Proceedings of the Southern Weed Science Society 76th Annual Meeting

Renaissance Hotel
Baton Rouge, LA
January 23-26, 2023

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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.

2023 Awards

Outstanding Young Weed Scientist - Academia
Charles Cahoon, North Carolina State University

Charlie Cahoon is an Associate Professor and Extension Weed Specialist in the Crop and Soil Sciences Department at North Carolina State University. Charlie was born and raised in the blacklands of eastern North Carolina (Swan Quarter) where he worked on his family's row crop, vegetable, and hog farm. Charlie attended Mattamuskeet High School where he was an active member of FFA, 4-H, and lettered in baseball and football. He graduated Summa Cum Laude from North Carolina State University with a BS in Agronomy-Soil Science in 2011. While still an undergraduate, Charlie stumbled into a summer job working for the legendary Extension Weed Specialist, Dr. Alan York. Following that summer, Charlie knew he had found his calling and commenced his graduate education in Weed Science under the direction of Drs. York and David Jordan. He received his PhD in 2015 and later that year began his career as an Extension Weed Specialist at Virginia Tech. Based at the Eastern Shore AREC in Painter, Virginia, Charlie had sole responsibilities for weed management in cotton, peanuts, and vegetables and split grain responsibilities with Dr. Michael Flessner. In 2018, Charlie was fortunate to replace his mentor at North Carolina State University as the Extension Weed Specialist for corn and cotton. In addition to his extension and research duties, Charlie teaches a cross-listed undergraduate/graduate introductory Weed Science course and guest lectures in various other classes. Charlie has authored or co-authored 34 peer-reviewed papers, 39 peer-reviewed extension publications, and 74 meeting abstracts. He has mentored 7 MS and 1 PhD students and served as a committee member for 14 additional students.

Charlie has served on several Southern Weed Science Society, Northeastern Weed Science Society, and Weed Science Society of America committees. In service to the Southern Weed Science Society, Charlie serves annually as a judge or moderator for the graduate student oral contest. From 2017 to 2019, Charlie served on the Southern Weed Science Society Student Contest Committee that culminated as committee chair for the 2019 annual meeting in Oklahoma City. As chair of the committee, Charlie organized the 2019 Graduate Student Contest which included 72 participants and 45 judges across nine separate contest sections. He has also chaired the Outstanding Educator Subcommittee and has been a member of the Continuing Education Unit Committee. Additionally, Charlie currently serves as Vice President of the Weed Science Society of North Carolina and is an active member of the Crop Protection Association of NC, Farm Bureau Young Farmers & Ranchers, and the NC Association of County Agricultural Agents. Charlie is a Deacon at Wendell Baptist Church where he also serves on the Administrative Team, Security Team, and is a substitute Sunday school and Royal Ambassador teacher. In his spare time, he enjoys tinkering on his 1962 John Deere 1010 tractor, traveling, farming/gardening, hunting/fishing, reading, playing cards, cheering on the Wolfpack (and Hokies), and spending time with his wife, two children, and yellow lab.

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 nominations	--
2006	Todd A. Baughman	Texas A & M University
2006	John V. Altom	Valent USA Corporation
2007	Clifford "Trey" Koger	Mississippi State University
2007	No nominations	--
2008	Stanley Culpepper	University of Georgia
2008	No nominations	--
2009	Jason K. Norsworthy	University of Arkansas
2009	No nominations	--
2010	Bob Scott	University of Arkansas

2010	No nominations	--
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 nominations	--
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
2022	Michael Flessner	Virginia Tech
2022	Sandeep Rana	Bayer Crop Science

Outstanding Educator Award
Darrin Dodds, Mississippi Statet University

Darrin Dodds was born and raised in Illinois and received a B.S. degree in Agriculture from Western Illinois University in 1999; a M.S. degree in Agriculture and Life Sciences (Weed Science) at Purdue University in 2002; and Ph.D. in Agriculture and Life Sciences (Weed Science) at Mississippi State University in 2007.

Darrin joined the faculty at Mississippi State University in June 2007 as an Assistant Extension Professor/Extension Cotton Specialist. He was promoted to Associate Extension/Research Professor in 2013 and Extension/Research Professor in 2018. Dr. Dodds was appointed Head of the Department of Plant and Soil Sciences at Mississippi State University in April 2019.

Darrin has graduated 11 M.S. and 5 Ph.D. students and currently has 6 M.S. students and 5 Ph.D. students under his direction. He has served on an additional 32 graduate student committees. His current and former students have won over 58 oral or poster presentation awards. Darrin has authored or co-authored 79 referred manuscripts, 2 book chapters, 63 extension publications, and 300+ published abstracts. Grants and contracts as principal investigator or co-principal investigator total over $9.2 M.

Darrin has taught Herbicide Technology for the past three years at Mississippi State University which focuses on herbicide mode of action and calibration. He has previously taught Remote Sensing Seminar; Pesticide Screening; and Resistance Management at Mississippi State University.

Darrin serves annually as a student contest judge at the Beltwide Cotton Conference, the Southern Weed Science Society, the Weed Science Society of America. In addition, Darrin has served as student presentation contest committee chair or co-chair four times for the Southern Weed Science Society and three times for the Weed Science Society of America. He was the first chair of the WSSA student presentation contest and helped author the contest rules and scoresheet. Darrin has served as contest chair for the WSSA on two occasions for five years, and as a co-chair for three additional years. He has also served as the chairperson for the SWSS summer weed contest and is a past president of the Endowment Foundation for the SWSS. Darrin has served on the SWSS and WSSA board of directors as the SWSS representative to the WSSA as well as secretary on the WSSA board of directors. Darrin currently serves as President of the Southern Weed Science Society.

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	University of Arkansas
2018	Stanley Culpepper	University of Georgia
2019	Larry Steckel	University of Tennessee
2020	Stephen Enloe	University of Florida
2021	No nomination	--
2022	Ramon Leon	North Carolina State University

Outstanding Graduate Student Award (MS)
Tristen Avent, University of Arkansas

Tristen Heath Avent of Somerville, TN, graduated Summa Cum Laude from the University of Tennessee-Martin in 2019 with a bachelor's degree in agriculture. His master's research at the University of Arkansas evaluated a herbicide safener seed treatment to mitigate rice injury caused by acetochlor. He successfully defended his master's thesis, "Evaluation of Fenclorim Safener for Use in Rice with Group 15 Herbicides," and graduated in May 2022.

He is currently pursuing his Ph.D. under the direction of Dr. Jason Norsworthy. His Ph.D. research will focus on optimizing John Deere's Green-on-Green See and Spray technology, which will reduce herbicide inputs with precision applications of pesticides. While attending the U of A, he has placed in 9 of 10 speaking or poster contests at professional conferences. He has been awarded the Department of Crop, Soil, and Environmental Science's Outstanding M.S. Student Award and the Bumpers College Distinguished Scholar Masters Award.

Tristen has also been a member of the Southern Weed Science Society since 2020 and a member of the University of Arkansas weed team for the past two years placing 8th and 1st in the individual contest, respectively. To date, Tristen has submitted three articles for publication. Upon completing his Ph.D., he intends to return to academia or industry to conduct research and bring forward new technologies and recommendations for producers across the U.S.

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
2022	Delaney Foster	Texas Tech University

Outstanding Graduate Student Award (PhD)
Taylor Randell-Singleton, University of Georgia

Taylor was raised in Wellborn, FL, where her family grew vegetables, corn, hay, and cattle. As a fifth-generation agriculturalist, agriculture has always been and continues to be a huge part of her life. Growing up, Taylor was actively involved in all aspects of her family's farm, which helped develop her love of plants, and influenced her decision to study agriculture. She graduated from Abraham Baldwin Agricultural College in Tifton, GA with a B.S. in Agriculture in 2017, and continued to the University of Georgia, where she received her M.S. in Crop and Soil Science under the advisement of Dr. Stanley Culpep-per in 2019. Taylor began her Ph.D. program at the University of Georgia in 2020, continuing under the direction of Dr. Culpepper, where her dissertation research focuses on quantifying PPO-herbicide resistance in Palmer amaranth, vegetable tolerance to numerous herbicides, selection pressure following herbicide applications to Palmer amaranth in cotton, herbicide integration into cover crop use, and also involves cooperating with Regional U.S. Fish and Wildlife Services to map and protect endangered species in Georgia.

During her time at UGA, Taylor has authored or co-authored 12 peer-reviewed publications with 5 more expected from her dissertation research, and completed her Ph.D. coursework with a 4.0 GPA. Additionally, she has authored or co-authored 10 extension publications, 33 abstracts from scientific presentations, and has given 10 invited presentations and 7 extension talks. Taylor received the University of Georgia Gary A. Herzog Fellowship for Applied Research in Cotton Agroecosystems, which funded her Master's research from 2017-2019, and served as one of the WSSA Science Policy Fellows in 2022. She is a member of the Southern Weed Science Society, Weed Science Society of America, and Beltwide Cotton Conference, has received 13 awards for graduate student presentations, two scholarships, serves as a graduate student member on three WSSA committees, and has enjoyed participating in the graduate student organizations and weed team competitions. Taylor is grateful for the opportunity to participate in the SWSS, and for the opportunities it provides for graduate students to grow as 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
2022	Maria Zaccaro-Gruener	University of Arkansas

Fellow Award
Larry Steckel, University of Tennessee

Dr. Larry Steckel is currently a Professor in the Department of Plant Sciences at the University of Tennessee. Larry was raised on a small family farm near Carrollton, Illinois. He received his B.S. in Agronomy in 1987 from Western Illinois University and his M.S. in Weed Science from the University of Missouri in 1989. Larry then joined Pioneer Hi Bred Int'l. where he worked for 10 years as an Agronomist. He left Pioneer to pursue a Ph.D. in the spring of 2000 and received his doctorate in 2003 from the University of Illinois under the direction of Dr. Christy Sprague.

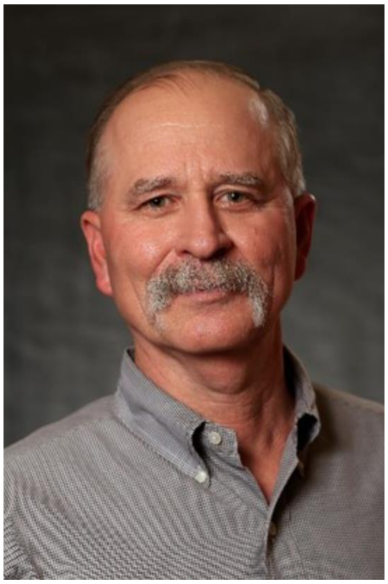
Larry joined the Department of Plant Sciences at the University of Tennessee in 2003 where he holds a weed science extension (75%) and research (25%) appointment. Dr. Steckel maintains an extensive applied research program in row crops that focuses on the biology and management of three troublesome multiple herbicide-resistant weeds, Palmer amaranth, junglerice, and horseweed. These three weeds cause Tennessee growers the most management challenges and is where the majority of his program efforts are directed.

His research program has been recognized by numerous awards including the National Conservation System Cotton and Rice Conference with the Conservation System Cotton Researcher of the Year award, the University of Tennessee Ag Research Impact award, the Award of Excellence – Outstanding Paper award in 2017 and 2018 for manuscripts in Weed Technology as well as the Superior Paper Award for a manuscript in the American Society of Agriculture and Biological Engineers in 2018. He has authored or co-authored over 100 refereed journal articles and has been the associate editor of over 90 Weed Technology journal articles.

Larry considers it a great honor to have mentored three Master's Students and six Ph.D. students to completion of their degrees. Seeing these students develop has been one of the two most rewarding aspects of his career. He is very proud of the many accomplishments of his former grad students and believes this group of young pest management scientists is having, and will continue to have, very positive impacts on advancing agriculture as their careers mature.

The other most rewarding aspect of Larry's career has been helping farmers, consultants and county agents navigate challenging weed management problems. He enjoys talking with these folks whether in the field, at Extension meetings, or over the phone. Larry's Extension program has been recognized by the WSSA Extension Award in 2015 and more recently by the SWSS 2019 Outstanding Educator Award and by the SWSS 2021 Excellence in Regulatory Stewardship Award. It's very satisfying when a solution to a grower problem can be found, and he feels that it's an honor to be a part of this process.

Fellow Award
Gary Schwarzlose, Bayer CropScience



Gary Schwarzlose, a Texan by birth, is a Principal Field Agronomist with Bayer Research and Development. He received his B.S. in Agronomy (1983) and his Master's of Ag in Agricultural Chemistry (1984), both from Texas A&M University.

Following graduation, Gary and his family moved to Leland, MS to work at the American Hoechst research farm. During his 38+ years in the industry, he has worked for Stauffer Chemical, American Hoechst, Hoechst-Roussel Agri-Vet, AgrEvo, Aventis, and Bayer CropScience. His job responsibilities have included Assistant Research Biologist, Herbicide Specialist, Field Development Rep, Technical Service Rep, Sales Rep, Principal Scientist, and now Principal Field Agronomist. His territories have included states from New Mexico to Alabama. In 1992, he moved back to Texas and is there to stay.

His current job responsibilities are to evaluate early-phase product chemistry in various cropping systems throughout his territory. Trial disciplines include herbicide, insecticide, fungicide, and seed growth products. He is frequently involved with the evaluation and improvement of Bayer CropScience Field Solutions' business activities. He helps develop, evaluate, and maintain upcoming hardware and software as it relates to current and future business models. Gary serves as the North America lead for a Bayer CropScience team which evaluates new software and trains users on the use of these programs for trial and data management.

He is a Past-President of both the Texas Plant Protection Association (TPPA) and the American Peanut Research and Education Society (APRES).

Gary has been an active member of the Southern Weed Science Society and the Weed Science Society of America, serving on numerous committees in both societies over the years. In the Southern Weed Science Society (SWSS) in addition to his SWSS Board of Director's responsibilities, he has chaired the Local Arrangements Committee, the Site Selection Committee, and the SWSS Endowment Foundation Committee.

Gary has received several awards, including being named a 2021 APRES Fellow and a 2021 Special Achievement Award from the West Texas Agricultural Institutes. He was recognized by the TPPA with an Industry Award, the Ray Smith Leadership Award, and the 2022 TPPA Norman Borlaug Lifetime Achievement Award.

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 nominations	--
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 nominations	--
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 nominations	--
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 nominations	--
2010	Jacquelyn "Jackie" Driver	Syngenta Crop Protection
2011	No nominations	--
2011	No nominations	--
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 Univsity
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
2022	Peter Dotray	Texas Tech University
2022	Henry McLean	University of Georgia

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
1949-50	E.C. Tullis
1950-51	O.E. Sell
1951-52	G.M. Shear
1952-53	D.A. Hinkle
1953-54	W.B. Ennis, Jr.
1954-55	W.C. Shaw
1955-56	G.C. Klingman
1956-57	W.B. Albert
1957-58	E.G. Rogers
1958-59	R. Behrens
1959-60	V.S. Searcy
1960-61	R.A. Darrow
1961-62	W.K. Porter, Jr.
1962-63	J.T. Holstun, Jr.
1963-64	R.F. Richards
1964-65	R.E. Frans
1965-66	D.E. Wolf
1966-67	D.E. Davis
1967-68	R.A. Mann
1968-69	W.L. Lett, Jr.
1969-70	J.B. Baker
1970-71	D.D. Boatright
1971-72	J.R. Orsenigo
1972-73	T.J. Hernandez
1973-74	A.F. Wiese
1974-75	W.G. Westmoreland
1975-76	P.W. Santlemann
1976-77	A.J. Becon
1977-78	G.A. Buchanan
1978-79	C.G. Parris
1979-80	M.G. Merkle
1981-82	J.B. Weber
1982-83	J.E. Gallagher
1983-84	C.G. McWhorter
1984-85	W.S. McIntire
1985-86	R.E. Talbert
1986-87	H.M. LeBaron
1987-88	R.L. Rogers
1988-89	L.B. Gillham
1989-90	L.R. Oliver
1990-91	J.R. Bone
1991-92	J.M. Chandler
1992-93	J.L. Barrentine
1993-94	A.D. Worsham
1994-95	P.A. Banks
1995-96	S.O. Duke
1996-97	B.D. Sims
1997-98	R.M. Hayes
1998-99	R.L. Ratliff
1999-00	D.S. Murray
2000-01	L.L. Whatley
2001-02	J.E. Street
2002-03	J.W. Wells
2003-04	W.W. Witt
2004-05	J.S. Harden
2005-06	D.R. Shaw
2006-07	J.A. Driver
2007-08	D.W. Monks
2008-09	A.M. Thurston
2009-10	D.B. Reynolds
2010-11	T.J. Holt
2011-12	B.J. Brecke
2011-12	2012-13
2014-15	S.A. Senseman
2015-16	B. Minton
2016-17	P. Dotray
2017-18	G. Schwarzlose
2018-19	B. Scott
2019-20	James Holloway
2020-21	Eric Webster
2021-22	Cletus Youmans
2022-23	Darrin Dodds

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	Ted 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, 2023 - January 31, 2024

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

100. SOUTHERN WEED SCIENCE SOCIETY OFFICERS AND EXECUTIVE BOARD

100a. OFFICERS

President	Eric Castner	2024
President Elect	Todd Baughman	2024
Vice-President	Eric Palmer	2024
Secretary-Treasurer	Hunter Perry	2023-2025
Editor (Proceedings)	Paul Tseng	2023-2025
Immediate Past-President	Darrin Dodds	2024

100b. ADDITIONAL EXECUTIVE BOARD MEMBERS

Member-at-Large - Academia	Michael Flessner	2022-2024
Member-at-Large - Industry	Pete Eure	2022-2024
Member-at-Large - Academia	Charlie Cahoon	2023-2025
Member-at-Large- Industry	Adam Hixson	2023-2025
Representative to WSSA	Pete Dotray	2023-2025

100c. EX-OFFICIO BOARD MEMBERS

Constitution and Operating Procedures	Carroll Johnson	2022-2024
SWSS Business Manager	Kelley Mazur	2021-2024
Student Representative	Mason Castner	2023-2024
Newsletter Editor	Tommy Butts	2022-2024

101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

President	Greg McDonald	2019-2024
Secretary	Jason Bond	2020-2025
	Sandeep Rana	2021-2026
	Lauren Lazaro	2022-2027
	Spencer Samuelson	2023-2028
Graduate Student Rep	Pamela Carvalho-Moore	2023-2024

101b. BOARD OF TRUSTEES - EX-OFFICIO

Gary Schwarzlose	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.

Darrin Dodds*	2024	Eric Prostko	2024	Nathan Boyd	2024
Henry McLean	2024	Matthew Wiggins	2024	Garrett Montgomery	2024

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

Henry McLean*	2024	Eric Prostko	2025	Gary Schwarzlose	2026
David Jordon	2024	Peter Dotray	2025	Larry Steckel	2026

102b. Outstanding Educator Award Subcommittee

Eric Prostko*	2024	Tim Grey	2025	Darrin Dodds	2026
Peter Dotray	2024	Larry Steckel	2025	Ramon Leon	2026

102c. Outstanding Young Weed Scientist Award Subcommittee

Matthew Wiggins*	2024	Sandeep Rana	2025	Charlie Cahoon	2026
Greg Stapleton	2024	Jim Brosnan	2025	Spencer Samuelson	2026

102d. Outstanding Graduate Student Award Subcommittee

Nathan Boyd*	2024	John Buol	2025	Nic Basinger	2026
Jim Heiser	2024	John Brewer	2025	Luis Avila	2026

102e. Excellence in Regulatory Stewardship Award Subcommittee

Garrett Montgomery*	2024	Joey Williams	2025	Matt Goddard	2026
Sanjeev Bangarwa	2024	Frances Meeks	2025	Dan Reynolds	2026

103. COMPUTER APPLICATION COMMITTEE

Shawn Askew*	2024	Tommy Butts	2025	Gary Schwarzlose	2026
Cade Hayden	2024	Sarah Kezar	2025	Hannah Wright-Smith	2026
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.

