus Roundup PowerMax 2 at 32 oz/A plus Valor EZ at 2 oz/A plus MSO at 1% v/v and Sharpen at 1 oz/A plus Enlist One at 24 oz/A plus Select Max at 16 oz/A both provided 98% control of ryegrass. Select Max at 16 oz/A plus Roundup PowerMax 2 at 32 oz/A and Sharpen at 1 oz/A plus Roundup PowerMax 2 at 32 oz/A plus MSO at 1% v/v provided 96% control, while Reviton at 1 oz/a plus Roundup PowerMax 2 at 32 oz/A plus MSO at 1% v/v provided 94%. Reviton at 2 oz/A plus MSO provided the lowest ryegrass control at 50%. Reviton, Sharpen, and Select Max programs provided equal ryegrass control 29 days after application. The data collected from these trials does support Reviton as a viable horseweed and ryegrass preplant control option, when used in a program. Application of Reviton alone did not provide adequate control.

Utilizing Preemergence Herbicides to Maximize the Value of Machine-Vision Application Technology.
JW Adams*[1], P Berry[2], R Wuerffel[3], DL Bowers[4]; [1]Syngenta Crop Protection, Fargo, ND, [2]Syngenta Crop Protection, Monticello, IL, [3]Syngenta Crop Protection, Gerald, MO, [4]Syngenta Crop Protection, Greensboro, NC (244)

Machine-vision precision application technology has enabled targeted applications of non-selective herbicides in non-crop situations (green-on-brown; GoB) commercially for several years. Recent advancements in machine-vision and sprayer technologies (e.g. pulse width modulation, single nozzle control) now allow for targeted applications to occur in major row crops with selective herbicides (green-on-green; GoG). This GoG technology has the potential to reduce the total amount of herbicide sprayed on a given field for major rows crops such as corn, soybeans, and cotton, especially in postemergence applications. However, it is unclear how weed pressure at the timing of postemergence applications will impact herbicide savings realized by the grower. This presentation aims to present preliminary data demonstrating the value that GoG technology, combined with robust preemergence herbicides (full use rates and multiple effective modes of action), may bring to growers in the future. Furthermore, this presentation will posit questions about the additional benefits (beyond herbicide savings) that the combination of GoG technology and robust residual weed control may bring, such as improved herbicide resistant weed management.

Quantifying the Impact of Herbicide Drift on Peanut Using UAV. N Singh*[1], P Devkota[1], J Iboyi[1], MJ Mulvaney[2]; [1]University of Florida, Jay, FL, [2]Mississippi State University, Mississippi State, MS (245)

The herbicide drift can negatively impact peanut growth and yield. The off-target movement of herbicides applied on cotton, soybean, and corn can result in a significant yield reduction in peanut. The research was conducted to evaluate the impact of herbicide-drift on peanut using NDVI measured from a UAV and field-based measurements. The first study evaluated the impact of 25% of the label rate of glufosinate, glyphosate, dicamba, paraquat, and lactofen applied at 25 and 60 days after planting (DAP) peanut. For the second study, 50%, 12.5%, 3.12%, 0.78%, and 0.2% of the label rate of glufosinate was applied at 25 and 60 DAP peanut. NDVI, peanut injury, yield, height, width, and leaf area index (LAI) were measured at 4 weeks after herbicide applications. The NDVI was calculated from images collected with a multispectral camera mounted on a UAV. In the first study, among different herbicides, the 25% label rate of dicamba, glufosinate, and glyphosate applied at 25 DAP resulted in the highest peanut injury. These herbicides caused 42 to 52% peanut injury and 25 to 57% NDVI reduction. Glyphosate (25% label rate) applied at 25 DAP and 60 DAP reduced the peanut yield by >65%. Likewise, dicamba (25% label rate) applied at 60 DAP reduced the peanut yield by 51%. In this study, NDVI showed a strong correlation with peanut injury, yield, plant height, and canopy width with R^2 of 0.71 to 0.85, 0.66 to 0.69, 0.76 to 0.94, and 0.89 to 0.94, respectively. In the second study, among different glufosinate rates, 50% of the label rate caused the highest peanut injury and caused a reduction in NDVI, height, weight, LAI, and yield. The average peanut injury from 50% glufosinate rate applied at 25 DAP and 60 DAP were 70% and 51%, respectively. Moreover, the 50% glufosinate rate reduced the NDVI by 51.9% and 33.8% when applied at 25 DAP and 60 DAP, respectively. Similarly, the peanut yield was reduced by 68% with the 50% glufosinate rate. NDVI showed a strong correlation with peanut injury, yield, plant height, and canopy width with R^2 of 0.83 to 0.96, 0.64 to 0.90, 0.63 to 0.93, and 0.75 to 0.93, respectively. The results from this research illustrate that the NDVI can be an indicator to quantify peanut injury and yield reduction caused by drift of glufosinate, glyphosate, and dicamba.