Eric Palmer* (VP)	2024
Todd Baughman (Pres. Elect)	2024
Hunter Perry (Sec-Treas.)	2024
Tim Adcock (Sustaining Mem.)	2024
Gary Schwarzlose	2024
Cletus Youmans	2024
Paul Tseng (ex-officio)	2024
Kelley Mazur – SWSS Business Manager	

106. GRADUATE STUDENT ORGANIZATION

President	Mason Castner	2024
Vice President	Navdeep Godara	2024
Secretary	Annu Kumari	2024
Weed Resistance & Technology Comm.	Jake Patterson	2024
Endowment Committee	Pamela Carvalho-	2024
Social Chair/Student Program Committee	Megan Mills	2024
Student Program Committee	Kayla Broster	2024

107. WEED RESISTANCE AND TECHNOLOGY STEWARDSHIP (STANDING)

Alabama	Steven Li		North Carolina	Charlie Cahoon

Arkansas	Jason Norsworthy		Oklahoma	Todd Baughman
Florida	Pratap Devkota		South Carolina	Matthew Cutulle
Georgia	Eric Prostko		Tennessee	Larry Steckel
Kentucky	Travis Legleiter		Texas	Pete Dotray
Louisiana	Daniel Stephenson		Virginia	Michael Flessner*
Mississippi	Luis Avila		Puerto Rico	Wilfredo Robles
Missouri	Jim Heiser		Grad. Student Rep	Jake Patterson

108. HISTORICAL COMMITTEE (STANDING)

Tom Mueller*	2024
David Russell	2025
Carroll Johnson	2026

109. LEGISLATIVE AND REGULATORY COMMITTEE (STANDING)

Eric Palmer*	Chair & Vice-President	2024
Lee Van Wychen	(ad hoc) WSSA Science Policy Executive Director	2024
Janice MacFarland	(ad hoc) Chair of the WSSA Science Policy Comm.	2025
Mark VanGessel	(ad hoc), EPA liaison	2025
Michael Flessner	Member-at-Large - Academia	2024
Pete Eure	Member-at-Large - Industry	2024
Charlie Cahoon	Member-at-Large - Academia	2025
Adam Hixson	Member-at-Large - Industry	2025

110. LOCAL ARRANGEMENTS COMMITTEE - (STANDING)

Luke Etheredge*	2024	San Antonio, TX
Matthew Cutelle	2025	Charleston, SC
TBD	2026	TBD

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

Clete Youmans (Chair-Elect) *	2024
Darrin Dodds	2025
Eric Castner	2026
Todd Baughman	2027

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.

Jim Brosnan (SE) *	2024	Stanley Culpepper (SE)	2026	Kelly Backscheider	2028
Ben McKnight (SW)	2025	Michael Flessner (SE)	2027	Darrin Dodds (MS)	2029
Kelley Mazur – SWSS Business Manager					

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

Darrin Dodds*	2024

114. PROGRAM COMMITTEE – 2024 MEETING (STANDING)

Todd Baughman*	2024
Eric Palmer	2025
TBD	2026

115. RESEARCH COMMITTEE (STANDING)

Eric Palmer*	2024			
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)

Ryan Edwards*	2024	Joey Williams	2025	David Russell	2026

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

Mississippi	T. Bararpour		Missouri	J. Heiser

Alabama	S. Li		North Carolina	W. Everman
Arkansas	N. Burgos		Oklahoma	T. Baughman
Florida	G. MacDonald		South Carolina	M. Cutulle
Georgia	N. Basinger		Tennessee	T. Mueller M. Wiggins*
Kentucky	T. Legleiter		Texas	P. Dotray
Louisiana	C. Webster		Virginia	S. Askew
Ad Hoc - Current	B. Kirksey		Puerto Rico	W. Robles

119. STUDENT PROGRAM COMMITTEE (STANDING)

Pratap Devkota*	2024	
Spencer Samelson	2025	
Hannah Wright-Smith	2026	
Kayla Broster	2024	Graduate Student Organization Rep. – Ex-officio member

120. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

Tim Adcock*	2024	Kelly Backsheider	2025	Eric Castner	2026
Scott Nolte	2024	Ray Kelley	2025	Joey Williams	2026
Michael Flessner	2024	James Holloway	2025	Cletus Youmans	2026

121. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

AL - Steve Li	2024		MO – Jim Heiser	2024
AR - Tom Barber	2024		NC – Angela Post	2024
FL - Calvin Odero	2024		OK - Todd Baughman**	2024
GA – Nic Basinger	2024		SC - Alan Estes	2024
KY – Travis Legleiter	2024		TN – Bruce Kirksey*	2024
LA – Daniel Stephenson	2024		TX - Jacob Reed	2024
MS -Te-Ming Paul Tseng	2024		VA – Shawn Askew**	2024

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

SWSS Board of Directors Meeting Minutes

Sunday, January 22, 2023
Renaissance Hotel; Baton Rouge, LA
Kullman Boardroom
3:30 PM – 5:30 PM

Attendees: Darrin Dodds, Eric Castner, Hunter Perry, John Byrd, Kelley Mazur, Tom Barber, Clete Youmans, Mike Lovelace, Connor Webster, Todd Baughman, Tommy Butts, Carroll Johnson, Lee Van Wychen, Pete Dotray, Pete Eure, Michael Flessner, Sara Kezar

Call to Order: Darrin Dodds 3:31 pm.

Program Update (Eric Castner):
Biggest challenge will be the size of the property. Salon 1 will be posters for the week. Poster boards will arrive at 9:00 am, Monday. Some flipping rooms, but everything should be fine. There may be some small adjustments on the fly. Registrants are slightly down from 2022. 220 on talks (265 in 2022). 95 on posters (~120 in 2022). Numbers may be attributed to WSSA the following week and "potentially" location. Talks will be ready to go (currently being downloaded by Eric). Todd will lead of the ESA discussion on Monday. Randy Rush from EPA will be in to address ESA from a different perspective. Boatright, Smith and Culpepper will also discuss their perspectives on ESA followed by Q&A. Lee will follow up that discussion with his update followed by
In 2024 (joint meeting), money allocations, contracts and student contests are a few items that will need to be arranged/discussed. A significant amount of discussion around the student contests at the joint meeting and how things have been arranged historically…..the board tossed around thoughts on how the contests may go in 2024. A joint board meeting will be held this summer, so that can be where we finalize how we move forward with the contests.

Local Arrangements (Connor Webster):
Only one room will not be theatre style for the meeting due to the room being used for tables. Connor is utilizing his graduate student team for basic needs. Poster boards came through a company in New Orleans ($3080). Poster Boards are being pulled out Wednesday at 10:00 am. AV ($8200) price was cut down slightly by using LSU computer/ projectors / clickers compared to $12,000+ in Austin. Only support packages and a technician are being utilized from the hotel. Screens will be 10' in talks. During the larger meetings, two screens and a stage will be utilized. Top Golf should be around 100 participants. Support is around $7K for the Top Golf event. Consensus is still very positive. Sarah recommends gauging interest with GSO after this meeting to determine if students still want to continue or change it up. We do not have a WiFi meeting package, so will need to use basic guest internet. Wednesday morning will have a room change. Grad students will be recorded during the contest and links for each speech will be sent to each student.

Awards Committee (Clete Youmans):

Awards event (1.5 hr in length). Scheduled for 12:30 Wednesday. Plated lunch during event. Clete will give a short presentation about awards. Goal is to break 10-15 minutes before next paper slot.
Outstanding Educator Award – Darrin Dodds
Outstanding Young Scientist (Academia) – Charlie Cahoon
Outstanding Young Weed Scientist (Industry) – no nominations
Outstanding Graduate Student – Tristen Avent (M.S.); Taylor Randall (Ph.D.)
Regulatory Stewardship Award – No nominations. Discussion around the difficulty to get nominees/winners due to the complex requirements for the award. Question was asked whether or not we change the MOP. Once committee spots are set, Darrin (2023 Chair) will "shake the tree" on awards.

Business Manager Update (Kelley Mazur):
241 pre-registrations as of morning, 89 students, 136 regular members, 10 fellows (9 active), 2 single day registrations, 1 press, 5 sustaining members with complimentary registration. Kelley doesn't have numbers, but some membership renewals w/o attendance did happen this year. After this meeting, the website will be overhauled…..Timeline for completion should be April. $7800 collected for the Top Golf event. Current attendees – 63 students and 30 non-students. We met our minimum (80%) rooms so no fees will hit the society. Typically, we have 25-30 walk-in registrations.
Currently, registration fees collected total $74,500. Doesn't include any meeting support. Compared to Austin ($91,000 which includes all meeting support). Total expenses from last year were just under $90K. Anticipated expenses for 2023 is around $75K.
The mobile app is connecting to Kelley's personal email, so she is hoping to have that corrected by tonight. Character limits in titles and other issues plague the app. This is the last meeting under the contract, so a new app will need to be identified to get around some of the issues.

Endowment Update (Mike Lovelace):
Mike has created a timeline of activities of the Endowment Board. He and Gary S. will get together this week to finalize the timeline. Endowment Foundation paid $2200 towards the Top Golf event. Spencer Samuelson was elected to the Endowment Board this past summer. Carroll recommends the Endowment write a column for the newsletter to break down what it does in relation to the SWSS organization as a "fundraising" effort. Todd recommends establishing a goal for annual contributions to the Endowment. Mason Castner, Eli Russell and John Peppers (13 applicants) were the 3 winners of the Endowment Enrichment Scholarship. Silent Auction items are in question. Next year (2024) joint meeting should be a good Silent Auction….we really need to bring in big money items

Washington D.C. Update (Lee Van Wychen):
A good year on the appropriations side. On the aquatics side $6M. Another 0.5M for IR4. House republicans are talking about moving appropriations back to 2022 numbers.
Note: a significant amount was discussed and can be found in Lee's formal report to the board.

Old Business (Darrin Dodds):
No old business topics
New Business (Darrin Dodds):

Do minutes need to be archived on the website? Need to develop a system of secure storage (i.e., in case of website issues).
Pete Dotray is good to go on the quiz bowl.

Adjourn: Todd Baughman motions to adjourn, Darrin seconded.

SWSS Board of Directors Meeting Minutes

Monday, January 23, 2023
Renaissance Hotel; Baton Rouge, LA
Cocodrie Boardroom
7:00 – 9:45 AM

Attendees: Darrin Dodds, Eric Castner, Connor Webster, Sara Kezar, Carroll Johnson, Clete Youmans, Pete Eure, Michael Flessner, Kelley Mazur, Tommy Butts, Tom Barber, Hunter Perry, Todd Baughman, Pete Dittmar

Call to order: Darrin Dodds 11:05 AM

Eric Castner: No major hang ups at this point. ESA session seems to be in good shape. If there is dead space during the Q&A, Eric asks BOD to help get it going.

Connor Webster: Local arrangements is in good shape. No area reserved for practices, dry runs.

Sara Kezar: GSO in good shape. Mason did a great job of finding speakers (free of charge). Last year in Austin, during the GSO student luncheon, the group decided to pass the social chair position. At the business luncheon, we will "officially" approve the social chair position and it will be approved by the BOD at the summer board meeting. It could be approved Thursday.

Peter Dotray: Quiz Bowl will be ready by the event. Connor will get the WiFi going!

Darrin Dodds: For 2026, site selection committee put forward Nashville as first choice, Ashville, N.C. second, Chattanooga third and Lexington fourth. Due to MLK day, committee is thinking to move to the week of January 26th. The 2027 meeting was discussed "some". It would be in the SW portion of the region, so need to be thinking about potential sites.

Clete brought up the National Weed Contest and how teams outside of the SWSS would pay to participate. General discussion around how many teams may participate, rules, contributions/funding, etc. Darrin recommends Garrett and the contest chair (Matthew Wiggins) have some room to operate since he is the one hosting and SWSS reps are putting in the work. Drew Ellis has lined up potential sites for the next few years (TN, VT fb Tom Eubank/Nutrien at Winterville, MS).

Hunter motions to adjorn and Tom seconded.

SWSS Board of Directors Meeting Minutes

Thursday, January 26, 2023
Renaissance Hotel; Baton Rouge, LA
Cocodrie Boardroom
7:00 – 9:45 AM

Attendees: Eric Castner, Darrin Dodds, Hunter Perry, Eric Palmer, Kelley Mazur, Lee Van Wychen, Michael Flessner, Paul Tseng, Taghi Bararpour, Peter Eure, Charlie Cahoon, Peter Dotray, Mason Castner, Luke Etheridge, Adam Hixon, Todd Baughman, Tommy Butts, Carroll Johnson, Clete Youmans, Matthew Wiggins

Call to Order: 7:15 am Eric Castner. Todd motions to approve agenda, Eric Palmer seconded Introductions of new board members and sitting members: Eric Palmer (VP), Charlie Cahoon (Member at Large academia), Adam Hixon (Member at large Industry), Mason Castner (GSO incoming president)

Hunter motions to approve notes from previous board meetings, Peter Dotray approves.

Matthew Wiggins provides an update on the contests. Multiple students withdrew from the contest without prior notification. Multiple students signed up for both the paper and poster contests which is not allowed (Need to discuss with David to adjust website to fix the issue). Two bullet points need to be added to the submission site as well (1. You cannot enter a contest in which you won the previous year and 2). You cannot enter both the paper and poster contest).

Darrin suggests potentially moving up the submission deadline by a week to provide contests chairs time to sort and fix issues. Several judges mentioned updating the score sheets to improve clarity. Last updates came around 2014. Suggestion put forward to potentially add a "single slide thesis" type of setup to simulate a grower facing presentation. Matthew had 48 judges with an alternate.

Matthew makes a motion to amend MOP to require 4 minimum judges per section; Tommy Butts seconded the motion.
Matthew brought up the topic of how to handle contest in San Antonio with the joint meeting with WSSA. Darrin indicated in the joint meeting with NEWSS, they didn't allow students to enter the NEWSS contest and the WSSA contest.

Eric was pleased with the recording of the presentations. After discussing with several students, Eric got the feeling students were excited about that opportunity.
The electronic version for tallying scores was very convenient for contest chairs. Feedback historically has been judges like it.

Pete Dotray asks if the "no shows" will be removed from the proceedings so they do not receive credit for presenting. Matthew shared a list with Darrin of no shows.
General discussion about how we handled proceedings and contests at the previous joint meeting.

National Weed Contest Discussion
Travel on the 25th, contest on the 26th, travel home 27th. In February, information will be sent out regarding the competition. Potential deadline set for March to determine how many teams each school will bring. Need to start getting a baseline set of how many approximate folks are attending. Potential deadline for July 1 to know exactly who is coming, so details can be finalized. There is an MOP for the National contest…..it is vague and different from our contest. Weed and herbicide lists are more extensive. Each student can only participate in one farmer problem and the top 12 are brought in to compete in a second problem. The BOD had significant discussion around different ways the farmer problem can be conducted. Matthew and the contest committee proposed shortening the list of weeds from 131 to 100 and a list of 35 herbicides to 25 herbicides.

Committee Report Compilation

76th Annual Meeting of the SWSS
January 22-26, 2023

2023 SWSS Endowment Board Committee Report
Submitted by Michael Lovelace, Secretary

Attending – Mike Lovelace, Jason Bond, Scott Nolte, Spencer Samuelson, Gary Schwarzlose, Lauren Lazaro, Pamela Carvalho-Moore

Greg MacDonald, Sandeep Rana not in attendance

Introductions were made.

Kelly Mazur Update on Financials: Paid $1500 toward grad student night out. Total current assets: ~$350,000

Top Golf – Very positive experience. $9,300 total cost and 7,800 in donations. A tremendous success! Last night, Just over 100 attendees for second year in a row. Top Golf seems to be a great venue for the objectives of the event. Great interaction and opportunities to interact with people you may not meet otherwise. Discussions about alternatives for 2024 in San Antonio. The city has two Top Golf facilities. The board will continue to evaluate opportunities through this year. Next year's meeting could be big for the graduate student mixer since it is joint meeting with WSSA. Pamela will survey students to get an estimate for attendance for 2025.

The endowment scholarship will continue. There were 14 applicants this past year with three winners. Mason Castner, Eli Russell, John Peppers were the winners.

Need to put together a list for the Endowment Board 2024 elections. Send names to Mike. This year is an academia year. Carol Johnson offered direction on modifying SOP for the endowment board. Mike recommends and board agrees to ask Carol to update SOP to alternating academia and industry.

Silent Auction – Need to discuss ways to streamline the process and improve the quality of the silent auction. There was discussion about the possibility of a live auction to complement the silent auction. Silent Auction Ends Wednesday at 1:00pm.

Mike mentioned an idea by Carol Johnson that proposed to write a letter for the newsletter describing the SWSS Endowment Foundation and the things they support. Suggested the idea of running a campaign for fundraising with fundraising goals.

Additional discussion related to communication improving lines of communication via social media vs. email.

New business: Mike proposed compiling a list of responsibilities and timeline for the endowment board chair deliverables.

Motion to adjourn: Jason
Second: Everybody

Adjourned

Weed Resistance and Technology Stewardship Committee 2023 Report

The committee met on Monday January 23, 2023 8:00 to 9:00am.
Committee Members: Underline font were present, *italics* were not present with notification, regular font were not present without notification.
Alabama Steve Li, North Carolina, Arkansas Jason Norsworthy, *Oklahoma Todd Baughman*, Florida Pratap Devkota, South Carolina Matt Cutulle, Georgia Eric Prostko, Kayla Eason, Tennessee Larry Steckel, Anthony Mills, Kentucky Travis Legleigter, Texas Peter Dotray, Louisiana Daniel Stephenson, Virginia Michael Flessner, *Mississippi Luis Avila*, Puerto Rico W. Robles, Missouri J. Heiser**,** Graduate Student Rep. Juliana Souzar
Others present: Zachary Taylor (TX A&M), Hunter Perry (Coretva), Drew Ellis (Corteva), Tom Eubank (Nutrien Ag Solutions), Nick Basinger (Univ. of Georgia), various graduate students

1. **Review committee charge from SWSS MOP:** http://www.swss.ws/wp-content/uploads/SWSS-MOP-2022-complete.pdf
2. **Allied committees and other groups working on addressing herbicide resistance.**
   - WSSA committees
     1. 4.9 Herbicide Resistant Plants Committee
     2. 4.10 Herbicide Resistance Education
   - Take Action On Weeds: https://iwilltakeaction.com/weeds
   - GROW: https://growiwm.org/
   - PNW Herbicide Resistance Initiative
3. **New herbicide resistant cases in 2022:**

Table 1. New cases of herbicide resistant weeds in 2022.

State	**Weed**	**Herbicide**	**Group #**	**Location**	**Status**
Alabama					
Arkansas	Palmer amaranth	2,4-D	4	localized	confirmed
	Palmer amaranth	florpyrauxifen benzyl	4	localized	confirmed
	barnyardgrass	propanil		expanding	confirmed previously
	weedy rice	Provisia	1		confirmed
Florida					
Georgia	yellow nutsedge	ALS (Cadre)	2	isolated (1 or 2 fields)	previously confirmed
	Palmer amaranth	PPO	14	localized	confirmed
Kentucky	Italian ryegrass	glyphosate	9	expanding	previously confirmed

	Italian ryegrass		1	expanding	previously confirmed
	Johnsongrass	ALS	2	expanding	previously confirmed
Louisiana	weedy rice	Provisia	1	expanding.becoming widespread	previously confirmed
	Johnsongrass	glyphosate	9	expanding	previously confirmed
Missouri	Palmer amaranth	glufosinate	10	multiple locations	confirmed
	Italian ryegrass	glyphosate	9	widespread	suspected
Mississippi	*no report*				
North Carolina	waterhemp	multiple	2 + 5 + 9 + 14 + 27	localized	confirmed
	common ragweed	multiple	2 + 9 + 14	localized	confirmed
	Palmer amaranth	glufosinate	10	localized	confirmed
	Redroot pigweed	ALS + PPO	2 + 14	localized	confirmed
	Italian ryegrass	paraquat	22	localized	confirmed
Oklahoma	*no report*				
Puerto Rico	*no report*				
South Carolina	Italian ryegrass	glyphosate	9	expanding	previously confirmed
Tennessee					
Texas	Kochia	gly, atrazine, dicamba, ALS, fluroxypyr	9, 5, 4, 2, 4		previously confirmed
	Johnsongrass	glyphosate	9		
	Johnsongrass	sulfosulfuron			previously confirmed
	Palmer amaranth	dicamba	4		confirmed
	others				previously confirmed
Virginia	Redroot pigweed	ALS + PPO	2 + 14	SE VA, localized	suspected

Other comments: Glyphosate is not as effective as previously for barnyardgrass in Arkansas and Louisiana; not full-fledged resistance yet, but declining in herbicidal activity. Mississippi- poor control of grasses in general, especially Johnsongrass, which has expanding areas of glyphosate resistance. Population of Palmer amaranth being investigated in Georgia for group 15 resistance.

Table 2. New cases of herbicide resistant weeds in **2021**.