Unmanned Aerial System-based Herbicide Applications in Agronomic Crops. V Singh*, D Srivastava, V Kumar; Virginia Tech, Painter, VA (246)

Unmanned Aerial Systems are widely used for mapping and classification of weed species these days. Along with sensing and collecting image data, a novel idea of pest management through UAS-based site-specific and broadcast pesticide-spray applications has emerged as a potential crop protection tool. Such interventions are necessary for reducing expenses, labor, and chemical load on the agroecosystems and managing pest-resistance issues. However, not much research has been conducted on these aerial platforms and data on their efficiency of controlling major pests (weeds) in diverse cropping systems are not available. Studies were conducted in 2021 at Painter, VA to evaluate the efficacy of UAS-based herbicide spray applications in corn, cotton and soybean. UAS-based herbicide applications were conducted at two different volumes at 18.7 (UAS-2) and 37.4 L ha^{-1} (UAS-4) and compared with a CO_2 pressurized backpack sprayer at 140 L ha^{-1} (BP-15). Water sensitive strips, and six-cell trays filled with seedlings of Palmer amaranth and large crabgrass were placed randomly in the test plots. All crop studies were replicated four times and repeated after one-month. UAS-based POST spray applications provided 90-100% control of weeds in all crop studies which was either similar to weed control efficacy of backpack sprayer or better with UAS when applied late-POST. Additional studies were conducted to evaluate the site-specificity of UAS-based herbicide applications and results have indicated that this technology can perform automatic spray operations with a frequency of 65% hitting target within 25-cm of radius. Overall weed control efficacy of spot spray was 94%. Results have indicated that current UAS technology can spot spray with high precision, but more studies and technological improvements are required for standardization.

Influence of Speed on the Effectiveness of Herbicide Applications. AA Tavares*[1], B Vukoja[2], GR Kruger[3], DM Dodds[1]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska-Lincoln, North Platte, NE, [3]BASF Corporation, Research Triangle Park, NC (247)

As the use of small unmanned aircraft vehicles (sUAV) for agricultural purposes becomes more popular, understanding the limitation of this technology and how to overcome it turns into a priority. sUAV for pesticide application doesn't have a system that allows significant changes in operating pressures while spraying, requiring to change the carrier volume based on nozzle orifice size and application speed. The objective of this research was to evaluate the influence of application speed on the effectiveness of herbicide application on green foxtail, common lambsquarters, and barnyardgrass following application of carfentrazone-ethyl, glufosinate, glyphosate, and 2,4-D. Research was conducted at the pesticide application technology laboratory at the University of Nebraska-Lincoln. After sowing, seedlings of each species were transplanted into plastic tubes containing commercial potting mix and maintained under greenhouse conditions (30/20 C with 16h photoperiod). Plants were supplied with water including fertilizer solution (0.2% v/v). Plants (10-cm tall) were sprayed using the same rate of each herbicide: glyphosate (0.73 L ha^{-1}), glufosinate (0.73 L ha^{-1}), 2,4-D (0.58 L ha^{-1}) and carfentrazone (0.07 L ha^{-1}). For glyphosate and glufosinate application, AMS was added at 2% v/v. Applications were was made using a 3-nozzle spray chamber calibrated to deliver 9.35, 18.7, 28, 46.8, 93.5, 140.3, and 183.1 L ha^{-1} using a TT 11001 nozzle at 150 kPa with speed changed in response to carrier volume. Glufosinate and glyphosate applied to green foxtail at all carrier volumes resulted in satisfactory control (> 80%). Carfentrazone control varied depending on carrier volume with higher carrier volumes being more effective but control was still low(< 40%). Common lambsquarters control decreased as the carrier volume increased, going from 68% when spraying 2,4-D at 9.35 L ha^{-1} to 30% at 183.1 L ha^{-1}. Barnyardgrass control was similar to that of green foxtail. Overall, glyphosate was not carrier volume-dependent as dry biomass reduction was similar regardless of carrier volume. For 2,4-D, carrier volume was an important factor to consider before application since carrier volumes higher than 93.5 L ha^{-1} reduced efficacy.

First Year Summary of the Redekop Seed Control Unit for Harvest Weed Seed Control in Wheat and Soybean. EC Russell*, ML Flessner, WC Greene, MP Spoth, C Sias, KW Bamber; Virginia Tech, Blacksburg, VA (249)