State	**Weed**	**Herbicide**	**Group #**	**Location**	**Status**
Alabama	goosegrass	paraquat	22		New

	Annual grasses		3		increasing
	Palmer amaranth	dicamba	4	isolated	New
	Palmer amaranth	glufosinate	10	isolated	New
Arkansas	Palmer amaranth	glufosinate	10	multiple	New
Florida	yellow nutsedge	imazapic	2	isolated	Suspected
Georgia	Palmer amaranth	PPOs (pre and post)	14	isolated	New
Kentucky	Italian ryegrass	Pinoxaden	1		Increasing
	Italian ryegrass	Glyphosate	9		Increasing
Louisiana	*no reports*				
Missouri	Palmer amaranth	dicamba	4		Suspected
	Palmer amaranth	glufosinate	10		Suspected
	Palmer amaranth	2,4-D	4		Suspected
	Palmer amaranth	Dicamba + glufosinate	4 + 10		Suspected
Mississippi	Smooth crabgrass	quinclorac	4/22	isolated	New
	Annual bluegrass	PSII inhibitors, pronamide, ALS-inhibitors	(5/6/7) + 3 + 2	widespread	New
	Palmer amaranth	Dicamba	4		Suspected
North Carolina	*no reports*				
Oklahoma	*no reports*				
Puerto Rico	*no reports*				
South Carolina	*no reports*				
Tennessee	*no reports*				
Texas	ragweed parthenium (false ragweed)	paraquat	22		new
	kochia	glyphosate	9	high plains	new
Virginia	buckhorn plantain	dicamba and triclopyr	4	isolated	new

4. Herbicide Resistance Technologies.

- Stewardship of new technologies is just not happening. For example, Provisia rice suggests that Provisia is not planted in the same field in consecutive years, but this has not been enforced. Clearfield rice is the same story.

5. Solutions?

- Carrot vs the stick.
    1. Carrot
        1. The carrot has not been working.
        2. Have we really tried it?
            1. The Roundup Ready reward program did work to incentivize the use of soil-applied residual herbicides.
                1. This could be a model to be used in other crops such as rice
            2. NRCS incentives are likely not feasible due to
                1. lack of expertise/tools to evaluate herbicide and weed management best practices
                2. only a portion of most farms can be incentivized, which doesn't work. For example, a farmer can get 100 acres incentivized but might farm 8,000
    2. Stick
        1. Regulatory environment is going to continue to tighten. This might be a stick that can be used. For example, "If a farmer continues to do what we're doing, regulatory bodies might take tools away."
        2. Need true enforcement (the stick).
- There will always be good actors and bad actors. Some farmers are changing and adopting best practices but many are not.
- Peer pressure among growers can work.
- Large farms simplify management by treating all fields alike.
- Lack of labor isn't helping, both on-farm and in government offices.
- Herbicide labels are getting longer/more complicated, possibly playing a role.
    1. makes enforcement even more difficult.

6. Other Business

- New Committee Chair- Drew Ellis
- Vice Chair/Secretary- Hunter Bowman

Sustaining Membership Committee

Submitted by Luke Etheridge

At the annual meeting we discussed and verified that the MOP has been updated with language around different levels of Sustaining Members, i.e. Platinum, Gold, Silver, Bronze.

Sustaining Membership was relatively flat year over year.

Still identified some "low hanging fruit" out there that has not paid. New chair (Dr. Scott Nolte) along with myself will work on updating the Sustaining Member spreadsheet and make sure that we reach out to these members that have lapsed.

We need to make sure that Sustaining Member Chair is invited to the Summer Board meeting in 2023 for the 2024 annual meeting and gives an update on Sustaining member dues mid-summer after the first round of letters are sent out.

New Committee members:
Dr. Scott Nolte (Chair)
Luke Etheredge
James Holloway
Michael Flessner
Tim Adcock
Kelly Backscheider
Charlie Cahoon
Matt Goddard
Tameka Sanders

Science Policy Report
December 21, 2022
SWSS Annual Meeting – Baton Rouge, LA
Lee Van Wychen

Science Policy Fellows

Anita Dille, Janis McFarland and I reviewed and selected two Science Policy Fellows for 2022-2023. **Taylor Randell** is a third year Ph.D. student at the University of Georgia studying under the direction of Dr. Stanley Culpepper. **Navdeep Godara** is a first-year Ph.D. student at Virginia Tech, pursuing his doctorate degree with Dr. Shawn Askew.

Weed Science Congressional Visits

I organized and conducted 28 Congressional meetings on weed science issues with the Weed Science Society Presidents and Science Policy Fellows. This included Stanley Culpepper (WSSA), David Simpson (NCWSS), Jacob Barney (NEWSS), Darrin Dodds (SWSS) and Joel Felix (WSWS) as well as Taylor Randell and Navdeep Godara. Half the meetings were conducted via Zoom in April and the other half were in person on Capitol Hill in November. The three main issues we focused on were:

• Supporting USDA NIFA **IR-4 Project funding** at $15 million in FY 2023. There is a phenomenal need for specialty crop protection products to help feed the world. The IR-4 Project provides an incredible return on investment as it contributes $9.9 billion to the annual U.S. GDP and supports more than 123,260 jobs. (*Congress did support IR-4 at $15 million for FY 2023 in their final Omnibus appropriations bill*).

• Supporting the USDA NIFA **Crop Protection and Pest Management (CPPM)** program at $22 million in FY 2023. This highly effective applied grant program tackles real world weed, insect, and disease problems with applied solutions through the concepts of integrated pest management (IPM), while supporting the Regional IPM Centers and extension IPM funding. (*Congress did provide $21 million to CPPM in their final Omnibus appropriations bill, CPPM's first increase since FY 2017*).

• Amend the Plant Protection Act in the 2023 Farm Bill so that the definition of a "Plant Pest" includes "noxious weeds", not just "parasitic plants" (7 USC 104, S.7702 (14)). USDA-APHIS Plant Protection and Quarantine (PPQ) only spends a small percentage of their nearly $400 million plant protection budget on noxious weeds. One reason is because the definition of "plant pest" only legally includes "parasitic plants". There are 111 Federal Noxious weeds, plus hundreds more prohibited and invasive weeds on state lists. However, there are only four genera of parasitic plants on the Federal Noxious weed list.

Other issues that were discussed included:

- Support for the Senate appropriations report language on **cogongrass** that directs $3 million to APHIS to partner with State departments of agriculture and forestry commissions to assist with cogongrass control
- Supporting appropriations for the $50 million per year for the federal Dept. of Transportation (DOT) "Invasive Plant Elimination Program (IPEP)". The 2021 Infrastructure Investment and Jobs Act (Public Law No: 117-58) created IPEP for managing weeds along rights-of-way and transportation corridors. IPEP is authorized at $50 million per year from FY 2022 to FY 2026 though the DOT, but has not been appropriated any funding in the first two years. After some discussions and meetings with DOT appropriations committee staff, we learned that WSSA was one of the first, and only groups asking Congress to support IPEP. In addition, we've heard that some state DOT's have not been as supportive of IPEP because the grant program would require them to do extra work. Finally, since IPEP is a "brand new" program, a $50 million per year start might be too big for Congress to get behind. Thus, we are considering an ask of $5 million for FY 2024 to get a pilot program started at DOT. Please feel free to contact me with your thoughts or ideas on how to get IPEP started.

Weed Science Presidents and Fellows meet with the Chairman of the House Agriculture Appropriations Committee, Rep. Sanford Bishop (D-GA) on November 16 in Washington DC.
Pictured (L to R): Taylor Randell (UGA), Science Policy Fellow; Navdeep Godara (VTech), Science Policy Fellow; Representative Sanford Bishop (D-GA), Reid Smeda, NCWSS President; Darrin Dodds, SWSS President; Stanley Culpepper, WSSA President; and Lee Van Wychen, WSSA Executive Director of Science Policy.

APMS Congressional Visits

I organized and conducted 11 Congressional meetings on aquatic plant management issues with House and Senate staffers in member's offices as well as on relevant authorizing and appropriations committees. Many thanks to APMS leadership for participating in these virtual meetings including Mark Heilman, Rob Richardson, Ryan Wersal, Ryan Thum, Jay Ferrell and Carlton Layne.

Main issues included seeking the full $25 million appropriation for the Army Corps Aquatic Plant Control Research Program (APCRP), discussing the potential impacts of the new strain of hydrilla in the Connecticut River basin, and supporting authorization and funding of invasive species provisions in the 2020 and 2022 Water Resources Development Acts (WRDA).

We've made excellent progress on these issues including initial funding for the Army Corps **Harmful Algal Bloom (HAB)** demonstration program, $1 million increases for the Aquatic

Plant Control Research Program, and a **brand-new funding line of $6 million** “for hydrilla control, research, and demonstration work in the Connecticut River basin”.

FY 2023 Appropriations Final (Almost)

The House and Senate passed a continuing resolution (CR) at the end of September to fund the federal government at FY 2022 levels through December 16, and then extended that another week to December 23, 2022. As I write this report on December 20, I am still awaiting final spending levels in certain parts of the Omnibus appropriations bill, but all signs indicate that the House will pass it and the president will sign it by December 23, 2022.

The table below includes the Omnibus Appropriations for FY 2023, as well as the final appropriations for FY 2021 and FY 2022 for various Federal programs important to weed and invasive plant research. The far-right column is the percentage increase compared to FY 2022.

	Final FY 2021	**Final FY 2022**	**Final FY 2023**	**Percent Increase**
	----------------$ millions----------------			
USDA-ARS	$1,492	$1,633	$1,744	6.8%
USDA-NIFA	$1,570	$1,637	$1,701	3.9%
-AFRI Competitive Grants	$435	$445	$455	2.2%
-Hatch Act (Exp. stations)	$259	$260	$265	1.9%
-Smith Lever (Extension)	$315	$320	$325	1.6%
-IR-4 Program	$11.9	$14.5	$15	3.4%
-Crop Protection and Pest Management	$20	$20	$21	5.0%
-SARE: Sustainable Ag Research & Educ.	$40	$45	$50	11.1%
Army Corps- Aquatic Plant Control Research	$7	$8	$8	0%
-CT River hydrilla control and research	n/a	n/a	$6	∞%
EPA - Great Lakes Restoration Initiative	$330	$348	$368	5.7%

We are very excited that the House and Senate approved $6 million for a hydrilla research and control program for the Connecticut River Basin to deal with a new strain of hydrilla that has the high potential to spread to the Great Lakes. Other noteworthy parts of the FY 2023 Omnibus Appropriations include:

- A $9.9 billion, or **12 percent increase,** for the **National Science Foundation (NSF)**. This is largest dollar increase for NSF of all time and the largest percentage increase for NSF in more than two decades. NSF’s funding level will support approximately 2,300 additional research and education grants and 35,000 more scientists, technicians, teachers, and students, compared to fiscal year 2022.

- The EPA's **Office of Pesticide Programs (OPP)** was funded at **$140 million** for FY 2023. While this is not as high as we had asked for ($163 million), this is still the highest funding for EPA OPP since 2010 and an **8.6 percent increase** over FY 2022.
- Finally, the **5th reauthorization of the Pesticide Registration Improvement Act (PRIA 5)** was included in the FY 2023 Omnibus bill, beginning on page 3,980. The National and Regional Weed Science Societies joined many other organizations in a letter to House and Senate Ag Committee leaders urging them to complete the reauthorization before it expired in 2023. First established in 2004, PRIA put in place pesticide registration service fees paid by registrants in exchange for specific time periods for EPA to make a regulatory decision on pesticide registrations and tolerance actions. The goal of PRIA is to create a more predictable and effective evaluation system that promotes shorter decision review periods for reduced-risk pesticides. Link to: PRIA overview and history.

Through the AFRI Coalition, the six National and Regional Weed Science Societies joined other scientific societies and organizations in supporting Congressional funding for the USDA AFRI Competitive Grants Program at its authorized level of $700 million in FY 2023.

Likewise, through the Friends of ARS Coalition, the six National and Regional Weed Science Societies joined other stakeholder organizations in urging House and Senate Appropriators to provide at least $1.9 billion for salaries and expenses at USDA-ARS in FY 2023.

There is also appropriations report language in both the House and Senate for a regionally focused **Herbicide Resistance Initiative** for the Pacific Northwest. In FY 2022, $2 million was allocated to "*support research to address weed management strongly affecting the long-term economic sustainability of food systems in collaboration with USDA-ARS, research institutions, and stakeholder support*". Another $1 million was added for FY 2023, which will support several new weed science positions.

Getting APHIS PPQ to Spend Money on Federal Noxious Weeds

Dr. Mark Davidson was appointed to lead APHIS Plant Protection and Quarantine (PPQ) in May 2022. APHIS PPQ's primary role is to safeguard U.S. agriculture and natural resources against the entry, establishment, and spread of pests and diseases. In July I met with Dr. Davidson and Samantha Simon to discuss APHIS PPQ's lack of focus on federal noxious weeds. Joining me on the meeting were WSSA President Stanley Culpepper and Jacob Barney, WSSA Noxious and Invasive Weeds Committee Chair.

We kindly reminded them that widespread weeds like hydrilla and cogongrass are federally listed noxious weeds for which APHIS PPQ has responsibility for managing. We discussed the new strain of hydrilla in the Connecticut River and its potential to spread into the Great Lakes. While APHIS has active permits for two hydrilla biocontrol agents, *Hydrellia balciunasi* and *Hydrellia pakistanae*, they do not have a current program for the control and management of hydrilla.

For the time being, APHIS PPQ pointed us to funding available under the Plant Protection Act section 7721 where you can find information about the Plant Pest and Disease Management and

Disaster Prevention Program (PPDMDPP). Key contacts for PPDMDPP are Van Pichler, who is the National Policy Advisor for PPA 7721. She can advise you regarding reviewers for project suggestions for PPDMDPP. Also, Christa Speekmann, who is the Director for Pest Evaluation and Response for PPA 7721 portfolio.

2023 Farm Bill

Work will progress rapidly for the 2023 Farm Bill with the 118th Congress starting in January. With the November election results giving each party a very small majority in the House and Senate in a divided Congress, passing a Farm Bill will require significant intra-party compromise.

I am working with the National Coalition for Food and Agricultural Research (NCFAR) and the Supporters of Ag Research (SoAR) on talking points for use in support of ag research in the Farm Bill. Collectively, we are recommending an **increase of $5 billion** allocated to agricultural research in the 2023 Farm Bill.

I have also worked with NAISMA to advance four invasive species policies for the 2023 Farm Bill. Our top recommendation is to update the definition of plant pest to include all noxious weeds, not just parasitic plants.

WSSA Committee Work

In addition to leading the Science Policy Committee, I continue to work with numerous WSSA committees on various weed science issues. This includes multiple press releases with the **Public Awareness Committee** (E13), updating WSSA's composite list of weeds through the **Standardized Plant Names Committee** (P23), drafting and disseminating the weed research priorities survey through the **Research Priorities Committee** (E6), helping coordinate a CAST issue paper on invasive weeds through the **Noxious and Invasive Weeds and Biocontrol Committee** (E4), and helping assimilate information on how the Endangered Species Act (ESA) impacts agriculture, the environment, and WSSA through the new **Endangered Species Act Committee**.

FIFRA and Endangered Species Act Compliance

The new WSSA Endangered Species Act (ESA) Committee, chaired by Bill Chism, continues to work on a symposium and workshop at the WSSA annual meeting on January 30, 2023 to determine how weed scientists can provide useful science-based information to regulators for ESA compliance to FIFRA approved herbicides. There are approximately 1,700 endangered species of which approximately 900 are plants, plus another 700 critical habitats. It is anticipated that glyphosate and other herbicides will impact almost all of those.

Endangered Species by County. Source: Precious Heritage: The Status of Biodiversity in the United States.

On November 16, the EPA released an Updated ESA Workplan that provides more detail about how EPA plans to impose various mitigation measures that will be required on pesticide labels to meet its ESA obligations when registering a pesticide. There are concerns about some of the mitigation options such as "buffers to reduce pesticide drift and water runoff" or "do not use when rain is expected in the next 48 hours" -- which raises other issues such as what or how compliance might be proven or enforced.

EPA has previously stated that by using the current ESA compliance approaches, they could only complete about 5 percent of the ESA required reviews in about 18 years. This means that it would take EPA about 360 years to complete its ESA compliance review for all pesticides, which is clearly not acceptable.

The Updated EPA Workplan released in November describes mitigation strategies that are "reasonable and prudent alternatives" (RPAs) for ESA compliance to help streamline the process and reduce the unacceptable timeframe of 360 years. However, these updated strategies might lead to fears among some stakeholders that in a "rush" to complete this work, EPA will make overly conservative label restrictions and reduce availability of the pesticide without adequate and legally defensible ESA protections.

The ESA Workplan Update also describes initiatives that, according to EPA, will help it and other federal agencies improve approaches to mitigation under the ESA and improve the interagency consultation process outlined in the ESA Workplan. These initiatives include EPA's work to identify ESA mitigation measures for pilot species, incorporate early ESA mitigation measures for groups of pesticides (*e.g.*, broadleaf herbicides), and develop region-specific ESA mitigations.

Comments on the proposed set of interim mitigation measures and the proposed revisions to label language are due on **January 30, 2023.** This is the day before the WSSA annual meeting symposium on ESA mitigation measures. For that reason, WSSA has requested a 60-day extension on the comment period. However, we have not heard back from EPA yet (as of Dec. 20, 2022). Please submit comments at EPA-HQ-OPP-2022-0908.

WSSA Comments on Atrazine Interim Registration Decision

I submitted comments on October 7 addressing EPA's proposed revisions for its interim registration review of atrazine. Among the various mitigation measures, EPA's proposal calls for prohibiting applications in saturated fields, limiting annual atrazine application rates and requiring growers in watersheds with atrazine levels above 3.4 ppb to choose from a "picklist" of practices to mitigate runoff. It is estimated that the proposed changes would impact over 65 million acres of corn, sorghum and sugarcane. We expect to see similar mitigation measures as the EPA works to advance pesticide compliance for the ESA-FIFRA process.

For atrazine, we also asked EPA to schedule a FIFRA Science Advisory Panel (SAP) to seek external peer review of atrazine's risks to aquatic plant communities, including the 3.4 ppb level of concern (LOC) since past ecological and scientific reviews have concluded higher LOC's for atrazine.

Many thanks goes out to WSSA President Stanley Culpepper and Science Policy Fellow Taylor Randell for pulling together the comments and the literature review, as well as edits and reviews by Bill Chism, Anita Dille and Bill Curran. Thank you also goes to members of the WSSA Extension Committee for their input.

Glyphosate Letters to US Solicitor General and Congressional Leaders

On May 10, 2022, Solicitor General Elizabeth Prelogar submitted a brief to the U.S. Supreme Court advising the Court against hearing a glyphosate case, arguing that federal pesticide registration and labeling requirements do not preclude states from imposing additional labeling requirements, even if those requirements run counter to federal findings. This position was a stunning reversal from numerous past administrations, Democratic and Republican alike. On behalf of the National and Regional Weed Science Societies, we supported a letter strongly urging Solicitor General Prelogar to withdraw the brief establishing this new policy. Unfortunately, Prelogar still submitted the letter and the Supreme Court did not hear the case.

In November, the National and Regional Weed Science Societies reaffirmed their position in supporting the FIFRA statutes governing state pesticide labels by joining over 300 other organizations in a letter to Congressional leaders in the House and Senate. The letter states "*The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the primary statute governing pesticides, places EPA in the authority to make foundational, science-based decisions on how pesticides can be labeled and used. States are permitted to regulate the sale and use of pesticides under FIFRA but are preempted from requiring additional or different pesticide labels or packaging*." In other words, California cannot require glyphosate registrants to put a Prop 65 statement on glyphosate labels because the EPA has repeatedly concluded that glyphosate is not carcinogenic.

Support for BLM's Intent to Approve Eight Herbicides

On behalf of the National and Regional Weed Science Societies, I submitted a letter of support to the Bureau of Land Management's (BLM) "notice of intent" to prepare a Programmatic Environmental Impact Statement (PEIS) for approval and use of aminocyclopyrachlor; clethodim; fluazifop-p-butyl; flumioxazin; imazamox; indaziflam; oryzalin; and trifluralin on public lands. BLM has said they plan to release a draft biological evaluation of the eight herbicides in November or December 2022.