Harvest Weed Seed Control (HWSC) targets weed seeds collected during harvest operations through means of destruction, concentration, or removal. HWSC is helping combat herbicide-resistant weeds and reduces weed seed inputs into the soil seed bank. The Redekop Seed Control Unit (SCU) is one way to implement HWSC. This seed impact mill is integrated into the back of the combine and destroys weed seeds as they exit the combine in the chaff fraction. The objectives of this study were to evaluate the effectiveness and operating costs of the Redekop SCU for use in wheat and soybean. Testing included the percentage kill of economically important weed species in wheat and soybean, population density changes of common ragweed in soybean, fuel use, and engine capacity. These preliminary data are from the first year of testing. In wheat, the percentage kill for Italian ryegrass (*Lolium multiflorum*), hairy vetch (*Vicia villosa*), and wild mustard (*Sinapis arvensis*) were 88.0%, 98.7%, and 99.8%, respectively. In soybean, the percentage kill for common ragweed (*Ambrosia artemisiifolia*) and Palmer amaranth (*Amaranthus palmeri*) were 99.2% and 99.9%, respectively. Three of the five fields evaluated for population density changes of common ragweed saw significant reductions of 34%, 42%, and 50% in common ragweed emergence in the area that used the Redekop SCU, compared to conventional harvest. No differences in common ragweed density were seen in the other two fields. Fuel use and engine capacity followed similar patterns in both wheat and soybean. In both crops, the Redekop SCU used more fuel and it increased engine demand during operation. Our first-year results indicate that there are some immediate benefits to using the Redekop SCU, but research in Australia where HWSC is widely implemented indicates that the practices need to be used for several seasons to minimize the soil seed bank. Although future research is needed to evaluate its efficacy, the Redekop SCU shows great potential as a weed management tool to help reduce viable weed seeds entering the soil seed bank.

Understanding the Resistance Mechanism of Palmer Amaranth to Trifluralin: Examination of Gene Amplification, Metabolism, and Target Site Mutations. F Gonzalez Torralva*, JK Norsworthy; University of Arkansas, Fayetteville, AR (250)

Palmer amaranth (*Amaranthus palmeri* S. Watson) is a difficult-to-control weed species in Midsouth crops such as cotton (*Gossypium hirsutum* L.) and soybean (*Glycine max* (L.) Merr.). Palmer amaranth has evolved resistance to different herbicide sites of action including ALS, EPSPS, VLCFA, and microtubule assembly inhibitors among others. In this work, we explored the resistance mechanism deployed by Palmer amaranth to surpass trifluralin (a microtubule assembly-inhibiting herbicide) toxicity. Different physical, physiological, and molecular assays were used to understand the resistance mechanisms involved in a trifluralin-resistant Palmer amaranth collected in Arkansas, USA. Our findings demonstrated that GST-mediated metabolism is playing at least a partial role in the resistance to trifluralin in a Palmer amaranth accession from Arkansas. Further efforts to understand the genes that lead to a differential GST-metabolism are needed.

Bioherbicidal Potential of Cotton Chromosome Substitution Lines on the Germination and Growth of Weeds. W Segbefia*[1], GA Fuller[1], PS Sharma[1], KA Boateng[1], J Kwetey[2], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS (251)

Weed interference is a persistent danger to cotton production. In fact, among all agronomic problems crops face, weeds have the most severe effect. They raise production costs, degrade fiber quality, and act as breeding grounds for plant diseases. This study aims to find chromosomal replacement lines with weed-suppressive qualities or characteristics. A stair-step structure was used to experiment in the MSU greenhouse. First, two replications were performed using the Randomized Complete Block approach. Palmer amaranth (Amaranthus palmeri) is the most prevalent and damaging cottonweed in Mississippi. Because it is resistant to glyphosate and other herbicides, chemical weed management tactics must be supplemented. Allelopathy, a potential weed management strategy, employs secondary metabolites from a plant species to impede the growth and development of plants in the vicinity. In order to screen for weed-suppressive ability, backcrossed chromosome substitution (CS) lines were substituted for a homologous pair of G. hirsutum (TM-1) chromosome or chromosome arm of G. hirsutum. These CS lines were developed with a homologous pair of the chromosome or chromosome arms of G. barbadense (CS-B), G. tomentosum (CS-T), and G. mustellinum (CS-M). Eight of the 50 CS lines were examined in greenhouse experiments and field-tested to determine the level of Palmer amaranth suppression. Allelopathy is a crucial method for cotton weed suppression because it could be used as a substitute for synthetic herbicide. Also, this method could function as the base for producing other non-synthetic fertilizers.

A Proactive Approach to Confirm the Glufosinate Resistance Before Widespread Evolution. EA Jones*, DJ Contreras, CW Cahoon, JC Dunne, KM Jennings, RG Leon, W Everman; North Carolina State University, Raleigh, NC (252)