NISAW: February 20-26, 2023

National Invasive Species Awareness Week (NISAW), https://www.nisaw.org/ will be digital again in 2023 (although there is the potential for some groups flying in to DC to advocate on Capitol Hill). The WSSA is a Partner Sponsor of NISAW, its 24th year of supporting NISAW. If you have topics or issues of concern, or would just like to get involved with NISAW planning, please let me know. Lee.VanWychen@wssa.net

Lee Van Wychen, Ph.D.
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National and Regional Weed Science Societies
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202-746-4686

Meetings of the National and Regional Weed Science Societies

Jan. 23 - 26, 2023 Southern Weed Science Society (SWSS), Baton Rouge, LA www.swss.ws

Jan. 30 - Feb. 2, 2023 Northeastern Weed Science Society (NEWSS), Arlington, VA www.newss.org
Jan. 30 - Feb. 2, 2023 Weed Science Society of America (WSSA), Arlington, VA www.wssa.net
Feb. 27 – Mar 2, 2023 Western Society of Weed Science (WSWS), Boise, ID www.wsweedscience.org
Jul. 24 - 27, 2023 Aquatic Plant Management Society (APMS), Indianapolis, IN www.apms.org
Dec. 11 - 14, 2023 North Central Weed Science Society (NCWSS), Minneapolis, MN www.ncwss.org

SWSS AWARDS COMMITTEE Annual REPORT
Nov. 30, 2022
Chair: Clete Youmans

The Parent Awards Committee consists of the immediate Past President (C. Youmans) as Chairperson and each Chair of the Award Subcommittees. The Chairs of the Awards Subcommittees are as follows:
Greg McDonald (SWSS Fellow Award), Stephen Enloe (Outstanding Educator Award), Todd Baughman (Outstanding Young Weed Scientist Award), Kelly Bachscheider (Outstanding Graduate Student Award), and Jason Norsworthy (Excellence in Regulatory Stewardship Award).

Fellow Award: There were three nominations for the Fellow Award, with two max. awardees allowed. The recipients of the 2023 Fellow Awards are Dr. Gary Schwarzlose and Dr. Larry Steckel.
Subcommittee members: G. McDonald (chair), C. Youmans, H. McLean (2024), D. Jordon (2024), E. Prostko, and P. Dotray
Outstanding Educator Award: The award goes to Dr. Darrin Dodds.
Subcommittee members: S. Enloe (chair), D. Spaunhorst, E. Prostko (2024), P. Dotray (2024), T. Grey, and L. Steckel
Outstanding Young Weed Scientist Award: The award goes to Charlie Cahoon (Academia). There were no nominations for the OYWSA for Industry.
Subcommittee members: T. Baughman (chair), K. Bachscheider, G. Stapleton (2024), M. Wiggins (2024), S. Rana, and J. Brosnan
Outstanding Graduate Student Awards: The M.S. award goes to Tristen Avent (UAR). The PhD award goes to Taylor Randell-Singleton (UGA)
Subcommittee members: K. Bachsheider (chair), M. Griffin, J. Heiser (2024), N. Boyd (2024), John Buol, and J. Brewer
Excellence in Regulatory Award: There were no nominations.
Subcommittee members: J. Norsworthy (chair), M. Goddard (Bayer/2023), S. Bangarwa (2024), G. Montgomery (Bayer/2024), F. Meeks, and J. Williams (Bayer/2025)
One of two Award subcommittee members whose name is followed by “2024” are usually the next year’s chair, from the end of the 2023 annual meeting to the end of the 2024 annual meeting. Matt Goddard expressed a desire to stay on the ERA subcommittee.

Graduate Student Program Committee Report for 2023

Meeting Date: January 24, 2023
Attendees: Matthew Wiggins, Pratap Devkota, and Spencer Samuelson
ITEMS OF BUSINESS:

I. **Student Contest Participation:**

Year	Poster Contest Participants				Oral Paper Contest Participants			Total Participants
	Undergrad	MS	PhD	Total	MS	PhD	Total	
2023	0	15	20	35	29	30	59	115
2022	3	30	13	46	25	24	49	95
2021	0	22	24	46	28	34	62	108
2020	0	13	9	22	29	26	55	77
2019	0	15	15	30	26	17	43	73

II. **Student Contest Overview**

a. Four separate rooms will be used for the student paper contest with a total of 4 sections; 2 MS sections; 2 PhD sections.
b. Minor cancellations so far this year, will update once the contest is complete
c. We will be needing over 50 volunteer judges to make this contest a success. The committee is working on securing volunteers now.
d. NEW FOR 2023 CONTEST: The student contest committee will be working with Eric Castner to implement a video recording option for students as they present their papers. The intent is to give the student contestants and their major professors an opportunity to review their performance and be able to compare notes from the judges. These videos will only be available to the presenting student and major professor.

III. **Online Ranking Recording**

a. A Google Spreadsheet for each section will be provided to allow judges to record scores online. The spreadsheet "auto averaged" scores across judges, speeding up the counting process for the committee. Additionally, it eliminated any potential confusion if final scores did not necessarily match with judges final rankings.
    i. Access to the spreadsheet was limited to judges within a section (i.e. MS Poster Section #1) and committee members.
b. An example of the spreadsheet may be found HERE.
c. In 2022, overall response to the online ranking recording was positive. Last year there were some hiccups regarding issues with logging in to Google and potentially some "firewall" type restrictions not allowing individuals to enter scores, but overall, most judges were successful at entering scores. Several judges even commented they were happy to see efforts were being made to move the scoring/judging into the 21st century.

IV. **Communication with Judges**

a. An email will be sent to judges (by section) the week prior to the meeting, including:
   i. A list of papers/posters to be judged in their section
   ii. A link and QR codes to a Google Document to record final scores, ranking, and comments for the section.
   iii. Pertinent instructions for judging ahead of the meeting and prior to the annual judges breakfast on Tuesday morning.

b. Committee member (Wiggins, Devkota, Samuelson) contact information will be shared with judges to address questions prior to, during, or after the contest.

V. **Contest Results**

a. Awards will be announce on announced at the awards reception held on Wednesday, January 25th.

b. Score sheets with comments were distributed back to student contest participants following the announcement of winners at the reception.

VI. **Committee Succession Plan**

a. Matthew Wiggins (matthew.wiggins@fmc.com) will be the committee chair in 2023.

b. Pratap Devkota (pdevkota@ufl.edu) will assist and follow as the chair in 2024.

c. The committee recommends Spencer Samuelson (spencer.samuelson@corteva.com) for the graduate student program committee and 2025 chair.

Constitution and Operating Procedures Committee Report

January 2023

The Manual of Operating Procedures was reviewed and edited throughout 2022. The following changes were presented to the SWSS Executive Board and approved for immediate change during the Summer Board Meeting. These changes were included in the updated SWSS Manual of Operating Procedures that was uploaded August 2022.

1. Revised Registration Fee MOP.

a. Added 'non-refundable' for pre-registration fees.

b. Moved the 'absentee registration' option to a different place in this section of the MOP.

c. Raised student registration fees by $50 to compensate for high cost of poster/easel rental. Preregistration fee for students is now $250. Walk-in registration fee for students is now $300.

2. Revised the Sustaining Membership Committee MOP.

a. Added a statement that a line-item invoice be sent to sustaining members in March.

b. Added a statement that a representative of the Sustaining Membership Committee present a report at the SWSS Summer Board Meeting on status of sustaining members.

c. Defined new categories of Sustaining Membership dues; Platinum (>$10,000), Gold ($5,000 - $9,999), Silver ($2,000 - $4,999), and Bronze ($200 - $1,999).

3. Revised the Awards Committee MOP.

a. Updated the description of the Excellence in Regulatory Stewardship Award for Bayer CropScience sponsorship for five years beginning in 2023.

b. Changed submission date for all award nominations no later than October 15. (Previously, the deadline was September 15.)
4. Revised the Newsletter Editor duties.
a. Changed the order of duties to reflect the continued importance of the SWSS Newsletter.
b. Added item 8 – expansion to include maintaining the SWSS presence on social media. This will be a coordinated effort with the Computer Applications Committee.
c. These minor changes are precursor to the renaming of the Newsletter Editor position to the proposed Director of Communications.
5. Revised the Computer Applications Committee duties.
a. Added language to reflect this committee's role in SWSS social media presence and coordinate with Newsletter Editor (i.e. Director of Communications).
b. The goal of these changes is to use social media to promote the Society, our science, accomplishments of members, and announce upcoming events.
The changes in title of the Newsletter Editor to 'Director of Communications' will require change to the Constitution which specifically mentions 'Newsletter Editor'. Changes to the Constitution will require announcement in the December 2023 newsletter followed by a vote of the general membership at the 2024 Business Meeting.
Respectively submitted;
Wiley C. Johnson, III
Chairman – SWSS Constitution and Operating Procedures Committee

2022 Weed Contest Report

The 2022 SWSS Weed Contest was held on August 2, 2022 at the Memphis AgriCenter and hosted by Bruce Kirksey. The 2023 National Weed Science Contest (Weed Olympics) will be held in Union City, TN on July 25-27, 2023. This event will be hosted by Bayer CropScience. Garret Montgomery (garret.montgomery@bayer.com) and Joey Williams (joey.williams1@bayer.com) will be the local contacts for the 2023 Weed Olympics.
At this time, the organizers are not requesting financial support from SWSS for the 2023 Weed Olympics. I will work to keep the board of directors updated if that was to change as more planning for the event takes place. I have attached the rules for the 2023 Weed Olympics Event.
2022 Weed Contest Results:
· 66 total students participated: 9 undergraduates; 57 graduate students
· 11 universities represented
· 14 total teams
· 59 total volunteers from academia and industry
Awards:
Top Individual Graduate Students:
1. Tristan Avent, University of Arkansas
2. Eli Russell, Virginia Tech
3. Mason Castner, University of Arkansas
4. Matt Spoth, Virginia Tech
5. John Peppers, Virginia Tech
6. Jake Patterson, Mississippi State University
7. Casey Arnold, University of Arkansas
8. Jose DeSanctis, North Carolina State University
9. Chad Abbott, University of Georgia

10. Andrew Osburn, Texas A&M
Top Individual Undergraduate Students:
1. Maria Carolina, University of Arkansas
2. Jacob Forehand, North Carolina State University
3. Hunter Lee, North Carolina State University
1st Place by Category:
· Weed Identification – Eli Russell, Virginia Tech
· Crop Response – Tristan Avent, University of Arkansas
· Farmer Problem – Jose DeSanctis, NCSU
· Individual Calibration – Tristan Avent, University of Arkansas
Team Calibration Results:
1. Texas Tech University
2. University of Tennessee (graduate team)
3. University of Arkansas
Overall Top Teams:
1. University of Arkansas
2. Virginia Tech Team A
3. Mississippi State University

Local Arrangements Committee Report
Submitted by Connor Webster, Chair

Poster Boards: $3,080.00
Overall, these poster boards were not easy to find and I was only able to find one company that supplies this service. I used Evolving Production LLC out of New Orleans. After talking with Luke Etheridge and hearing of his struggles with finding a company for the 2022 meeting in Austin, this was one of the first things on my list that I took care of.
Audio/Video: $8,166.66
The price for AV is fairly reasonable at the Renaissance hotel and it is my understanding that this price is much lower than previous meetings. I was able to get the price down by supplying all of the computers, projectors (with Gary Schwarzloses assistance), and presentation clickers. The hotel is supplying "support packages" which include screens, an AV cart, and basic cabling needs.
Top Golf: $9,347.00
We have around 100 people registered for the Top Golf event, which is up from about 78 people in 2022 in Austin. Top Golf was very easy to work with but they do have some strict timelines for the deposit, final guest count, and final payment. We were able to offset some of this cost through sponsors.
Meals: ?
Kelley Mazur handled all of the meals for the meeting. I am very grateful for her handling this portion of Local Arrangements.
Challenges
The biggest challenge that we faced was the size of the hotel. Eric Castner and myself have put in a lot of work to ensure that we maximize our space efficiently. This has required us to flip rooms frequently throughout the conference. The hotel was willing to do everything in their

power to meet our needs. Our only “loss” is that we will have to keep rounds set up Wednesday morning for the agronomic crops section instead of theatre seating.

Proceedings Editor Report

Report by: Paul Tseng

Proceedings Editor's Report of the 2022 Meeting

The 2022 meeting was held in Austin, TX during January 23-27, 2022. The 2022 Proceedings of the Southern Weed Science Society contained 253 pages, including 265 abstracts. By comparison, the 2021 Proceedings of the Southern Weed Science Society contained 276 pages, including 165 abstracts (virtual), 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 265 titles (119 posters and 137 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 completed and uploaded to the SWSS website in September 2022.

Graduate Student Report

Report by: Sarah Kezar

The Graduate Student Organization luncheon was held on Tuesday, January 23rd and students were able to hear a presentation from financial advisors local to Baton Rouge about financial wellness as well as a great discussion. Thereafter, elections were conducted and the 2023-2024 slate is as follows: Mason Castner (President), Navdeep Godara (Vice-President), Jake Patterson (Herbicide Resistance Committee Representative), Pamela Carvahlo-Moore (Endowment Committee Representative), Annu Kumari (Secretary), Kayla Brewser (GSO Representative), Megan Mills (Social Chair). Following the SWSS Annual Meeting, the board of directors had a passing vote to approve the amendment of the Social Chair position to the SWSS Manual of Operating Procedures and inclusion of the description of the new officer position in the document. You can find the updated GSO Manual of Operating Procedures on the SWSS website and follow @SouthWeedSciSoc on Twitter to keep up to date with the SWSS community!

WSSA Representative Report

Report by: John Byrd

President: Culpepper, Stanley stanley@uga.edu
President-Elect: Moseley, Carroll carroll.moseley@syngenta.com
Vice-President: Dahl, Gregory GKDahl@landolakes.com
Past-President: Dille, Anita dieleman@ksu.edu
Secretary: Lazaro, Lauren lauren.lazaro@bluerivertech.com
Treasurer: Elmore, Greg greg.elmore@bayer.com
Director of Publications: Willenborg, Chris chris.willenborg@usask.ca
Chair, Constitution and Operating Procedures: Lindquist, John jlindquist1@unl.edu
Member-at-Large: Flessner, Michael flessner@vt.edu
Member-at-Large: Sosnoski, Lynn lms438@cornell.edu
Graduate Student Member: Kezar, Sarah sarah.kezar@tamu.edu
Executive Director of Science Policy: Van Wychen, Lee (Ex-off and non-voting) lee.vanwychen@wssa.net

Regional Representatives
Aquatic Plant Management Society: Sperry, Ben bpsperry@ufl.edu
Canadian Weed Science Society: Robinson, Darren drobinso@uoguelph.ca
North Central Weed Science Society: Miller, Brett brett.miller@syngenta.com
Northeastern Weed Science Society: Pyle, Steve steve.pyle@syngenta.com
Southern Weed Science Society: Byrd, John jbyrd@pss.msstate.edu
Western Society of Weed Science: Helm, Alan ahelm@gowanco.com
NIFA Representative: Kells, Jim kells@msu.edu
CAST Representative: Schroeder, Jill jischroe1@gmail.com
EPA Liaison: VanGessel, Mark mjv@udel.edu

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

The 2023 Annual Meeting will be joint with the Northeastern Weed Science Society scheduled for January 30-February 2 at the Crystal Gateway Marriott in Arlington, VA. Five of the ten submitted symposia were selected for the meeting:

Endangered Species Act (Chism);
Novel Technology for Weed Management (Sosnoskie);
Crop-Weed Management in a Rising CO2 and Warming World (Williams),
Cover Crops (Haramoto and Young), and
WSSA Research Priorities Survey Results (Kells and Young).

In addition, there will be two tours offered prior to the meeting: One will focus on U.S. Botanical Gardens, the other the Smithsonian's Museum Support Center, which includes the greenhouse operations. Both tours are behind the scenes (not open to the public) and indoors (winter in Arlington). The Graduate Student Organization scheduled a panel to discuss Overcoming Hurdles in Graduate School to help address conflict and stress students encounter. Lastly, the International Weed Genomics Consortium (IWGC) Annual Meeting will meet January 29 and 30 prior to

WSSA Annual Meeting in Arlington. Registration for that conference is separate from WSSA and vice-versa.

There was discussion regarding the need to form an autonomous/alternative weed management methods section to offer those individuals involved with drone or other "nonchemical" weed management technology a place to group presentations.

Sarah Lancaster presented a list of professional website developers proposals to update and maintain the WSSA website. Her committee will make a recommendation to the board on selection.

The MOP will be modified to waive membership to authors that publish in a calendar year ("fully accepted by the editors with no pending revisions") four or more manuscripts in WSSA journals. The waiver will apply to senior author or corresponding authors if multiple.

The update of the Herbicide Handbook is moving, but more slowly than expected. The new version will be electronic.

The Innovative Grants language was passed and three grants accepted for funding. The program provides opportunity for grant submission ($100,000 WSSA expenditure per funding cycle) when WSSA assets exceed $1,500,000 the last day of April after the Annual Meeting. Only proposals of ideas not currently funded by WSSA and innovative in nature will selected. Proposals cannot be renewed, but can be more than 1 year duration. The Proposal Form on the WSSA webpage under Society, Information and Project Proposal and Review Process must be submitted to the WSSA Executive Committee by October 1. The WSSA Executive Committee will evaluate and selected proposals to fund. Proposal PIs selected for funding will be notified by November 15 with funds available December 1. The three proposals selected for funding this year are 1) Developing an Electric Mulch System in Vineyards and Blueberry Production. Erik Lehnhoff, NMSU ($50,000 over two years); 2) Cease the seeds: understanding seed microbiomes to accelerate seedbank mortality. Carolyn Lowry, Penn State ($19,922 over two years); 3) Do Plant-Soil Microbe Interactions Explain *Ventenata dubia*'s Competitive Advantage? Timothy Prather, Univ. of Idaho ($3,854 for one year).

Future meetings:
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.

Respectfully submitted,

John D. Byrd, Jr.

Necrologies and Resolutions

Report by: David Black

Four necrology reports were submitted, Dr. S. Wayne Bingham, Dr. Vernon Victor Vandiver, Jr., Dr. Douglas Wayne Houston, Dr. Vernon Biggs Langston.

Dr. S. Wayne Bingham, 91, died on October 20th, 2020. Wayne was born and raised on a dairy farm in Cleveland County, North Carolina where he learned the value of hard work and perseverance. He earned his bachelors and master's degrees from North Carolina State University and his doctorate from Louisiana State University. In 1961, Wayne and Ruby moved their home to Blacksburg, VA where he worked for 35 years as a Virginia Tech professor in plant physiology and weed science. He was a true Hokie at heart and enjoyed attending the football games every year since the stadium opened.

During his tenure at Virginia Tech, he was an active member of numerous professional organizations including the International Turfgrass Society and received numerous awards for his research on turf weed control, grass growth regulators, weed control on rights-of-way, and physiology and control of specific weeds in Virginia and the Northeast. He developed a strong turfgrass weed control program which addressed the turfgrass industry needs and communicated results through a strong extension program. In 1991, he received several awards: the Northeastern Weed Science Society Outstanding Applied Research Award for turf, ornamentals, and vegetation management; the Virginia Turfgrass Council R.D. Cake Memorial Award for outstanding contributions to the turfgrass industry; the Society Award from the International Turfgrass Society; and was named fellow by the Weed Science Society of America for his sustained quality programs.

Dr. Bingham was a great advisor for his students and was well-respected by his academic and industry peers. He also took his job at Virginia Tech seriously. He was major advisor for more than 20 graduate students (MS and PhD) and served as a committee member on many others. He published many scholarly and professional articles, made countless professional and extension related presentations, and brought in well over 2 million dollars in grant monies. His impact to the Weed Science Society was monumental as Dr. Bingham's turf publications, recommendations, and advised students are resonating through the WSSA today.

Dr. Bingham is survived by wife Ruby, to whom he was married sixty-five years, three children (and their spouses), six grandchildren, and two great grandchildren.

WHEREAS Dr. Bingham served with distinction at Virginia Polytechnic Institute and State University, and,

WHEREAS Dr. Bingham provided numerous contributions to weed science, and,

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. S. Wayne Bingham, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Vernon Victor Vandiver, Jr., 78, died on May 26th, 2022, in Gainesville, FL. Vernon was born in Miami, FL on February 11th, 1944, the only child of Vernon and Mary Vandiver. The family lived in Ochopee, FL. He was very proud of growing up in the Everglades and his childhood friends remained his friends for life. Vernon attended school in Everglades, FL, and graduated from Everglades Highschool in 1961. He went on to earn his Bachelor’s degree from the University of Florida and a PhD from North Carolina State University in Raleigh, NC.

Vernon was commissioned as a 2nd Lieutenant in the United States Air Force in December of 1965 and served four years of active duty. He was stationed at the 780th Radar Squadron, Fortuna AFS North Dakota, the 347th Tactical Fighter Wing, Takaoyoma, Japan and the 678th Radar Squadron, Tyndall AFB, Panama City, Fl. He then served in the USAF Reserve and was presented the Legion of Merit upon his retirement as a Colonel on April 30th, 1997.

Dr. Vandiver was the first aquatic weed specialist hired by the University of Florida in 1975 and worked with UF Institute of Food and Agricultural Sciences for 28 years. He was stationed at Ft. Lauderdale Research Center and worked throughout the state of Florida and beyond. He was recognized as an expert in his field. He was active in the South Florida, Florida, and national Aquatic Plant Management, and Weed Science Societies. He served as president of the state organization in 2011 and received the Max C. McCowen Friendship Honor from the national society in 2012.

Dr. Vandiver is survived by his wife Frances Vandiver, his son Scott Vandiver (Holly), two granddaughters, and one grandson.

WHEREAS Dr. Vandiver served with distinction at the University of Florida, and,

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

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. Vernon Victor Vandiver, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Douglas Wayne Houston, 89, died at his home in Starkville, MS on June 8, 2022. Wayne was born in Sylvarena, MS to Joseph and Gertrude Houston. Wayne graduated from Sylvarena High School in 1951 and then attended Mississippi State University where he earned his

Bachelor's, Master's, and PhD degrees in Agronomy. In between earning his degree's, Wayne served in the U.S. Army for two years during the Korean Conflict.

Dr. Houston began working for the Extension Service at Mississippi State University in 1962 as a Soil Testing Leader and Soil Scientist. Throughout his 33 years with the Extension Service Dr. Houston also served as Cotton Specialist and Weed Specialist. In 1995, Dr. Houston retired from the Extension Service as Leader of the extension Agronomy Department. While at Mississippi State, Dr. Houston was a member of many professional organizations. After retiring from MSU, Dr. Houston worked in the private sector for Terra Industries and BASF. He fully retired in 1997 but continued to be active in various organizations.

Dr. Houston is survived by his wife, Beverly Pickler Houston, to whom he was married sixty-four years. He is also survived by sons Doug Houston (Jan) and Russ Houston (Suzy), daughter Janet Beall (Darin), all of Starkville, MS; eight grandchildren; and five great-grandchildren.

WHEREAS Dr. Houston served with distinction at Mississippi State University, Terra Industries, and BASF, and,

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

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. Douglas Wayne Houston, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

Dr. Vernon Biggs Langston, 67, died on July 18th, 2022. Vernon was born in Jackson, Mississippi, on June 18th, 1955. He graduated from Raymond High School in Raymond, Mississippi. He then attended Mississippi State University where he received his Bachelor and Master of Science Degrees in agriculture. He went on to graduate from Louisiana State University with a PhD in agriculture. Vernon worked 30 years for Dow Agrisciences in Research and Development. After retiring with Dow, he worked for Rotam North America in product development.

Dr. Langston is survived by his wife of Tammie, his daughter Katherine Griggs, and son Rob Langston.

WHEREAS Dr. Langston served with distinction at Dow Agrisciences and Rotam North America,

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

2023 MEETING ABSTRACT

Endangered Species Act: Protecting Species, Herbicides, and the Farm. AS Culpepper[*1], T Randell-Singleton[1], J Vance1, B Chism[2]; [1]University of Georgia, Tifton, GA, [2]Retired U.S. EPA, Point of Rocks, MD

As the world's population is expected to approach 10 billion people by 2050, family farms are faced with a mighty challenge of feeding and clothing them all. Herbicides are critically important for the control of weeds in nearly all crops grown across the United States. Preserving the practical use of these herbicidal tools for agriculture is challenging as regulations become more complex. In an abundance of caution to protect species listed under the Federal Endangered Species Act (ESA) and help minimize the risk of litigation associated with the ESA's citizen-suit provision, the U.S. Environmental Protection Agency (U.S. EPA) has been inserting large spatial buffers in certain pesticide labels that restrict applications in counties where listed species may be present. Although the effort to protect listed species by the U.S. EPA is critically important, label restrictions seem excessive in some situations. Georgia agriculture and the Weed Science Society of America are working to develop and promote the use of scientific data in regulatory decisions.

Georgia agriculture: During 2022, a Georgia Pilot Program and team was formed to accomplish the goals of ESA without restricting the practical use of herbicides and destroying our family farms. Initially, the Pilot Program has focused on addressing the restrictions placed on Enlist Duo (2,4-D choline + glyphosate), where applications are prohibited in 11 counties due to the historical record of two endangered salamander species. These 11 counties produce over 374,000 acres of cotton, 104,500 acres of corn, and 13,900 acres of soybean, all of these crops are included on the Enlist Duo label. Through collaboration with the Southern Regional office of the U.S. Fish and Wildlife Services, information was collected to correlate the interaction of these historical salamander populations with farm fields to create refined range maps; as well as to identify potentially suitable habitats where additional populations may exist. If a farm field, when treated with Enlist Duo, is identified as having the potential to impact these species or their habitats, mitigation plans will be implemented for their protection. Once efforts are completed with Enlist Duo, a similar process will be initiated for glyphosate and atrazine.

Weed Science Society of America (WSSA): During 2022, the WSSA created an Endangered Species Act committee, including members from all regional weed science societies. Initial goals of the committee include fostering the protection of listed species through developing partnerships that maximize the WSSA's ability to communicate science-based information to regulators and to organize an ESA workshop to determine what scientific information weed scientists could provide to regulatory agencies for their assessments. Additionally, members of the WSSA ESA committee provided six presentations to inform various audiences of challenges the ESA regulatory actions are expected to have on agriculture and ways WSSA members can assist. During 2023, the committee plans to 1) develop presentations for WSSA members that can be shared with pesticide applicators to help them better understand ESA challenges, 2) develop a webpage for improved communication, 3) conduct a literature review on pesticide mitigation and phytotoxicity of herbicides on listed species, and 4) create subcommittees developing information on the following topics: phytotoxicity data on listed species or surrogate species, label reform, offset plantings, off-target herbicide mitigation measures, and improved communication methods.

Impact of the Endangered Species Act – An Extension Weed Scientist's Perspective. TA Baughman*; Oklahoma State University-Institute for Agricultural Biosciences, Ardmore, OK.

Concerns about protecting threatened plant and animal species has been around for decades. From a governmental regulation standpoint this started with the Lacey Act of 1900. This was in response to the decline of the passenger pigeon. This act also involved preserving and restoring wild game birds and preventing the interstate commerce of illegally harvested animals. This was followed by federal laws such as the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940. The Redbook on Rare and Endangered Species was first published in 1964. The Endangered Species Preservation Act was enacted in 1966, becoming the first comprehensive legislation to protect, conserve, and restore certain species. This also led to the first published list of threatened and endangered species in the Federal Register (32:49:4001) on March 11, 1967. President Richard Nixon signed the Endangered Species Conservation Act of 1969, and it became Public Law (91-135) on December 5, 1969. This law protected species beyond game and wild birds, listed both foreign and native species, prevents purchase or sale of listed species, and did not allow these species to be brought into the United States. Additionally, it allowed for acquiring land to conserve and protect endangered species. The most recognized law is the Endangered Species Act of 1973. It was introduced on June 12, 1973, widely approved by both the U.S. House and Senate, and signed into law by President Nixon on December 28, 1973. This established the U.S. Fish and Wildlife Services and NOAA Fisheries Service as the lead federal agencies. It also required the development of a list of worldwide endangered species and required federal agencies to ensure actions do not jeopardize the continued existence of any listed species. Federal agencies also must prevent destruction or adverse modification of designated critical habitat of said species. There have been additional amendments to this law in 1978, 1982, 1988, and 2004. These deal with various components and management of the law. More recently this law has been used through law suits to vacate registrations and use of various pesticides. The most publicized being the vacation of the use of registered dicamba products (Engenia, Xtendimax, and FeXapan) in dicamba tolerant cotton and soybean in 2020. This caused much consternation because it occurred during the growing season after tolerant crops had already been planted. There is concern among practitioners and crop producers about this law being used to jeopardize the use of pesticides in the future. The additional concerns are district courts setting law through these judgements and the potential lack of understanding of science with these courts and their decisions. There are future issues with the registration and re-registration of pesticides and potential loss or increased regulation through labeling and language restricting use. Thus, making the use of pesticide products difficult if not nearly impossible to apply in large scale production agriculture. This ultimately, should be a concern for all involved in agricultural production going forward.

Relative Soybean Response from 4 Auxin Herbicides Applied POST. TC Mueller*[1], L Steckel[2]; [1]University of Tennessee, Knoxville, TN, [2]University of Tennessee, Jackson, TN (2)

Auxin herbicides have been a key component to weed management in cropping systems and non-crop settings. Dicamba, 2,4-D, aminopyralid, and aminocyclopyrachlor (ACP) were sprayed over top of non-auxin resistant soybean at 0.001X, 0.01X, and 0.1X of a target rate to simulate tank contamination or possible particle drift. Visual evaluations, leaf samples, and high-quality images were taken at 3, 7, 14, and 21 days after application. Leaf samples were analyzed using extraction followed by liquid chromatography-mass spectrometry to determine herbicide concentration. Herbicide concentration in leaf samples decreased while symptomology increased over time. At 21 DAT, all 0.1X treatments had greater than 20% crop injury with 2,4-D indicating the least. Auxin herbicides can reduce yields at low concentrations. These herbicides have the same or a similar mode of action which makes discerning symptomology difficult even if the exact dosage and time frame is known. Analytical analysis is needed to differentiate between auxin herbicide present. Comparing the slopes for the respective herbicides at the lowest herbicide rate, dicamba had a much greater linear increase in soybean response over time compared to ACP, aminopyralid, and 2,4-D. Dicamba sensitivity to soybean is well documented and these findings are consistent with the extreme sensitivity of soybean to dicamba. This report also documents the relative activity of the other herbicides when soybeans are exposed at a range of concentrations. The observation that the herbicide concentration in the treated leaves is rapidly declining while the apparent soybean response is increasing over time shows the dilemma of trying to obtain soybean leaf samples and verify which herbicide would be responsible for a given soybean response. This is an example where herbicide chemical analysis would be more definitive in conclusively showing which herbicide caused the damage. Given that detectable auxin herbicide residue in soybean is transitory over time, Extension agents and State Department of Agriculture inspectors often rely more upon visual symptomology than herbicide chemical analysis to determine potential (dicamba) soybean exposure.

Cover Crop Residue Amount Influences Weed Seed Suppression. A Kumari*[1], S Li[1], AJ Price[2]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL (3)

Weed seed germination and early growth stage are critical parts of the weed life cycle controlled by environmental and genetic factors. Therefore, weed control strategy should focus on the most susceptible parts of the weed cycle to maintain sustainability and reduce chemical herbicide use. Cover crops have been increasingly adopted to suppress weed germination and vigorous vegetative growth. A greenhouse experiment was conducted 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 rye straw. Plant growth was quantified through weed counting and recording of dry weight. The results illustrated that morning glory was least responsive to increasing biomass, and palmer was the most responsive due to small seed sizes. While germination and growth rate of crabgrass and sicklepod have fluctuated with different levels of biomass residue during this greenhouse study.

Crop Response and Weed Control in Field Corn with Empyros™ and Shieldex® With/Without Counter®. EP Prostko*, C Abbott, NJ Shay; University of Georgia, Tifton, GA (4)

Empyros (tolpyralate + S-metolachlor) and Shieldex (tolpyralate) are two new herbicides recently registered for weed control in field corn. The current Shieldex label permits the use of Counter (terbufos) in-furrow for soil insect/nematode control but the Empyros label does not. The objective of the research was to investigate the effects of Empyros and Shieldex, with/without Counter on crop injury, weed control, and yield of field corn. An irrigated, small-plot field trial was conducted in 2022 at the UGA Ponder Research Farm. Field corn (cv. DKC-6895) was planted on March 28. Treatments were arranged in a randomized complete block design with a 2 (soil-insecticide) X 5 (herbicides) factorial arrangement with 4 replications. Soil insecticide treatments included Counter 20G at 6 oz/1000 row feet or none. Herbicide treatments included Roundup PowerMax3 5.88SL @ 22 oz/A + Shieldex 3.33SC @ 1.0 or 1.35 oz/A + Aatrex 4L @ 32 oz/A, Roundup PowerMax3 5.88SL @ 22 oz/A + Empyros 3.82L @ 32 or 45 oz/A + Aatrex 4L @ 32 oz/A, and a non-treated control (NTC). The corn stage of growth at application was V4 (6" tall) and all weeds were 1-3" tall. Treatments were applied with a CO_2-powered backpack sprayer calibrated to deliver 15 GPA with 11002AIXR nozzles. Data collected included corn bleaching, plant height, weed control, and yield. All data were subjected to ANOVA and means separated using Fisher's Protected LSD Test (P = 0.10). At 7 DAT, corn bleaching was increased when Counter was applied in-furrow with Empyros at both rates and Shieldex @ 1.35 oz/A. By 14 DAT, this effect was not observed and bleaching was = 6%. At 43 DAT, corn heights were not influenced by Counter (P=0.4193). Corn heights were greater in all herbicide treated plots in comparison to the NTC except for the higher rate of Empyros. At 49 DAT, all herbicide treatments provided >99% control of Palmer amaranth. All herbicide treatments provided >90% control of annual grasses except the 1.0 oz/A rate of Shieldex (83% control). For corn yield, no interaction between Counter and herbicides was observed (P=0.4813). Counter had no effect on yield (P=0.6011). When averaged over Counter rates, all herbicides improved yield in comparison to the NTC with no differences between herbicides.

Seed Retention and Removal of Palmer Amaranth and Waterhemp During Cotton Harvest.
SA Chu*[1], BM McKnight[2], G Morgan[3], MJ Walsh[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]Sydney University, Sydney, Australia (5)

Weed seed retention at harvest determines if harvest weed seed control (HWSC) can be effective in a cropping system. Within cotton cropping, there are no established methods of HWSC, a system that has high herbicide-resistant weed pressure (especially *Amaranthus* spp.) due to the frequent use of few herbicide modes of action. Cotton harvesting may favor weed seed shattering prior to subsequent capturing during stalk shredding, due to potential disturbance by the harvest machinery. The objective of this study was to determine how different types of cotton harvest machinery (picker or stripper) influence *Amaranthus* spp. seed retention, shattering, and removal in cotton. To achieve this objective, studies were conducted in Somerville, TX and Thrall, TX with waterhemp (*Amaranthus tuberculatus*) and Palmer amaranth (*A. palmeri*), respectively. The picker or stripper cotton harvester was operated in fields infested with *Amaranthus* spp., and data pertaining to the total amount of seed retained on the plant, the amount of seed shattered to the ground, and amount of seed removed via lint were determined. Sixty-four percent of weed seeds were retained on the plants in the cotton rows with the use of the cotton picker, while only 14% of seeds were retained for the stripper. Further, among the shattered seed, 4% and 16% were dispersed to the ground, respectively, for the picker and stripper. Minimal weed seed shattering was observed on plants in the row-middles. Results suggest that weed seed retention is significant following cotton harvest, though higher with pickers than strippers, and strategies can be developed to effectively target the retained seed and reduce seedbank inputs.

Evaluation of Pyroxasulfone for Control of Italian Ryegrass (*Lolium perenne* L. Ssp. *multiflorum*) in Kentucky Winter Wheat. T Legleiter*; University of Kentucky, Princeton, KY (6)

Italian ryegrass (*Lolium perenne L.* ssp. *multiflorum*) is one of the most problematic weed species in Kentucky soft red winter wheat hectares. Kentucky wheat growers have traditionally relied on postemergence herbicides such as ALS-inhibitors and ACCase inhibitors for control of this problematic weed. Although, overreliance on both sites of action has led to resistance to the majority of available postemergence herbicides for control of Italian ryegrass, including the increasing presence of pinoxaden resistant ryegrass across the state. The loss of postemergence herbicides for control of this weed species has led to a need to explore alternative herbicide timings and active ingredients. The recent approval of several 24c labels for pyroxasulfone based herbicides for preemergence application in wheat has led to interest in the use of this chemistry for control of Italian ryegrass in soft red winter wheat. An experiment was conducted at the University of Kentucky Research and Education Center in Princeton, KY during the 2020-21 winter wheat growing season. Soft red winter wheat was no-tilled into a field with a known infestation of Italian ryegrass in October 2020. Herbicide programs consisted of a burndown application that included either paraquat or glyphosate with the addition of a pyroxasulfone based residual applied either 14 days preplant, at planting or early postemergence. All treatments received a spring application of pinoxaden plus fenoxaprop. Herbicide treatments were evaluated for visual control following residual applications as well as in the spring and at harvest. Italian ryegrass seed head panicles m^{-2} were taken prior to harvest and wheat yield taken at harvest. The efficacy of pyroxasulfone on Italian ryegrass suppression was dependent on activating rainfall events, with 14 preplant applications having a reduced suppression of ryegrass as compared to at planting and early postemergence applications due to a lack of rainfall at the 14 day preplant timing and adequate and timely rainfall events occurring around the latter two applications. All treatments receiving an application of a pyroxasulfone resulted in at least 87 percent control of Italian ryegrass at the end of the season and significantly reduced seed head production at harvest. The incorporation of pyroxasulfone as a residual herbicide into winter wheat herbicide program increases consistency of control of Italian ryegrass and reduces selection pressure on the limited postemergence herbicides remaining for control of this problematic weed.

Effectiveness of Salvage Herbicide Programs for Weed Management (Particularly on Glyphosate-Resistant Palmer Amaranth) Programs and Possible Yield Reduction in Cotton Resistant to Glyphosate and Glufosinate. T Bararpour*; Mississippi State University, Stoneville, MS (8)

Sometimes, weed management program can't be done on time due to adverse environmental condition (such has continued rain and wet condition) in which weeds will be out of control in terms of growth stage and completely cover cotton. Also, sometimes residual herbicides fail due to adverse environmental conditions in which cotton yield loss from weed interference and losses due to harvest difficulty are likely costly to cotton producers. This research proposal aims to determine: 1) what can be done (herbicide programs) when weed infestation and growth stage is out of the range or control due to adverse environmental condition; 2) what is cost (number of application or herbicide program) to control >10-12" (large) glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*), 3) what cotton yield will be in salvage herbicide treatments as compared to standard treatment or weed-free check. The experiment was designed as a randomized complete block. Different herbicide programs (salvage) were used. Research was conducted at the Delta Research and Extension Center. Stoneville cotton (ST 4550) was planted on May 11, 2022 and emerged on May 17. Treatment (rate in oz/a) as follows: 1) Roundup (glyphosate) at 32 (B) followed by (fb) Roundup (C); 2) Liberty (glufosinate) at 32 (B) fb Liberty (C); 3) Liberty at 32 (B) fb Roundup + Dual Magnum (*S*-metolachlor) at 16 (C); 4) Liberty at 32 (B) fb Liberty + Dual Magnum (C); 5) Liberty at 32 (B) fb Roundup + Select (clethodim) at 12 + Dual Magnum + Agri-Dex (1% v/v) (C); 6) Liberty at 32 (B) fb Liberty at 32 + Select at 12 + Dual Magnum + Agri-Dex (C); 7) Liberty at 29 (B) fb Liberty at 29 + Select at 12 + Agri-Dex (C) fb Liberty at 29 (E); 8- Brake (fluridone) at 16 + Cotoran (fluometuron) at 16 (A) fb Liberty at 29 + Select at 12 + Agri-Dex (B) fb Liberty at 29 + Dual Magnum (D); 9) Weed-free check [Brake + Cotoran (A) fb Liberty at 29 + Dual Magnum (B) fb Liberty at 29 (D)]; and 10) Weedy check. Herbicide applications were done on May 12 for A (preemergence = PRE), June 14 for B (3- to 4-weeks after emergence), June 24 for C (2-weeks after B), June 29 for D (weed flowering), and July 6 for E (2-weeks after C). There was no cotton injury. Glyphosate-resistant Palmer amaranth control was 0% by August 16 (9 WAE) from the application of glyphosate at 32 oz/a at B (4-weeks after cotton emergence) application followed by (fb) glyphosate at C application (2-weeks after B) (Trt. 1) which indicate Palmer amaranth population in test area is glyphosate-resistant. Salvage treatment of Liberty (29 oz/a) at B application fb Liberty + Select Max at C application fb Liberty at E application (Trt. 7) provided 100% control of glyphosate-resistant Palmer amaranth which it is comparable with Brake + Cotoran at A (PRE) fb Liberty + Select Max at B fb Liberty + Dual Magnum at D application and with weed-free check. Cotton was harvested on November 4, 2022. As was mentioned previously, the first salvage treatments (application B) were applied 4-weeks after cotton emergence on June 14 where palmer amaranth was 8- to 22-in tall (treatment 2, 3, 4, 5, 6, and 7). The salvage herbicide program (treatment 7) Liberty fb Liberty + Select Max +Agri-Dex fb Liberty stopped glyphosate-resistant Palmer amaranth seed production (0%) as weed-free check plot did. The plot that received this salvage herbicide program provided 4,422 lb/A seedcotton yield which it was only 22% less seedcotton yield as compared to the weed-free-check plot (5,684 lb/A). Weed interference (weedy check) reduced seedcotton yield 98.8% as compared to weed-free check. The salvage herbicide program (Trt. 7) worked well with 4,422 lb/A seedcotton yield and provided not only 100% control of glyphosate-resistant Palmer amaranth, but also 100% reduced Palmer amaranth seed production (stopped seed deposition to the soil seedbank). Palmer amaranth seed deposition to the soil seedbank must be stopped/reduced for long-term weed management and delaying/stopping the evolution of herbicide-resistant weed.