Glufosinate resistance has evolved in only five species and resistance has yet to evolve widespread. Glufosinate is one of the remaining effective postemergence herbicides, thus reliance on this herbicide for weed control is likely to increase and select for resistant weeds. Putative glufosinate-resistant weeds are subjected to dose-response assays or molecular sequencing to determine if resistance has evolved. The current assays to confirm herbicide resistance can be time and labor intensive (dose-response) or require a technical skillset (molecular sequencing). Since glufosinate inhibits chlorophyll production and incurs rapid necrosis, we propose a new, rapid assay utilizing spectral reflectance to confirm glufosinate resistance. Leaf discs were excised from a glufosinate-resistant and –susceptible cotton variety and placed into a 24-well plate containing different concentrations (0-10 mM) of glufosinate for 48 hours. A multispectral sensor captured images from the red, blue, green, and rededge wavebands after the 48 hour incubation period. The green leaf index (red and green wavebands) was utilized to determine the green ratios of the treated leaf discs. Clear differences of spectral reflectance was observed between the leaf discs of the glufosinate-resistant and susceptible cotton varieties at the highest concentration tested for all wavebands and the green leaf index. Leaf discs from two additional glufosinate-resistant and –susceptible cotton were subjected to a similar assay with the discriminating glufosinate 10 mM concentration. Clear differences again were observed between the leaf discs of glufosinate-resistant and –susceptible cotton varieties for all wavebands. The leaf discs of the cotton varieties were inseparable with the green leaf index. The results provide a basis for rapidly detecting glufosinate-resistant plants via spectral reflectance. Future research will need to determine the glufosinate concentration thresholds for weeds that evolve resistance.

Potassium Borate as a Volatility Reducing Agent: What We Know Today. MC Castner*[1], JK Norsworthy[1], TL Roberts[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (253)

The University of Arkansas Systems Division of Agriculture has been evaluating and was recently granted a patent for use of potassium tetraborate tetrahydrate (potassium borate) as a dicamba volatility reducing agent (VRA) and boron (B) nutritional. Potassium borate has the potential to alleviate B deficiency in XtendFlex® cotton and soybean systems. To assess the volatility reducing properties of potassium borate, two low tunnel (Fayetteville, AR) and two large-scale (Fayetteville and Newport, AR) experiments were conducted in 2020. For low tunnel experiments, potassium borate at 0.00625, 0.0125, 0.025, 0.05, and 0.1 M concentrations were combined with the diglycolamine salt of dicamba at 560 g ae ha^{-1} plus the potassium (K) salt of glyphosate at 1,256 g ae ha^{-1}. The large-scale experiments consisted of two treatments, DGA dicamba with VaporGrip® Technology plus K salt of glyphosate at 560 and 1,256 g ae ha^{-1}, respectively, with and without potassium borate at a 0.1 M concentration. As potassium borate concentration increased, the amount of detected dicamba from air samplers decreased in the low tunnel experiments. Additionally, injury caused by dicamba that included potassium borate concentrations ranging from 0.025- to 0.1-M demonstrated negligible maximum, average, and distance traveled compared to lower potassium borate concentrations or no additive. The large-scale experiment corresponded well to low tunnel results at both locations, indicating that 0.1 M potassium borate is sufficient to reduce dicamba volatility. Overall, potassium borate has shown promise as a VRA in small- and large-scale trials, and continued research is needed to evaluate crop tolerance and nutritional capabilities of this additive.

Evaluation of Fluridone in a Peanut Weed Control Program. LM Collie*[1], T Barber[2], RC Doherty[3], ZT Hill[4], A Ross[5], TR Butts[2]; [1]University of Arkansas, Lonoke, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [4]University of Arkansas Cooperative Extension Service, Monticello, AR, [5]University of Arkansas Cooperative Extension Service, Ward, AR (255)

Evaluation of fluridone in a Peanut Weed Control Program L.M. Collie[1], L.T. Barber[1], R.C, Doherty[2], Z.T. Hill[2], A.W. Ross[1], T. R. Butts[1] [1]University of Arkansas Research and Extension Service Lonoke AR [2]University of Arkansas Research and Extension Service, Monticello AR In recent years, peanut acres have increased in Arkansas and growers require new ways to control the persistent problem of PPO-resistant Palmer amaranth (*Amaranthus palermeri* S. Wats) and other troublesome weeds. In 2021 two experiments were established to determine the length of residual control of fluridone and to evaluate weed efficacy of fluridone in a weed control program. These trials were conducted in Marianna, Arkansas at the Lonn Mann Cotton Research Station on a Calloway silt loam. Peanut variety Georgia 60G was planted and herbicide treatments were arranged in a randomized complete block design with four replications. Fluridone, flumioxazin, and dimethenamid-P were applied preemergence, alone and in combinations, to determine the length of residual control in the first experiment. In the second experiment, several herbicide programs were evaluated that contained fluridone compared against other preemergence herbicides followed by early (EPOST), mid (MPOST), and late (LPOST) POST applications of various herbicide combinations. Visual weed control was observed at 30 and 45 days after application (DAA) and visual crop response was observed at 28 DAA in the first trial. Visual weed control ratings of Palmer amaranth, broadleaf signalgrass *(Brachiaria platyphylla* Nash.*)*, and yellow nutsedge *(Cyperus esculentus L.)* were taken 21 days after the LPOST application in the second experiment. When comparing length of residuals in the first experiment, all treatments provided greater than 83% Palmer amaranth control 30 DAA. Dimethenamid-P at 0.75 lb ai/A provided the least amount of Palmer amaranth and broadleaf signalgrass control with 58% and 63% control 45 DAA, but when combined with fluridone at 0.15 lb ai/A the highest control (87 and 88%) was observed at the same timing. Only fluridone applied alone resulted in no crop response observed, but flumioxazin at 0.094 lb ai/A in combination with fluridone or dimethenamid-P provided a crop response of 10% or greater 28 DAA. In the second experiment, all program treatments achieved 94% or greater broadleaf signalgrass control 21 days after LPOST application. When combined, flumioxazin at 0.094 lb ai/A with fluridone at 0.112 or 0.15 lb ai/A applied preemergence provided the least yellow nutsedge control 21 days after the LPOST application. Regardless of POST applications, Palmer amaranth control is greater than 84% in treatments where fluridone applied alone and in combination with other preemergence herbicides. Palmer amaranth control was reduced to 71% control 21 days after the LPOST application when flumioxazin at 0.094 lb ai/A and acetochlor at 0.375 lb ai/A were applied together preemergence. Fluridone herbicide appears to be a new valuable tool for Arkansas peanut producers, especially for control of multiple-resistant Palmer amaranth with limited risk for crop injury. However, if yellow nutsedge is present, combinations of dimethenamid-P, or *S*-metolachlor should be tankmixed with fluridone for optimum control.

Integrated Weed Management Practices to Control ALS and PPO-Inhibitor Resistant Palmer Amaranth in Peanut. JT McCaghren*, S Li, RD Langemeier, L Pereira; Auburn University, Auburn, AL (256)

Palmer amaranth (*Amaranthus palmeri*) is an economically damaging weed found throughout southeastern United States. Over reliance of herbicides in management has caused development of herbicide resistance in Palmer amaranth including ALS-inhibitors and PPO inhibitor herbicides potentially limiting peanut producers' options to control Palmer. Evaluation of alternative preemergent herbicides and cultural practices (high residue cover crops) to control Palmer amaranth is imperative for peanut production. This project evaluates integration of high residue cover crops (CC) versus conventional tillage (CT) and pre-emergent herbicides programs in peanut to control resistant Palmer amaranth without using PPO-inhibitor herbicides. Cereal rye was the only CC species using in CC system. Acetochlor, fluoridone, norflurazon, pendimethalin were used as PRE-treatments in different tank mixes. Paraquat was used in CT system to clean up Palmer with 2,4-DB. Imazapic, 2,4-DB and S-metolachlor were applied in CC system to provide morning glory and residual control of Palmer amaranth. Approximately 7000-8000 kg ha^{-1} CC residue was present at peanut planting and 2000-3000 kg ha^{-1} residue still remained on soil surface at 56 days after peanut planting (DAP) in both locations. All herbicide treatments provided effective control of Palmer amaranth with more than 90% control compared to the non-treated check (NTC) in all planting systems through 70 DAP. The CC NTC had 64% fewer Palmer amaranth compared to the NTC of CT at 70 DAP. Data indicated that cover crop residue allowed for quicker canopy closure and as well as effective Palmer amaranth suppression throughout the growing season. These results suggest that alternative approach of residual herbicides plus CC residue is an effective method to control ALS and PPO resistant Palmer amaranth while maintaining sufficient peanut crop growth.

Cotton Response to Non-labeled Herbicides. GA Stephens*, DM Dodds, JS Calhoun, J Krutz; Mississippi State University, Mississippi State, MS (257)

Herbicide resistance continues to be problematic for United States cotton producers. Prior to the introduction of genetically modified cotton, postememergence broadleaf weed control options were limited. Since introduction of herbicide tolerant cotton varieties, herbicide resistance has become common. Additional herbicide options are needed for weed control in cotton and to provide additional options as part of a broad spectrum weed management program. This experiment was conducted to evaluate cotton injury following application of herbicides not labeled for use in cotton and how crop injury was impacted by application placement. The effect of the herbicide (ametryn, amitrole, imazapic, and topramezone) application and sprayer type (broadcast, layby, and drop-nozzle) on visual injury and seedcotton yield were evaluated at the R.R. Foil Plant Science Research Center, Mississippi State, MS; the Black Belt Branch Experiment Station near Brooksville, MS; and at an on-farm site in Drew County, AR in 2020 and 2021. Visual injury was negatively correlated with seed cotton yield. Visual cotton injury following broadcast herbicide application was between 13 and 37%; between 4 and 20% following applications through drop nozzles; and between 0 and 12% following layby applications. Herbicides applied broadcast reduced seedcotton yield between 50 and 99%, regardless of herbicide was applied. Conversely, layby applications of ametryn, amitrole, and topramezone had no effect on the seed-cotton yield. All herbicide treatmentsapplied with drop nozzles, except ametryn reduced seedcotton yield between 27 and 93%. Imazapic applied postemergence decreased seed cotton yield 71 to 90% regardless of the application placement. Directed placement of postemergence herbicides can reduce the detrimental effects of some herbicides not labeled for use in cotton and could provide a pathway to incorporate new and different chemistries into weed control programs in production systems across the United States.