Influence of Carrier Water pH and Hardness on Paraquat and Imazapic Efficacy for Spiderwort Control. OS Daramola*[1], P Devkota[2], GE MacDonald[3], R Kanissery[4], BL Tillman[5], H Singh[2]; [1]University of Florida/IFAS, Jay, FL, [2]University of Florida, Jay, FL, [3]University of Florida, Gainesville, FL, [4]University of Florida/IFAS, Immokalee, FL, [5]University of Florida, Marianna, FL (9)

Water is the primary solvent for herbicide applications. Unfavorable spray water pH and hardness can negatively affect herbicide efficacy. Tropical spiderwort (*Commelina benghalensis* L.) is an exotic invasive weed that poses a serious problem to crop production systems in the southern U.S. Due to its tolerance to many commonly used herbicides on peanut, successful management of tropical spiderwort will require the optimization of herbicides that have good activity on it. Therefore, two separate fallow experiments were conducted in the summer of 2022 to evaluate the effect of spray water pH and hardness on paraquat and imazapic efficacy for tropical spiderwort control. The experiments were conducted as randomized complete block designs with spray water pH adjusted to 5, 6, 7, 8, and 9 and water hardness adjusted to 0, 150, 300, 450, and 600 mg L^{-1} of $CaCO_3$ equivalent in four replications. Paraquat efficacy was reduced with spray water at pH 5, 8, and 9 compared with pH 6 and 7 at 2 and 4 weeks after treatment (WAT). Tropical spiderwort control and density reduction were improved when paraquat was applied at spray water pH 6 and 7 compared with pH 5, 8, and 9. Increasing spray water hardness from 0 to 150, 300, 450, or 600 mg L^{-1} resulted in 21% to 54% reduction in tropical spiderwort control with paraquat at 4WAT. The efficacy of imazapic on tropical spiderwort was not affected by spray water hardness but by spray water pH. Imazapic efficacy was at least 11% lower with spray water pH 9 compared with pH 5 at 2 and 4WAT. The results illustrate that spray water at acidic or alkaline pH and hardness =150 mg L^{-1} has the potential to reduce paraquat efficacy, while alkaline pH condition has the potential to reduce imazapic efficacy for tropical spiderwort control.

One-Pass Weed Management Programs in Mississippi Corn. T Bararpour*; Mississippi State University, Stoneville, MS (10)

A field study was conducted in 2022 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate one-pass herbicide application programs for glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*), entireleaf morningglory (*Ipomoea hederacea var. integriuscula*), prickly sida (*Sida spinosa*), broadleaf signalgrass (*Urochloa platyphylla*), and hemp sesbania (*Sesbania herbacea*) control in Mississippi corn (*Zea mays*). Corn (Pioneer 1718 VYHR) was planted on beds with 40-inch row spacing at a seeding rate of 2.5 seeds ft^{-1} on April 27, 2022 and emerged on May 3. The study was designed as a randomized complete block with 20 herbicide treatments and four replications. The herbicide programs contain eight preemergence (PRE), six postemergence (POST) at V2-V3, and six postemergence at V3-V4 corn stage. A weedy (nontreated) and weed-free check were included in the study. Corn Injury level was 0 to 5% for all herbicide treatments except for Halex GT (3.6 pt/A) + Sencor (4 oz wt/A) at final evaluation (July 13). Corn injury was 12% for this treatment. PRE: Acuron (*S*-metolachlor + atrazine + mesotrione + bicyclopyrone) at 80 fl oz/a applied preemergence provided 81, 95, 100, 95, 73% control of Palmer amaranth, entireleaf morningglory, hemp sesbania, prickly sida, and broadleaf signalgrass at 10 weeks-after emergence (WAE). Verdict (haloxyfop) at 10 fl oz/a + Zidua SC (pyroxasulfone) at 5 fl oz/a + AAtrex (atrazine) at 64 fl oz/a, Axiom (flufenacet + metribuzin) at 14 oz/A + AAtrex at 64 fl oz/A, and Axiom + Zidua (pyroxasulfone) at 5 fl oz/a as one-pass preemergence treatments provided comparable or better results as Acuron. Therefore, these treatments can be used as alternative treatments as Acuron. Corn yield was comparable too. POST (V2-V3): Halex GT (mesotrione + *S*-metolachlor + glyphosate) at 3.6 pt/a + AAtrex at 1.5 qt/a + COC at 1% v/v applied (one-pass) postemergence at V2-V3 stage of corn provided 100% control of all weed species by 10 WAE. ImpactZ (topramezone + atrazine) at 8 fl oz/a + AAtrex at 4 pt/a + Roundup PowerMax (glyphosate) at 32 fl oz/a + MSO at 0.25% v/v and Halex GT at 3.6 pt/a + Sencor (metribuzin) at 4 oz wt/a + COC provided comparable results in terms of broad-spectrum weed control (100% weed control) and corn yield as Halex GT + AAtrex + COC treatment. Therefore, these treatments can be used as alternative treatment as standard treatment (Halex GT + AAtrex + COC). POST (V3-V4): Halex GT at 3.6 pt/A + AAtrex at 1.5 qt/A + COC applied (one-pass) postemergence at V3-V4 stage of corn provided 100% control of Palmer amaranth, entireleaf morningglory, hemp sesbania, prickly sida, and broadleaf signalgrass by 10 WAE. ImpactZ + AAtrex + Roundup PowerMax + MSO provided comparable results in terms of broad-spectrum weed control and corn yield as standard treatment. Therefore, these treatments can be used as an alternative treatment as standard treatment for herbicide program at V3-V4 stage of corn. Weed interference (weedy check) reduced corn yield 65% as compared to the weed-free check plot. In conclusion, there are some one-pass herbicide programs (for preemergence and postemergence at V2-V3 or at V3-V4 stage of corn) as good as the standard treatment that could be used in weed management programs in Mississippi corn.

Effect of Low Rate of Dicamba on Tomato at Different Growth Stages. T Bararpour*[1], T Tseng[2]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Starkville, MS (12)

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 September 28, 2021. Tomatoes were emerged on October 02. Tomato seedlings were transplanted in a bigger pot (4" x 4" x 4.75") on October 18. 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. Tomato injury was greater at flowering stage than fruiting stage. Tomato injury increased as dicamba rate increased. Two WAA, still tomato at vegetative stage was most sensitive compared to the flowering or fruiting stage. Tomato at flowering stage was more sensitive to low rates of dicamba than fruiting stage. 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. Tomato injury was greater at flowering stage than fruiting stage. Tomato injury increased as dicamba rate increased. Tomato injury was 42, 17, and 9% as compared to non-treated check at vegetative, flowering, and fruiting stage (averaged over dicamba rates), respectively. Dicamba application at 1/16 X, 1/32 X, 1/64 X, and 1/128 X injured tomato 44, 34, 22, and 14% (averaged over tomato growth stage), respectively. The seedlings at the vegetative stage (application A= 5- to 6-leaf tomato with 9- to 10-inch in height) sprayed on October 28 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 November 16 and December 10, 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 January 24, 2022 and seedlings emerged on February 01. The tomato seedlings (F1 = progeny) were evaluated on February 09, 17, and 28 for any injury or dicamba symptomology. The tomato progeny (F1) which was evaluated three weeks did not show any type of 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, the sensitivity of tomato growth stages to lower rates of dicamba application was vegetative > flowering > fruiting. 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.

Paraquat-resistant Ryegrass (*Lolium perenne L. spp. multiflorum*) Confirmed in North Carolina. JH de Sanctis*, CW Cahoon, W Everman, T Gannon; North Carolina State University, Raleigh, NC (13)

Italian ryegrass is commonly found across most US agronomic regions. This important weed species can cause a significant yield loss if left uncontrolled. Adding to its troublesome nature, Italian ryegrass is capable of producing a large amount of seed and is an obligate outcrossing species, which account for greater genetic variability. Furthermore, in US, Italian ryegrass has evolved resistance to 6 herbicide modes of action. In the fall of 2020, the NCSU weed science team was informed that multiple North Carolina growers observed unsatisfactory control of Italian ryegrass after sequential burndown applications of paraquat. The objectives of this study were to confirm the evolution of paraquat-resistant Italian ryegrass biotypes and determine the level of tolerance in a whole-plant dose-response bioassay. Plants from three different locations that survived sequential application of paraquat under field conditions were grown in separate greenhouses for seeds. Progeny from populations collected in the field were seeded under greenhouse conditions along with seeds from four known susceptible populations. Treatments consistent of ten paraquat rates (0.0625X, 0.125X, 0.25X, 0.5X, 1X, 2X, 4X, 8X, 16X, and 32X) where the 1X treatment represents the maximum label rate of paraquat (840 g ai ha^{-1}) plus a nontreated check that was added for comparison. Plants were harvested at 28 days after application and dry biomass weights were converted to biomass reduction. Based on the effective dose required to reduce biomass by 50% (ED50), the putative paraquat-resistant Italian ryegrass biotypes were 21- to 60-fold resistant to paraquat compared to the averaged ED50 of susceptible populations. If converted to g ai ha^{-1}, the ED50 of putative paraquat-resistant population ranged from 633 to 1887 g ai ha^{-1} whereas the average ED50 of susceptible populations was 31.5 g ai ha^{-1}. This research confirms the evolution of paraquat-resistant Italian ryegrass in North Carolina.

Corn Response to Reduced Rates of Reviton. D Miller*[1], T Barber[2], J Bond[3], DO Stephenson, IV[4], AM Barfield[1]; [1]Louisiana State University AgCenter, St Joseph, LA, [2]University of Arkansas, Lonoke, AR, [3]Mississippi State University, Stoneville, MS, [4]Louisiana State University AgCenter, Alexandria, LA (14)

A field study was conducted in 2022 at the LSU AgCenter Northeast Research Station near St. Joseph, LA to evaluate impacts of reduced rates of Reviton (Tiafenacil) on corn growth and yield. The study was conducted in a randomized complete block design with treatments replicated three times. Treatments were applied via compressed air sprayer at 15 GPA. Treatments included a factorial arrangement of reduced rates of Reviton at 0x, 1/8x, 1/16x, 1/32x, 1/64x, 1/128x, and 1/256x rate applied to 2- or 4-leaf corn. The 1x rate basis for reduced rate calculation was 1 oz/A. MSO was added at 1% v/v to all treatments. A comparison 1% MSO alone treatment was included but resulted in no impacts on parameters measured in comparison to the 0x rate and therefore was excluded from analysis. Application was made to DKC 65-99 corn on April 19 and 27. Parameter measurements included visual injury 7, 14, and 28 DAT; plant height at 14 and 28 DAT; and yield.At 7 DAT, a significant application timing by reduced herbicide rate interaction was observed. With the exception of the 1/128 (13 and 15%) and 1/256 (5 and 6%) x rates, where injury was similar, all respective rates resulted in significantly greater injury at the 4-lf application timing (23 to 32%) in comparison to 2-lf (13 to 15%). At 14 DAT, averaged across reduced herbicide rate, injury was greater at the later timing (11 vs 5%). Averaged across application timings, with the exception of the lowest rate (3%), all rates resulted in equivalent injury ranging from 9 to 13%. At 28 DAT, averaged across reduced herbicide rate, injury was equivalent among application timings (4%). Averaged across application timings, all reduced rates resulted in equivalent injury ranging from 3 to 5%. At 14 DAT, averaged across application timings, corn height ranged from 48 to 55 cm and was not reduced by any treatment. At 28 DAT, averaged across application timings, corn height ranged from 111 to 115 cm and was not reduced by any treatment. Averaged across reduced herbicide rate, yield was equivalent regardless of application timing (185 and 189 bu/A). Averaged across application timings, corn yield ranged from 179 to 199 bu/A and was not reduced by any treatment.

Gene Copy Number Comparison Across Years: Glufosinate Survivors Vs. Sensitive Palmer Amaranth Plants. P Carvalho-Moore*[1], JK Norsworthy[1], F Gonzalez Torralva[1], LB Piveta[1], MC Souza[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (15)

Palmer amaranth [*Amaranthus palmeri* (S.) Wats.] has developed resistance to nine different herbicide modes of action. The latest case was glufosinate resistance confirmed in populations from Arkansas and North Carolina. The amplification and overexpression of chloroplastic glutamine synthetase (*GS2*) was confirmed to be the resistance mechanism in one highly resistant population from Arkansas. It is uncertain when this variation in the gene occurred, and this study aimed to verify if *GS2* copy number has been increasing over the years across Palmer amaranth populations with reduced susceptibility to glufosinate in comparison to accessions collected more than twenty years ago. Ten accessions from 2001 (A01 accessions) and thirteen accessions collected in 2020 or 2021 (A20 accessions) were selected for this experiment. A total of 75 plants per accession were treated with glufosinate at 575 g ai ha^{-1}, and mortality was assessed twenty-one days after treatment. Gene copy number assay was conducted with DNA extracted from nontreated plants and glufosinate survivors from A01 and A20 accessions, respectively. Three biological replications were extracted for each accession, and each DNA sample was assessed twice in each primer pair. Reference gene was used to calculate gene copy number. Three clusters were formed with the mortality data. Cluster 1 comprised accessions with mortality ranging from 96 to 100% and included two A20 accessions and all A01 accessions. Cluster 2 and 3 only included A20 accessions. Mortality ranged from 82 to 93% in cluster 2. Cluster 3 included two accessions with low mortality (52% and 68%). No significant difference was detected for gene copy number among the accessions when grouped by collection year. When comparing the response of Palmer amaranth populations from 20+ years ago to those recently collected, glufosinate mortality decreased greatly. Overall, it is undeniable that glufosinate efficacy has decreased among Palmer amaranth populations throughout the years. However, the mechanism behind this increased tolerance remains unclear.

Cotton Response to Reduced Rates of Reviton. D Miller*[1], T Barber[2], J Bond[3], DO Stephenson, IV[4], AM Barfield[1]; [1]Louisiana State University AgCenter, St Joseph, LA, [2]University of Arkansas, Lonoke, AR, [3]Mississippi State University, Stoneville, MS, [4]Louisiana State University AgCenter, Alexandria, LA (16)

Field studies were conducted in 2022 at the Dean Lee Research and Extension Center near Alexandria, LA, the LSU AgCenter Northeast Research Station near St. Joseph, LA, the Lon Mann Cotton Research Station in Marianna, AR, and the West Tennessee Research and Education Center in Jackson, TN to evaluate impacts of reduced rates of Reviton (Tiafenacil) on cotton growth and yield. Studies were conducted in a randomized complete block design with treatments replicated three or four times. Treatments were applied via compressed air sprayer at 15 GPA. Treatments included reduced rates of Reviton at 0x, 1/8x, 1/16x, 1/32x, 1/64x, 1/128x, and 1/256x rate. The 1x rate basis for reduced rate calculation was 1 oz/A. MSO was added at 1% v/v to all treatments. A comparison 1% MSO alone treatment was included but resulted in no impacts on parameters measured in comparison to the 0x rate and therefore was excluded from analysis. Application was made to 1 to 2 leaf cotton. Varieties and application dates were as follows: Alexandria, LA (DP2127 BG3XF; Planted 5-13; Treated 6-1); St. Joseph, LA (DP1646 B2XF; Planted 5-9; Treated 5-23); Marianna, AR (DP2127 BG3XF; Planted 5-11; Treated 6-20); and Milan, TN (DP2127 BG3XF; Planted 5-11; Treated 6-3). Parameter measurements included visual injury 7, 14, and 28 DAT; plant height at 14 and 28 DAT; and seed cotton yield.At 7 DAT, at Alexandria, greatest injury of 95% was observed at the highest rate. A significant stepwise reduction in injury was observed from the 1/16 to 1/64x rate (66, 36, 21%). The two lowest rates resulted in 18 and 5% injury. At Marianna, injury was greatest at the two highest rates (61 and 54%) while the 1/32x rate resulted in 43% injury, which was greater than all lower rates (10-13%). At Milan, injury was greatest at the two highest rates (92 and 83%). A significant stepwise reduction in injury was observed for each successive lower rate (63, 53, 40, and 20% to 20%). At St. Joseph, injury was greatest at the two highest rates (98%). The 1/16 and 1/32x rates resulted in 87 and 47% injury, respectively, and greater than lower rates (35 and 28%). At 14 DAT, at Alexandria, a significant stepwise reduction in injury was observed for each successive lower rate (97, 79, 65, 33, 20, and 0%). At Marianna, injury was greatest at the highest rate (68%). The 1/16 and 1/32x rates resulted in equivalent injury of 43 and 38%, respectively, and greater than all lower rates (8-11%). At Milan, a significant stepwise reduction in injury was observed for the three highest rates (87, 57, and 32%). Injury at lower rates ranged from 17 to 0%. At St. Joseph, injury was greatest at the two highest rates (98%). The 1/16 and 1/32x rates resulted in 83 and 53% injury, respectively, and greater than lower rates (30 and 20%). At 28 DAT, at Alexandria, a significant stepwise reduction in injury was observed for each successive lower rate (97, 79, 65, 33, 20, and 0%). At Marianna, injury ranged from 24 to 5% with only minor differences noted among treatments. At Milan, injury was greatest at the highest rate (90%). The 1/16 and 1/32x rates resulted in equivalent injury of 63 and 57%, respectively, and greater than all lower rates (10 to 0%). At St. Joseph, injury was greatest at the two highest rates (98%). The 1/16 and 1/32x rates resulted in 60 and 15% injury, respectively, and greater than lower rates (10%). At 14 DAT, at Milan, plant height was not significantly reduced. At St. Joseph, the five highest rates reduced height 99, 97, 64, 22, and 10%, respectively. At 28 DAT at Marianna, plant height was not significantly reduced. At Milan, plant height was reduced only at the 1/8 (55%), 1/16 (38%), and 1/32x (34%) rates. At St. Joseph, the four highest rates reduced height 82, 73, 43, and 21%, respectively. At Marianna, seed cotton yield was not significantly reduced. At Milan, seed cotton yield was only reduced at the highest rate (89%). At St. Joseph, seed cotton yield was reduced at the 1/8 (97%), 1/16 (96%), and 1/32x (63%) rates.

Multiple Herbicide Resistance in a Walter's Barnyardgrass (*Echinochloa walteri*) Population from Texas. TT Mundt*, G Elizarraras, I Ceperkovic, I Ceperkovic, MV Bagavathiannan, NK Subramanian; Texas A&M University, College Station, TX (17)

The genus *Echinochloa* (Poaceae) is one of the most important weed species in rice production systems worldwide. Walter's barnyardgrass (*E. walteri*) is a less common weed species in Texas rice; however, a suspected herbicide-resistant population of this species was identified in a rice field near Beaumont, TX. This study was aimed at evaluating this population's sensitivity to some commonly used rice herbicides. A total of 10 herbicides belonging to five different modes of action were tested at the recommended label rate (1X). These included cyhalofop, fenoxaprop, imazethapyr, bispyribac-sodium, penoxulam, nicosulfuron, quinclorac, florpyrauxifen-benzyl, propanil, and glyphosate. Four to six seedlings per treatment were sprayed at the three-to-four leaf stage using a track sprayer, and the experiment was repeated twice. The survival rate was documented at 28 days after the herbicide treatment. Following this, a confirmative assay was conducted with the 2.5X rate. Among the herbicides tested, resistance was documented for six different herbicides belonging to three different herbicide modes of action [acetolactate synthase (ALS)-inhibitors (imazethapyr, penoxsulam, bispyribac-sodium, nicosulfuron), auxin analog (quinclorac), and PSII-inhibitor (propanil)]. Molecular mechanisms and dose-response studies are currently underway to further characterize resistance. This is the first report of herbicide resistance in this species globally, and the development of alternative management options is imperative.