Cotton Stalk Regrowth Management in Enlist Cotton Systems in South Texas. S Samuelson*[1], M Lovelace[2]; [1]Corteva Agriscience, Bryan, TX, [2]Corteva Agriscience, Oklahoma City, OK (258)

Texas has invested nearly 1 billion dollars towards the Boll Weevil Eradication Program to functionally suppress and eradicate boll weevil (*Anthonomus grandis*) across the state. One measure that was implemented is the requirement to remove all standing stalks that survived after cotton (*Gossypium hirsutum*) harvest. In southern geographies of Texas, and prior to the advent of Enlist cotton, this was historically done with an application of 2,4-D; which effectively killed the plant and eliminated hostable overwintering structures for boll weevil. The purpose of this study was to determine effective herbicide options that will delay regrowth or kill cotton stalks in Enlist cotton to give growers adequate time to pull stalks or allow for overwinter fallow. This study utilized a randomized complete block design and took place across three site locations in Southern Texas (Edinburg, East Bernard, and Bishop), with 4 replications and two application timings. Plots measured four rows wide and 9 meters deep. Treatments included varied tank mixtures of dicamba, dichlorprop-P (Duplosan DP), thidazuron (FreeFall SC), dicamba+diflufenzopyr (Distinct), diuron+thidiazuron (CutOut Cotton Defoliant), flumioxazin (Valor), and atrazine, comprising of 24 treatments. Cotton was shredded after harvest and plots were sprayed when 2-3 new leaves (3-4 cm diameter) grew from the stalk base (application A). Twenty-one days after application A, the back 4.5 meters of each plot was sprayed with the same corresponding treatment (application B). Ratings were taken at 2, 4, 6, and 8 weeks after each application (WAA). Percent visual regrowth (plant and fruit) and kill were observed and recorded (0-100). At application A treatments with three actives showed the best control at 8 WAA, followed by tank mixes of duplosan and dicamba, and dicamba and distinct. Dicamba tank mixes in general provided more control compared to duplosan tank mixes. Across all treatments, two applications were most effective at managing regrowth and killing the plant. Fruiting regrowth was only observed in the untreated check and at 8 and 10 WAA-A. Further research will be conducted to observe which follow-up applications, when deemed necessary, will be the most cost-effective to the grower.

A Beltwide Study Evaluating an Integrated Approach to Palmer Amaranth Management in Southern US Cotton. SE Kezar*[1], MV Bagavathiannan[1], PA Dotray[2], JK Norsworthy[3], RG Leon[4], G Morgan[5], FH Oreja[4], DC Foster[6], MM Houston[3], D Hathcoat[7], KR Russell[8]; [1]Texas A&M University, College Station, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]University of Arkansas, Fayetteville, AR, [4]North Carolina State University, Raleigh, NC, [5]Cotton Incorporated, Cary, NC, [6]University of Tennessee, Jackson, TN, [7]Texas A&M AgriLife Research, College Station, TX, [8]Texas Tech University, Lubbock, TX (259)

Despite the best efforts to control weeds in crops fields, they manage to persist long-term due primarily to seed production and seedbank replenishment by uncontrolled weed escapes and by individuals that germinate and establish after crop harvest. Herbicide-resistant Palmer amaranth (*Amaranthus palmeri*) is a serious concern in cotton, with direct impact on production and profitability. The present study is centered around seedbank management as a key aspect of herbicide-resistant weed management, by exploring integrated management tactics implemented throughout the growing season. This multi-state study was conducted in 2020 and 2021 in Raleigh-North Carolina, Marianna-Arkansas, College Station-Texas, and Lubbock-Texas. The XtendFlex® cotton was planted in a Randomized Complete Block Design with four replications. A number of tactics were evaluated as part of management programs for their impact on minimizing Palmer amaranth population size over time. The treatments allowed for: evaluation of weed suppression with cereal rye as a cover crop, comparison of programs with and without the use of residual herbicides, testing the benefit of a dual-purpose harvest aid or early desiccant application, and the effectiveness of precision spot-spraying or hand weeding after the layby timing. A standard herbicide program was included for comparison in each location. Across the site-years, there were differences in cotton yield, with Marianna-Arkansas being the highest yielding location. Overall, treatments that contained residual PPI/PRE herbicides consistently yielded higher. The greatest amount of Palmer amaranth biomass was recorded in treatments that did not include a residual herbicide at PPI/PRE or MPOST timings irrespective of the location. Greater Palmer amaranth densities were recorded in Marianna-Arkansas and College Station-Texas compared to the other two locations, with 93,021 and 43,346 plants/ha respectively, in the treatment that didn't contain a residual herbicide at PPI/PRE or MPOST. Results so far demonstrate the value of integrating residual herbicides and targeting weed escapes in the late season in minimizing seedbank inputs. This is an ongoing experiment with two remaining years (8 site-years). We will continue to evaluate long-term influence of these treatments on Palmer amaranth population dynamics. Findings are expected to help develop regionally suitable integrated management programs for reducing Palmer amaranth infestations in the long run.