Sweepotato Response to Reduced Rates of Liberty Plus 2,4-D Choline. D Miller*, AM Barfield; Louisiana State University AgCenter, St Joseph, LA (18)

A field study was conducted in 2022 at the LSU AgCenter Northeast Research Station near St. Joseph, La with the objective to evaluate impacts of reduced rates of co-application of glufosinate (Liberty 280 SL) and 2,4-D choline (Enlist One) on sweetpotato. A four-replication factorial arrangement of treatments was used and included herbicide application timing (Factor A: 10 or 30 d after planting (DAP)) and reduced use rate (Factor B: 0 (nontreated), 1/8, 1/16, 1/32, 1/64, 1/128, or 1/256 of the use rate). The use rate utilized in reduced rate calculations was 0.66 kg ai/ha^{-1} for glufosinate and 1.06 kg ae/ha^{-1} for 2,4-D choline. Treatments were applied to each 3 x 7.62 m plot at the scheduled timing following planting of 'Orleans" sweet potato on June 9. Parameter measurements included visual crop injury (chlorosis, stunting, twisting, leaf crinkling) 7, 14, and 28 d after application (DAT), NDVI reading 42 DAT, and yield (U.S. #1, canner, jumbo, and total). A significant application timing by reduced herbicide rate interaction was observed for injury 7 DAT. At the 1/8 (75 vs 56%), 1/64 (20 vs 11%), and 1/256 (19 vs 4%) x rates, injury was greater at the earlier 10 DAP application timing. Injury was equivalent among application timings at the 1/16 (49 vs 43%), 1/32 (28 vs 21%), and 1/128 (18 vs 11%) x rates. At 14 DAT, a significant application timing by reduced herbicide rate interaction was observed. Injury was greater at the 10 DAP application timing at all rates: 1/8 (73 vs 54%), 1/16 (43 vs 28%), 1/32 (24 vs 18%), 1/64 (23 vs 7%), 1/128 (14 vs 5%), and 1/256 (10 vs 3%) x rates. At 28 DAT, a significant application timing by reduced herbicide rate interaction was observed. Injury was greater for the 10 DAP application timing only for the 2 highest reduced rates (40 vs 9 and 15 vs 4%, respectively). Injury was no greater than 3% and equivalent at all other rates for both timings.NDVI readings for treatments ranged from 0.876 to 0.889 and equivalent to the 0 rate (0.88).Averaged across reduced herbicide rate, US no. 1 yield was greatest at the 10 DAP application timing (197 vs 136 bu/A). Averaged across application timings, yield was only reduced at the two highest rates (63 and 44%, respectively). Averaged across reduced herbicide rate, canner yield was greatest at the 10 DAP application timing (115 vs 89 bu/A). Averaged across application timings, yield was only reduced at the highest rate (46%). Averaged across application timings, jumbo yield was only reduced at the two highest rates (92 and 78%, respectively). Averaged across reduced herbicide rate, total yield was greatest at the 10 DAP application timing (294 vs 197 bu/A). Averaged across application timings, yield was only reduced at the two highest rates (55 and 39%, respectively). Producers with multi-crop operations including sweet potato are cautioned to thoroughly follow all labeled sprayer cleanout procedures when previously spraying one of the combination herbicides evaluated or to devote separate spraying equipment. Producers are also cautioned to follow all label restrictions to prevent off target movement to adjacent sweet potato fields.

Alternatives to Glyphosate for Preplant Weed Control. WJ Stutzman*, EC Russell, K Bamber, ML Flessner; Virginia Tech, Blacksburg, VA (19)

Recent increases in glyphosate price and reduction in availability has created a necessity to identify alternative pre-plant burndown options. Thus, multiple trials were conducted to evaluate herbicide treatments for preplant burndown control cover crop and weeds. Trials were conducted as RCBD with three and four replications. Treatments consisted of combinations of the following: glyphosate; 2,4-D ester; paraquat; metribuzin; saflufenacil; glufosinate-ammonium; rimsulfuron and thifensulfuron methyl; clethodim; and tiafenacil. Cover crops and weeds evaluated consisted of annual ryegrass (Lolium multiflorum L.), crimson clover (Trifolium incarnatum L.), cereal rye (Secale cereale L.), and hairy vetch (Vicia villosa Roth). Speedwell (Veronica persica Poir.), mouse-ear chickweed (Cerastium fontanum Baumg.), and purple deadnettle (Lamium purpureum L.) were also rated for control. Visible control ratings were taken 7, 14, and 27 days after application (DAA). Data were subjected to ANOVA followed by means separation using Fishers protected LSD(0.05) for each species and timing. For annual ryegrass, paraquat, 2,4-D, and metribuzin, glyphosate, rimsulfuron and thifensulfuron, glyphosate and 2,4-D, and saflufenacil, rimsulfuron and thifensulfuron all provided significantly different control from the untreated check (>95%). In mouse-ear chickweed, all treatments were significantly different from the nontreated check except for glyphosate and 2,4-D at 7 DAA; 73.078 ml/ha of tiafenacil; 146.156 ml/ha of tiafenacil; and tiafenacil and clethodim at 27 DAA. In rye, only 2,4-D and clethodim, as well as 2,4-D, clethodim, and metribuzin at 7 DAA, were not significantly different from the check, with a majority of treatments providing > 95% control. In downy vetch, all treatments except for glyphosate, rimsulfuron, and thifensulfuron at 7 DAA and saflufenacil and clethodim, as well as paraquat dichloride, AMS, and MSO at 27 DAA were significantly different from the check, with 2,4-D, clethodim, and metribuzin, glyphosate, rimsulfuron and thifensulfuron, glufosinate, paraquat, 2,4-D, and metribuzin, and tiafenacil, glyphosate and 2,4-D all provided >95% control. All treatments showed a significant difference in crimson clover with tiafenacil, glyphosate and 2,4-D providing >95% control. All treatments but saflufenacil along with glyphosate, rimsulfuron, and thifensulfuron at 7 DAA and saflufenacil at 14 DAA were significantly different for control of purple deadnettle, of which paraquat, 2,4-D, and metribuzin, and tiafenacil with clethodim had the greatest control (>95%), while only 2,4-D, clethodim at 27 DAA wasn't significantly different in speedwell. These trials suggest that many herbicide combinations show promise for cover crop burndown comparable to that glyphosate, such as paraquat, 2,4-D, and metribuzin. Future studies should evaluate the efficacy of these treatments on a greater variety of Virginia weeds that are common before spring planting.

Absorption, Translocation, and Metabolism of 2,4-D in Resistant Palmer Amaranth (*Amaranthus palmeri* S. Wats.). J Hwang*[1], JK Norsworthy[1], LB Piveta[1], MC Souza[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (20)

Evolution of herbicide resistance in Palmer amaranth (*Amaranthus palmeri* S. Wats.) may be a major issue that can lead to reductions in yield and quality of crops. Recently, three Palmer amaranth biotypes with reduced sensitivity to 2,4-D (R1, R2, and R3) were confirmed in a preliminary experiment conducted to screen herbicide resistance in a greenhouse. In the present study, the putative-resistant (R) biotypes along with two 2,4-D-susceptible (S) biotypes were used to characterize reduced responses following treatment with 2,4-D at different dose rates and then investigate the herbicide resistance mechanisms. Based on the dose-response results obtained by evaluating mortalities of each biotype at 21 days after herbicide treatment, the mortality was greater in order of S1 = S2 > R3 = R1 = R2 indicating that the less mortality was the greater herbicide resistance. The mortality of R1 and R2 biotypes increased by treatment of malathion (cytochrome P450 inhibitor) and 4-chloro-7-nitrobenzofurazan [NBD-Cl; glutathione S-transferase (GST) inhibitor] followed by 2,4-D. However, the mortality of the R3 biotype was not affected by pretreatment of such broad-spectrum metabolic inhibitors. Absorption and translocation of 2,4-D were similar for S and all R biotypes over the entire 48-h experiment period. The 48-h metabolism of the herbicide was also similar between S (21%) and R3 (19%) biotypes. However, metabolism in R1 (48%) and R2 (68%) was 2 to 3 times greater than that in the S biotype. Thus, the evolution of 2,4-D resistance in R1 and R2 Palmer amaranth biotypes was likely associated with enhanced metabolism of herbicide by the activity of cytochrome P450s and GSTs. Further studies are needed to verify the presence of TSR mechanisms in all three R biotypes.

Characterization of Herbicide Injury in Cotton Using an Unmanned Aerial System. U Torres*[1], J Johnson[1], BB Sapkota[1], SA Nolte[2], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Extension, College Station, TX (21)

Herbicide-induced crop injury 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 Systems (UAS) equipped with multispectral imaging sensors may have the potential to aid in detecting and classifying 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. Additionally, the use of deep learning models may have the potential to classify the herbicide responsible for the injury. Field experiments were conducted in 2021 and 2022 at the Texas A&M Research Farm near College Station, TX, to classify 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 simulated drift rates (high, moderate, and low, all below 1X) was evaluated at three (15-, 30-, and 60-cm-tall) growth stages, along with a non-treated control. Herbicide treatments were applied with a CO2 pressurized backpack sprayer to conventional cotton using a TTI11002 (for auxins) or a TT11002 (all other herbicides) nozzle, at a spray volume of 140 L ha-1. A DJI Matrice 600 Pro® UAV equipped with a MicaSense RedEdge™ multispectral imaging sensor was flown weekly at an altitude of 20 meters, resulting in imagery with 1.4 cm pixel-1 spatial resolution. Treatment differences were assessed using the Normalized Difference Vegetation Index, Green Normalized Difference Vegetation Index, Secondary Modified Soil Adjusted Vegetation Index, and the Renormalized Difference Vegetation Index. Imagery for isoxaflutole, dicamba, and 2,4-D showed the greatest injury levels. Classification accuracy varied between treatments, with nicosulfuron having the highest classification accuracy. Results demonstrate that UAV-based multispectral imagery can be used for assessing herbicide-induced crop injury under field conditions. Research is ongoing to further improve classification accuracy and modeling with other convolutional neural networks.

Corteva New Residual Herbicide for PRE and POST Application in Soybean and Cotton. KA Backscheider*[1], DM Simpson[2], M Lovelace[3], D Ellis[4]; [1]Corteva Agriscience, Franklin, IN, [2]Corteva Agriscience, Indianapolis, IN, [3]Corteva Agriscience, Newcastle, OK, [4]Corteva agriscience - IFS, Arlington, TN (22)

Waterhemp (*Amaranthus tuberculatus*) and Palmer amaranth (*Amaranthus palmeri*) continue to be driver weeds in soybean production throughout the Midwest. With their long germination period, extended residual control is required for effective control of *Amaranthus* species. Group 15 herbicides are being tank mixed with postemergence herbicides in soybean to provide additional residual control of late emerging *Amaranthus* species. However, many group 15 herbicides can often cause crop response including necrosis and leaf deformation when applied POST in soybean. GF-5223 is a new herbicide developed by Corteva Agriscience and is a proprietary formulation of a group 15 herbicide for PRE and POST application in soybean. Trials were conducted in 2022 to evaluate soybean crop tolerance with POST application of GF-5223 at 1X and 2X rates compared to commercial group 15 herbicides including s-metolachlor, encapsulated acetochlor, and pyroxasulfone. Group 15 herbicides are often applied in combination with other herbicides including glyphosate, glufosinate, or 2,4-D choline. Therefore, two and three-way tank-mix combinations with common tank-mix partners were also evaluated. Minimal crop response to soybean (<10%) was observed with GF-5223 at 1X and 2X rates at 14 days after application (DAA) and continued to decline after this evaluation timing. Additionally, all tank-mix combinations averaged less than 15% crop response when averaged across all 7 locations at 14 DAA. GF-5223 will be the preferred residual tank-mix partner for the Enlist® weed control system, pending US EPA regulatory approval, and will be an important tool in managing resistant weeds such as waterhemp and Palmer amaranth.

Differential Effects of Shading on Hydrilla (*Hydrilla verticillata*) and Native Submersed Aquatic Species. CM Prince[1], J Ferrell[1], BP Sperry[2], DC Canfield*[1]; [1]University of Florida, Gainesville, FL, [2]US Army Corps of Engineers, Gainesville, FL (23)

Invasive floating plants, such as water hyacinth (*Eichhornia crassipes*), have environmental impacts (i.e., reduced gas exchange, changes in nutrient cycling, reduced light penetration) that can degrade habitat for native submerged aquatic vegetation (SAV). Invasive floating plants may also create conditions that facilitate the spread of invasive SAV, such as hydrilla (*Hydrilla verticillata*), which is more tolerant of shading than native SAV. Floating plant management is intended to reduce these negative effects and increase habitat suitability for native SAV. However, stakeholders have expressed concerns that chemical control of floating aquatic plants leads to a decline in native SAV coverage. Additionally, managers are concerned with the possibility of hydrilla invading open niches created by management, given its high growth rate compared to native plants. Here, we evaluated the effects of shading on the growth of three SAV species: two native species, eelgrass (*Vallisneria americana*) and Illinois pondweed (*Potamogeton illinoensis*), and hydrilla. We hypothesized that invasive hydrilla is more likely to survive shading from floating plants than native species, and that it will recover faster following the removal of shading stress. Ten pots per species were placed in 900 L mesocosms (8 mesocosms per species). Half of the mesocosms were covered with 90% shade cloth, while the remaining half remained uncovered as a control. Four pots per species were harvested prior to shading for baseline biomass. After shading was initiated, four pots per species were harvested every two weeks. Shade cloth was removed after eight weeks; four pots per species were harvested for a further ten weeks to evaluate recovery of SAV from shading pressure. The experiment was conducted twice, from December 2021- May 2022 and July 2022-October 2022, to account for seasonal conditions. Temperature and light were recorded for the length of the study. LOESS regression was used to demonstrate general trends. Biomass from shaded plants was normalized based on biomass data from the light treatment for each species and analyzed using linear regression. The results of this study will inform future research on how floating plants and their management affect SAV populations.

Yellow Nutsedge Tuber Production and Viability in Response to Postemergence Herbicides. E Begitschke*, C Wang, AA Young, KA Tucker, GM Henry; University of Georgia, Athens, GA (25)

Yellow nutsedge (*Cyperus esculentus* L.) is one of the most problematic turfgrass weeds due to its fast growth rate and high tuber production. Effective long-term control relies on translocation of systemic herbicides to underground tubers. Research was conducted at the Athens Turfgrass Research and Education Center in Athens, GA in 2022 to evaluate postemergence herbicides on tuber production and viability. Tubers were planted into 1 L pots containing a 2:1 mixture of Cecil clay loam soil and Wakulla sand. Plants matured in the greenhouse for 6 weeks before initial herbicide treatments were applied on 13 Jan. 2022 with sequential applications made 4 Feb. 2022. Pots were arranged in a randomized complete block design with five replications. Treatments included pyrimisulfan (Vexis) at 73 g ai ha^{-1} once or 49 g ai ha^{-1} twice, imazosulfuron (Celero) at 736 g ai ha^{-1} once or 420 g ai ha^{-1} twice, sulfentrazone + carfentrazone (Dismiss NXT) at 220 g ai ha^{-1} once or 141 g ai ha^{-1} twice, and halosulfuron (Sedgehammer +) at 70 kg ai ha^{-1} once or 35 kg ai ha^{-1} twice. A non-ionic surfactant was added to Celero at 0.25% v/v. At 8 and 11 weeks after initial treatment (WAIT), shoot dry biomass (g), tuber dry biomass (g), tuber number, and tuber viability (%) were measured. Dismiss NXT exhibited the quickest phytotoxicity. Two applications of Celero resulted in the greatest reduction in tuber number (81%) and tuber weight (85%), while one application of Dismiss NXT resulted in the greatest reduction in shoot biomass (71%). Viability of tubers that were recovered from each pot were reduced 48 to 70%, with the greatest reduction in response to Dismiss NXT. Although two applications of Vexis only resulted in tuber number and shoot biomass reductions of 66% and 38%, respectively, tuber weight reduction was 80%.

Impact of Cover Crop and Planting Date on Palmer Amaranth Emergence in Furrow-irrigated Rice. TA King*, JK Norsworthy, LB Piveta, CT Arnold; University of Arkansas, Fayetteville, AR (26)

With an increased adoption of furrow-irrigated rice (FIR) systems in Arkansas, additional herbicide applications may be necessary to control Palmer amaranth (*Amaranthus palmeri* S. Wats.) due to the prolonged germination period by the lack of a continuous flood. In crops such as soybean and cotton, cover crops have reduced Palmer amaranth emergence, mitigating some selection for herbicide resistance. In 2022, a field trial was conducted at the Milo J. Shult Agricultural Research and Extension Center in Fayetteville, AR, to determine the effect of cover crops and rice planting date on total Palmer amaranth emergence and rough rice yield. The cover crops in this study included none, cereal rye, wheat, Austrian winterpea, and hairy vetch, all seeded at recommended rates. Cover crops were terminated on March 28, 2022, and April 22, 2022, for the early and late plantings, respectively. Rice was planted on April 22, 2022, and May 13, 2022. For the first rice planting date, cover crop biomass ranged from 60 to 167 g/m^2. Biomass at the later rice planting date totaled 100, 250, 272, 332, and 412 g/m^2 for none, wheat, Austrian winter pea, hairy vetch and cereal rye, respectively. Palmer amaranth emergence, at both rice planting dates, was statistically greater in the Austrian winterpea treatment than both cereal cover crops. Rough rice yields were similar among treatments, ranging from 7,170 to 8,580 kg/ha. Findings from this research fail to show a weed control benefit for the evaluated cover crops in rice relative to the no cover crop treatment. Research should be conducted across additional site years to ensure greater confidence in the results observed in Fayetteville.

Fertility Impacts the Competitive Response of Common Lawn Weeds with Bermudagrass. C Wang*[1], E Begitschke[1], AA Young[1], KA Tucker[1], GM Henry[1], JD McCurdy[2], D Held[3]; [1]University of Georgia, Athens, GA, [2]Mississippi State University, Starkville, MS, [3]Auburn University, Auburn, AL (27)

Turfgrass covers more than 164,000 km^2 of land in the US, which includes residential, commercial, and institutional lawns, as well as recreational parks, golf courses, and sports field complexes. A healthy turfgrass system can provide a range of ecological functions; however, turfgrass is typically managed as a monoculture through the implementation of several cultural practices and the application of numerous products including fertilizers. Although these inputs are necessary for the production of a healthy, dense turfgrass stand, monocultures provide limited habitat and floral resources for pollinators. Adjustments to fertilization practices could further promote floral production and long-term persistence of common lawn weeds as a pollinator resource, but little is known about the competitive response of common lawn weeds to fertility in bermudagrass. Therefore, the objective of our research was to study the impact of fertility on perennial weed growth and floral production in a hybrid bermudagrass stand. Research was conducted at the Athens Turfgrass Research and Education Center in Athens, GA during the summer of 2022. White clover (*Trifolium repens* L.) and Virginia buttonweed (*Diodia virginiana* L.) were transplanted into 'IronCutter' hybrid bermudagrass maintained at 3.8 cm by removing a soil core with a golf course cup cutter and replacing it with a weed plug of similar size. Both weed species were obtained from local populations. Weed plugs were allowed to grow and acclimate for 2 weeks before fertility treatments were initiated on July 15, 2022. Fertilizer (18-12-6) was a granular material which were preweighed and applied by hand every four weeks. Four fertility levels [0 g (none), 12 kg (low), 24 kg (medium), and 48 kg N ha^{-1} (high)] were evaluated in a randomized complete block design with four replications. Plant lateral spread (two perpendicular measurements) and flower count data were recorded weekly over three months. Fertility significantly affected the floral production and lateral spread of both weeds. Virginia buttonweed lateral spread and floral production was greater than white clover, regardless of fertility. Virginia buttonweed floral production was greatest at low fertility, whereas white clover floral production was greatest at medium fertility. Virginia buttonweed and white clover both exhibited the largest lateral spread in response to low fertility. Although each weed species shows potential as a floral resource for pollinators, evaluation of competitive response of the same weeds in other species of turfgrass will further determine best management practices. Fertility may need to be limited if weed persistence and floral production is desired in order to maintain weed competition with bermudagrass.