Response of Palmer Amaranth Accessions Across the U.S. to Dicamba and Glusofinate. LB Piveta*[1], JK Norsworthy[1], KW Bradley[2], KL Gage[3], DB Reynolds[4], LM Lazaro[5], L Steckel[6], BG Young[7]; [1]University of Arkansas, Fayetteville, AR, [2]University of Missouri, Columbia, MO, [3]Southern Illinois University Carbondale, Carbondale, IL, [4]Mississippi State University, Mississippi State, MS, [5]LSU Ag Center, Baton Rouge, LA, [6]University of Tennessee, Jackson, TN, [7]Purdue University, Brookston, IN (260)

Dicamba and glufosinate have been effective herbicides used for postemergence weed control in XtendFlex® technology. The occurrence of Palmer amaranth (*Amaranthus palmeri* S. Wats.) escapes in fields that rely on these tools demonstrate the importance of monitoring the emergence and spread of herbicide resistance. For that purpose, Palmer amaranth accessions were collected from fields in regions where auxins (dicamba or 2,4-D) and glufosinate are heavily relied upon for weed control. Collections occurred in the fall of 2018, 2019, and 2020 from fields located in Mississippi, Missouri, Nebraska, Illinois, Indiana, Louisiana, Tennessee, and Arkansas. Every state did not sample for Palmer amaranth each year. Both herbicides were applied at a 0.5 and 1X rate, which was 297 and 594 g ai/ha for glufosinate and 280 and 560 g ae/ha for dicamba to greenhouse-grown plants at the 5- to 6-leaf stage. Some accessions could not be thoroughly evaluated due to limited seed availability or lack of seed viability. For all samples reported, at least 100 plants were assessed. Thus far, the screening has evaluated 277 and 276 accessions to dicamba and 269 and 266 accessions to glufosinate at a 0.5 and 1X rate of each herbicide, respectively. Evaluations of the accessions showed a high variability of plant response to the herbicide treatments. Dicamba and glufosinate applied at a 0.5X rate resulted in less than 60% mortality to 37 and 63 accessions, respectively. Nevertheless, a full labeled (1X) rate of dicamba and glufosinate provided at least 80% mortality of 145 and 230 Palmer amaranth accessions, respectively. These results indicate that there are many fields where Palmer amaranth survival would be likely following a single application of either herbicide, especially considering that well-watered, succulent plants grown under greenhouse conditions were treated at a spray volume of 187 L/ha. Future experiments will be conducted to determine the mechanism for reduced susceptibility to these herbicides as well as alternative herbicides that can be used to control these troublesome accessions.

Comparison of Engenia/Liberty Tank-mixes and Sequential Application. CR White*, W Keeling, J Spradley; Texas A&M AgriLife Research, Lubbock, TX (261)

Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats) changed weed management strategies in the Texas High Plains and shifted back to tillage and residual herbicides. Palmer amaranth is the most troublesome weed in Texas cotton production. Dicamba-tolerant (XtendFlex) varieties are planted on the majority of cotton acres in the region. Dicamba (Engenia) is a very effective herbicide postemergence on Palmer amaranth. However, control of this troublesome weed with Liberty (glufosinate) is challenging due to the tough, dry growing conditions. These two herbicides may be used together to both delay resistance to dicamba as well as increase efficacy of glufosinate. Studies were established in Lubbock, Texas across a three-year period (2019-2021) to evaluate Palmer amaranth control comparing tank-mixes and sequential applications of Roundup (glyphosate), dicamba, and glufosinate. Applications were made using a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1} with TurboTeeJet 11002 nozzles for glufosinate treatments and TurboTeeJet Induction 11002 nozzles for dicamba treatments. In 2019, sequential applications of dicamba followed by (fb) dicamba and glufosinate fb dicamba provided more effective control of Palmer amaranth than glufosinate fb glufosinate or dicamba fb glufosinate. In 2020, less weed pressure was observed, and all sequential applications provided similar Palmer amaranth control. Greater weed pressure was observed in 2021, and any early postemergence dicamba treatment was not improved with the addition of glufosinate. Most effective control with sequential combinations was achieved with dicamba + glyphosate at the first application fb any tank-mix application, either dicamba + glyphosate, dicamba + glufosinate, or glufosinate + glyphosate. These results indicate that glufosinate can be more effectively used in XtendFlex cotton as a sequential treatment with dicamba and not as a tank-mix partner.

Acuron GT: Mesotrione Plus Bicyclopyrone for Enhanced Weed Control in GT Corn. BD Black*[1], RD Lins[2], M Saini[3], M Kitt[3]; [1]Syngenta Crop Protection, Searcy, AR, [2]Syngenta Crop Protection, Rochester, MN, [3]Syngenta Crop Protection, Greensboro, NC (262)

Bicyclopyrone and mesotrione are HPPD inhibiting herbicides developed by Syngenta for use in corn production. This presentation outlines some of the work that has been done to characterize and support the combination of these two active ingredients in products such as Acuron GT®.

Soybean Weed Control in Southeast Texas. M Matocha*; Texas AgriLife Extension Service, College Station, TX (263)

Weed management in soybeans has become more challenging in recent years due to the continued proliferation of herbicide resistant weeds. In 2020, Texas ranked far behind Mid-Western states in total bushels produced (#29th, 3.74 million bushels). Despite this ranking, if Texas soybean producers expect to continue growing soybeans then they must still have an effective weed control program in place to help in mitigation of herbicide resistance weeds. There are still some older soil residual products, such as (Dual Magnum, and others) that do a good job of pre-emergence control behind the planter. However, as is true with most transgenic crops today, it is always recommended that you always include a knock down, plus residual herbicide in the tank when making a postemergence application, in order to buy you some time for your crop to get ahead of any weeds. The scope of this talk will include some older chemistry that is still effective, some new technology, (XtendFlex Soybeans, 3 herbicide tolerant), and LibertyLink GT27 Soybeans. I will also discuss herbicides offered with the Enlist Soybean herbicide system. And lastly, older herbicide product offerings will also be mentioned as appropriate.

TENDOVO – Setting the Standard for Soybean Herbicides. JC Holloway Jr*; Syngenta Crop Protection, LLC, Jackson, TN (264)

TENDOVO™ is a new herbicide delivering broad-spectrum residual control of annual grasses and key broadleaf weeds in soybeans from Syngenta Crop Protection. TENDOVO contains *S*-metolachlor, metribuzin and cloransulam-methyl in a ratio that delivers robust rates of all three herbicides in a convenient premixture. In field testing, TENDOVO provides excellent crop safety across soil types and environments in all soybean growing regions of the country. This new herbicide premixture controls annual grasses and most small-seeded broadleaves like waterhemp (*Amaranthus rudis*) and Palmer amaranth (*Amaranthus palmeri*) as well as many key larger-seeded weeds including common and giant ragweed (*Ambrosia artemisiifolia* and *trifida*), morningglories (*Ipomoea* sp.) and velvetleaf (*Abutilon theophrasti*). TENDOVO can be used across all geographies, soil types and tillage systems, and is compatible with common burndown herbicides such as Gramoxone 3.0 SL, glyphosate, 2,4-D and dicamba. TENDOVO helps protect soybean yield by providing early season weed management and will provide an excellent preplant or pre-emergence product as the strong residual base for weed management programs regardless of soybean trait platform.

"Dicamba Is Done" the Evolution of Synthetic-Auxin Resistant Pigweed in Tennessee: an Extension Perspective. L Steckel*, DC Foster; University of Tennessee, Jackson, TN (265)

"Dicamba is done" has been the conclusion drawn by several Tennessee retailers after they have repeatedly witnessed disappointing Palmer amaranth (*Amaranthus palmeri* S. Wats) or waterhemp (*Amaranthus tuberculatus* (Moq) Sauer) control with multiple dicamba applications on clientele fields. Follow-up investigations in some of these fields from 2019 to 2021 from University of Tennessee Extension determined that in many cases, dicamba was applied to small (<10cm) pigweed suggesting that resistance could be the cause of poor control. Greenhouse research on selected populations conducted at Texas Tech University, Purdue University and the University of Tennessee suggested that the populations of Palmer amaranth and waterhemp were indeed resistant to dicamba. Field research in 4 of these sites in 2021 showed that only 40-60% of Palmer amaranth or waterhemp <10 cm tall were controlled using 0.56 kg dicamba ha^{-1} resulting in 40 to 70% survivors 21 days after application. Moreover, a 2x labeled rate of 1.12 kg ha^{-1} controlled only 46 to 65% of the pigweed populations. At one location in Lauderdale county, Tennessee, some Palmer amaranth survived an 8x labeled rate of dicamba (4.48 kg ha^{-1}). Finally, results from this research indicated that all Palmer amaranth populations tested that were resistant to dicamba were also resistant to 2,4-D. However, the dicamba resistant waterhemp was still controlled with 2,4-D. Growers, retailers and crop consultants have been increasingly concerned and continue to reach out to Extension requesting recommendations on how to best manage these newly evolved herbicide resistant pigweed populations. Results on management research suggest the best option is to integrate cultural practices like cover crops, tillage and hand weeding with overlapping residual herbicides thereby greatly limiting the number of pigweed that will need to be controlled POST emergence. The most consistent control of emerged synthetic-auxin herbicide resistant pigweed is either a tankmix of 2,4-D with glufosinate or an application of dicamba followed 7-10 days later with glufosinate.

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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