Soybean Response to Volatility of 2,4-D and Dicamba in Humidome. E Gomiero Polli*, T Gannon, R Rogers, M LeCompte, K Ahmed; North Carolina State University, Raleigh, NC (28)

2,4-D and dicamba are post-emergence herbicides widely used to manage broadleaf weed species in agronomical crops. However, the volatilization potential of 2,4-D and dicamba has raised concern over the use of these herbicides near sensitive crops. Currently, there are multiple 2,4-D and dicamba formulations available in the market. The salt form, adjuvants, and other substances in the formulation can influence the volatilization potential of these herbicides. Therefore, the objective of this study was to evaluate the response of glufosinate-tolerant soybean to volatility of 2,4-D and dicamba formulations containing distinct salt forms in humidome. Field studies were conducted from July to November 2021 at the Lake Wheeler Road Field Laboratory of the North Carolina State University in Raleigh, NC. Experimental design consisted of a complete randomized block design with three replications and two independent runs. Herbicide solutions were prepared using commercial formulations of 2,4-D and dicamba. Herbicides were applied at 1681 and 560 g ae ha^{-1} of 2,4-D and dicamba, respectively, plus one untreated check. Humidomes consisted of two plastic containers fitted with plastic valves used to attach each side of the humidome to tubes connected to an air vacuum pump and an external air entrance. One air vacuum pump per block was used to provide an airflow of 2 L min^{-1} for each humidome throughout the study. Glufosinate-tolerant soybean plants were grown under greenhouse conditions and once the second trifoliate leaf was established (V2) the study was initiated. One day before the study initiation, sod was harvested from a bermudagrass field maintained at 6 cm tall and cut into 18 x 15 cm pieces. Sod was then placed into 19 x 16 cm aluminum trays. For each treatment, two trays of sod were sprayed using a three-nozzle handheld CO_2 pressurized backpack sprayer (Bellspray Inc., Opelousas, LA, USA) calibrated to deliver 304 L ha^{-1} through XR8002 nozzles (TeeJet Technologies Spraying Systems Co., Glendale Heights, IL, USA) at 124 kPa. To avoid cross-contamination, sod trays were sprayed 166 m away from the experimental site and then immediately transported to the experimental site in the back of a utility vehicle covered with a clean plastic sheet which was replaced between treatments. After placing the sod trays in the humidomes, soybean plants were carefully placed and centered between the sod trays to avoid any contact with sprayed material, and humidomes were sealed. Humidomes were opened 24h after application and soybean plants were transferred to the greenhouse. At 28 days after application (DAA), visual estimation of injury (VEI) was recorded. VEI data were subjected to analysis of variance in SAS software (Cary, NC) version 9.4, and treatment means were computed using Tukey's test procedure (a=0.05). Additionally, contrast analysis was conducted to compare formulations within herbicides. The highest injury was observed for dicamba treatments, DMA (72%) and DGA (64%), and the lowest for 2,4-D treatments, DMA (21%), choline (13%), and dual-salt (8%). While injury by 2,4-D alone treatments were lower than by pre-mixed treatments (57%), injury by dicamba alone treatments was higher than by pre-mixed treatments. The findings of this study suggest that dicamba (DMA>DGA) is more likely to volatilize and injure glufosinate-tolerant soybean than 2,4-D (DMA>choline>dual salt). Additionally, the addition of dicamba to formulation containing 2,4 increases its volatility potential.

Deposition Characteristics of Targeted Application Devices in Managed Turf. JM Peppers*, S Askew; Virginia Tech, Blacksburg, VA (30)

In intensively managed ornamental turf, such as golf course putting greens, few selective herbicides are labeled and most of these still carry substantial risk of turf injury. Broadcast application of selective herbicides in these management systems are often avoided in favor of targeted weed control techniques, such as hand cutting, dabbing, or spot spraying. Targeted-application devices (TAD), such as dabbers or spot sprayers, have been utilized in the turf and ornamentals industry for many years, but have never received scientific scrutiny. Turf managers desire to use TADs with selective herbicides to reduce collateral turf damage, use more effective herbicide rates on escaped weeds, and reduce chemical cost. These TADs, however, are marketed for use only with nonselective herbicides, and contain no reference to application volume or actual herbicide rate per unit area. In order to properly examine weed control efficacy of targeted applications, the output characteristics of TADs must be characterized. The objectives of this research were to characterize the amount and consistency of application volumes from several commercially available TADs and evaluate annual bluegrass control when selective herbicides are applied with a dabbing TAD. We hypothesized that herbicide output would be highly variable between devices, but consistent within a given device. We also hypothesized that herbicide applications would effectively control annual bluegrass when applied as a targeted application. Favoring our hypothesis, TADs varied greatly in application volume between devices, but contrary to our hypothesis, many of these devices also delivered inconsistent output between dabs. The Weed Wand Magic® deposited an average of 6894 L ha^{-1} which was significantly higher than all other devices. Jerry's Weed Stick® and the bingo dabber deposited the least volume at 3208 and 3957 L ha^{-1}, respectively. Statistical differences were also observed in the standard deviation of device output. The Weed Wand Magic® had a standard deviation of 4181 L ha^{-1} which was significantly higher than the deviation observed from all other devices. Dabbers, with the exception of the bingo dabber, had a higher standard deviation in application volume compared to the Jerry's Weed Stick sprayer standard deviation of 75 L ha^{-1}. Application inconsistency among dabbers was found to be correlated to fluid level within the device. As fluid was depleted, fluid pressure likely decreased reducing the dabbing output. Additionally, air disturbance due to the refilling of the device significantly increased fluid output at all fluid fill levels. In the annual bluegrass control study, dabber-applied glyphosate (2.24 kg ai ha^{-1}), paclobutrazol (1.12 kg ai ha^{-1}), amicarbazone (0.20 kg ai ha^{-1}) and mechanical removal controlled annual bluegrass >87% and more than all other treatments 28 days after treatment. Only glyphosate and hand removal injured creeping bentgrass greater than 30%. These data suggest that dabbers can offer commercially acceptable weed control and selective herbicides yield better turf injury profiles compared to nonselective herbicides or hand removal. Consistent application volumes from dabbers will depend on maintaining uniform gravitational pressure and air lock in the fluid reservoir.

Does PRE Herbicide Timing Affect the Control of Foxtail Species (*Setaria* Spp.) in Southern Forages? NT Basinger*, C Bocz, HC Lindell, S Shome; University of Georgia, Athens, GA (32)

Foxtail species (*Setaria* spp.) are becoming increasingly problematic in southeastern forages. Often forage producers recognize they have a foxtail problem when the plant produces a seed head resembling its namesake. PRE herbicides often are an effective option to limit the impact of foxtail in pastures but due to weather and other issues, the timing of these applications is in most cases too late to control early emerging cohorts. This study was conducted at the J. Phil Campbell Research and Education Center (JPCREC) in 2022 in a foxtail-infested bermudagrass pasture. Applications of indaziflam (70 g ai ha^{-1}), pendimethalin (4480 g ai ha^{-1}), and hexazinone (840 g ai ha^{-1}) were applied bi-weekly beginning February 1, with the last application on April 1. Cumulative emergence counts were conducted biweekly beginning April 1 through September 1 within ¼ m^2. Three harvests were conducted in June, July, and September and botanical separations (foxtail, bermudagrass, other) occurred from 2 ¼ m^2. Foxtail cumulative emergence was reduced with pendimethalin when compared to other herbicide treatments and the non-treated check regardless of timing. February 1 applications of pendimethalin delayed foxtail emergence until later in the season. The composition of bermudagrass was greatest for the first two harvests for indaziflam and pendimethalin treatments, but foxtail composition across all treatments was similar for the third harvest. Results suggest that producers may need to apply pendimethalin earlier than their current application timings. But may need to implement other methods of control (mowing, mid-season herbicide application) to further reduce seed production of later emerging foxtail cohorts.

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 (33)

Flumioxazin is crucial for peanut weed management across the United States with over 75% of growers applying it to control troublesome weed species. For maximum peanut yield, it is essential that weed control is maintained during weeks three through eight after planting. Peanut injury due to flumioxazin PRE applied has been noted under unfavorable moisture or weather conditions, but also due to delays in application as growers plant hundreds of hectares on their farms. Research in Georgia investigated the response of dryland peanut to flumioxazin PRE applied from 0 to 107 g ai ha^{-1} at 0 to 14 d after planting for cultivar GA-16HO. Trends at two locations during the 2020 through 2022 growing seasons indicated that as rate and time after planting of application increased, injury also increased. Over 50% injury was noted in Tifton and 24% in Plains during the 2021 growing season. Peanut pod yield decreased while flumioxazin rate increased and timing of application after planting was delayed in Tifton, but no differences were noted in Plains. The recorded injury coincided with large amounts of rainfall at both locations. It was also noted that peanut may be most sensitive to flumioxazin application injury between days seven and ten after planting.

Palmer Amaranth Management in Sorghum with Postemergence Herbicide Combinations.
CR White*, W Keeling; Texas A&M AgriLife Research, Lubbock, TX (34)

Grain sorghum (*Sorghum bicolor*) is an important rotational crop to cotton on the Texas High Plains. Palmer amaranth (*Amaranthus palmeri*) is the most common weed in grain sorghum grown in the region and there are limited postemergence (POST) options to control this troublesome weed compared to other agronomic crops. Trials were conducted in 2021 and 2022 at the Texas A&M AgriLife Research and Extension Center in Lubbock, Texas to evaluate efficacy of preemergence (PRE) and POST herbicide combinations to control Palmer amaranth. In both years, sorghum was planted mid-May and treatments were applied June 16. Applications were made to 3-4 inch weeds using a CO2-pressurized backpack sprayer calibrated to deliver 15 gallons per acre (GPA) with TurboTeeJet 11002 nozzles. In 2021, all plots were treated with Dual PRE, followed by (fb) POST treatments including atrazine alone, atrazine + Peak (0.33, 0.5, 0.67, 1.0 oz product/acre), atrazine + dicamba, atrazine + dicamba + Peak; atrazine + Gambit, and atrazine + Yukon. At 14 days after POST applications, the addition of either Peak or dicamba improved Palmer amaranth control compared to atrazine alone. No crop injury was observed by any treatment at any rating date. These treatments provided similar levels of control at 49 DAT, and the addition of Peak or dicamba to atrazine continued to improve Palmer amaranth control compared to atrazine alone. Peak tank-mixed with atrazine + dicamba also improved Palmer amaranth control. In 2022, Dual PRE tank-mixed with atrazine improved control compared to Dual alone. The addition of Peak or dicamba to atrazine POST enhanced Palmer amaranth compared to atrazine alone. Most effective control was achieved with Dual + atrazine PRE fb Peak or dicamba POST. Initial crop injury was observed with dicamba (<10%) but the injury declined as the season progressed. These results indicate that both PRE and POST herbicide applications are needed for season-long Palmer amaranth control in sorghum. Applying POST herbicide combinations can improve Palmer amaranth control compared to single herbicide treatments alone.

Using Unmanned Aerial System to Quantify Impact of Herbicide Drift on Peanut. P Devkota*[1], N Singh[1], JE Iboyi[2]; [1]University of Florida, Jay, FL, [2]University of Florida/IFAS, Jay, FL (36)

Peanut growth and yield can be negatively impacted by herbicide drift. The off-target movement of herbicides applied in other agronomic crops such as cotton, soybean, and corn can result in a significant yield reduction in peanuts The research was conducted to evaluate the impact of herbicide-drift on peanuts using an unmanned aerial system (UAS) and field-based measurements. The 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) peanuts. NDVI, peanut injury, yield, height, width, and leaf area index (LAI) were measured at 4 weeks after herbicide application. The Normalized Difference Vegetation Index (NDVI) was calculated from images collected with a multispectral camera mounted on a UAS. 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% of the label rate) applied at 25 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, canopy height, canopy width, and yield with R^2 of 0.71 to 0.85, 0.76 to 0.94, 0.89 to 0.94, and 0.66 to 0.69, respectively. Therefore, UAS-derived NDVI can be a helpful parameter to determine peanut injury and yield reduction caused by herbicide drift.

Integration of Cover Crop and Preemergence Herbicide for Early Season Weed Control in Cotton. YR Upadhyaya*[1], P Devkota[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL (37)

Early-season weed control is critical for crop establishment and to prevent weed competition during the critical weed-free period. High weed pressure increases the competition for resources and reduces crop yield. A field experiment was conducted with a randomized complete block split-split-plot design to evaluate the effect of cover crops and preemergence (PRE) herbicides for early-season weed control in cotton. The main-plot factors were four cover crop types (crimson clover, cereal rye, rye/clover mix, and weed-free winter fallow). The sub-plot factors were termination methods (rolled vs. standing), and the sub-sub-plot factors were PRE herbicides (Dual Magnum at 1.46 kg ha^{-1} vs. without herbicide). Data were collected for Texas panicum, tropical spiderwort, and sicklepod on the naturally established populations. The weed density data were collected from a 1-m^2 area between two middle rows of cotton at two and four wks after planting (WAP), and the weed biomass was harvested prior to the postemergence application of glyphosate at four WAP. Texas panicum biomass was significantly higher in clover (34.5g m^{-2}) compared to all other cover crop types (<29 g m^{-2}) at four WAP. Texas panicum biomass (30.63 g m^{-2}) was significantly higher without PRE herbicide compared to PRE applied herbicide (12.07 g m^{-2}). Tropical spiderwort biomass was also significantly higher without PRE herbicide (13.3 g m^{-2}) compared to PRE herbicide applied plot (1.8 g m^{-2}). Sicklepod, Texas panicum, and tropical spiderwort density were not affected by cover crop species or PRE herbicide treatment. Additionally, there was no differences between rolled and standing cover crop termination methods on weed density and biomass. Use of cover crop has potential to contribute to the integrated weed management in cotton production system.

Control of Common Ragweed (*Ambrosia artemisiifolia*) and Sicklepod (*Senna obtusifolia)* with Dicamba and Glufoisnate. EA Jones*, DJ Contreras, CW Cahoon, RG Leon, W Everman; North Carolina State University, Raleigh, NC (38)

Dicamba and glufosinate are among the few effective postemergence herbicides to control multiple herbicide-resistant weeds in southeastern U.S. cotton and soybean production. Field studies were conducted to determine the effect of weed size and the application of dicamba and glufosinate individually, mixed, or sequentially on common ragweed (*Ambrosia artemisiifolia)* and sicklepod (*Senna obtusifolia*) control. Sequential herbicide treatments were applied 7 d after the initial treatment. The tested weeds sizes predominantly did not affect weed control. The order of the herbicides in the sequential applications did not affect either species control. Additionally, sequential applications did not increase control compared to singular applied dicamba, glufosinate and dicamba + glufosinate. Dicamba + glufosinate additively controlled the weeds. The results of the experiment provide evidence that dicamba and glufosinate applied individually, mixed, and sequentially are effective on common ragweed and sicklepod found in the southeastern United States, but sequential applications may not be necessary if applied timely.

Evaluation of Spray Droplet Size for UAV Applications. AA Tavares*[1], DM Dodds[1], J Golus[2], B Vukoja[2], GR Kruger[3]; [1]Mississippi State University, Starkville, MS, [2]University of Nebraska-Lincoln, North Platte, NE, [3]BASF, Railegh, NC (39)

The crop protection unmanned aerial vehicle (UAV) was a new pesticide spraying technology adapted to the development of modern agriculture, however, droplets sprayed from the UAV sprayers have a higher risk of spray drift due combination of the downwash effect caused by the movement of the rotors with the volume of fine droplets generated by the spray nozzles. The tank solution shows as an important factor that changes the droplet spectra. The objective of this research was to determine the influence of different herbicide solutions on the droplet spectra of different nozzles. The current study was conducted in the wind tunnel of the Pesticide Application Technology Laboratory of the University of Nebraska-Lincoln in North Platte, Nebraska, USA. The experiment was carried out in a completely randomized design with a factorial arrangement of 3 × 8 × 2 treatments with three replications. The factors studied were three models of spray nozzles, eight solutions, and two carrier volumes. The application of herbicides mesotrione, 2,4-D, glufosinate, fomesafen, and glyphosate alone or in a mixture were used at the label rate and prepared to simulate an application rate of 28 and 94 L ha^{-1}. The applications were performed using the nozzle models XR110015, AIXR110015, and TTI110015 at a pressure of 275 kPa. The droplet spectra analysis for each treatment was achieved using a Sympatec HELOS-VARIO K/R droplet size detection system with an R7 lens that detects particles ranging from 9 to 3700 µm. The distance between the nozzle and the laser was 0.3 m. The system was coupled in a low-speed wind tunnel with a constant wind speed of 6.7 m s^{-1}. The collected parameters were $Dv_{0.1}$, $Dv_{0.5}$, and $Dv_{0.9}$. In addition, we recorded the percentage of the total volume sprayed that consisted of droplets with diameters =200 µm (V200) and 100 µm (V100) and Relative Span (RS). Spray ratings were based on the droplet spectra generated by reference nozzles that spray water according to the ASABE S572.1 standard. Data were submitted for analysis of variance and means compared using Fisher's. The interaction of the three factors was significant for all the variables analyzed. The highest $Dv_{0.5}$ resulted from applications made using a TTI110015 nozzle in a combination with 94 L ha^{-1}. Overall, applications using 2,4-D represent the highest value of droplet spectra (433 µm).

Effect of Tank-mix Sicklepod Extract and Herbicide Application on Weed Control and Deer Management in Soybean. Z Yue*[1], K Beneton[2], D Augusto[1], CA Snoddy[1], MW Shankle[1], T Tseng[1]; [1]Mississippi State University, Starkville, MS, [2]Oklahoma State University, Oklahoma, OK (40)

Deer browsing of soybean was widely documented in the US. This is not only because of the large acreage of soybean in the country (No. 2 in soybean production in the world) and the relatively high deer density but also because soybean leaves are a preferred food by deer. Deer repellents are the primary ways to protect soybean from deer browsing besides fencing, which is usually unfeasible as soybean fields are typically large. Deer repellents generally fall into three categories: animal products, such as egg-based products like Liquid Fence and Deer Pro; plant products, such as a mint product like Deer Out; and chemically synthesized, such as Hinder and Thiram. Plant-derived deer repellents are secondary plant metabolites that usually function as plant defense and are extracted as deer repellents. During the past five years, we have prepared sicklepod extract as a deer repellent, experimented in captive deer facilities and forest environments, and compared it with Liquid Fence (egg-based) in terms of deer repellency. To integrate deer management with weed control in the soybean production system, we tested numerous tank-mix combinations of deer repellents and glyphosate herbicide. The advantage of this project was the possible integration of the deer repellent into the soybean production system, with no need for additional change and cost. The results showed the tank mix treated soybean had lower deer browsing than the herbicide only treatments but repellents only treated soybean showed even lower deer browsing due to weed shielding effects. From the results, we understand that the experiments must be conducted at weed-free conditions since weeds interfered with deer browsing.

Effect of Nitrogen Rate and Preemergence Herbicide on Weed Control in Industrial Hemp. S Mathew*[1], P Devkota[1], YR Upadhyaya[2], S Regmi[1], OS Daramola[3], N Singh[1]; [1]University of Florida, Jay, FL, [2]University of Florida, Gainesville, FL, [3]University of Florida/IFAS, Jay, FL (41)

Industrial hemp (*Cannabis sativa* L.), has been introduced as an alternative crop in many U.S. states including Florida. As a recently introduced crop in the U.S., there is limited information regarding nutrient-related weed dynamics in industrial hemp. A study was conducted at University of Florida, West Florida Research and Education Center at Jay, Florida during the summer of 2022. Treatments consisted of factorial arrangements of three nitrogen rates applied in the form of urea (0, 84, and 168 kg ha-1) and two preemergence herbicides (*S*-metolachlor and pendimethalin). S-metolachlor effectively controlled barnyardgrass (92%) and tropical spiderwort (52%) compared to pendimethalin (85 and 12% respectively) at 4 weeks after planting (WAP). The results illustrated that nitrogen applied at a higher rate (168 kg ha-1) resulted in significantly greater barnyardgrass (92%), Texas panicum (94%), and large crabgrass (93%) control compared to a lower rate (0 kg ha-1) of nitrogen (70%, 77%, and 71% respectively) at 8 WAP. Texas panicum was effectively controlled by S-metolachlor and pendimethalin, i.e., (>78%) at 4 WAP and >86% at 8 WAP. At 4WAP, weed biomass was significantly lesser in S-metolachlor applied plots for barnyardgrass (0.6 g), crabgrass (0.007 g,) and Texas panicum (0.9 g) compared to weedy check (11.9 g, 15.0 g, and 13.1 g respectively). Hemp height (204.5 cm) was significantly higher with 168 kg ha-1 N compared to 84 (174.6 cm) and 0 (108.2 cm) kg ha-1 N at 4 weeks after top-dress application. Hemp height was greater (135.1 cm) in *S*-metolachlor compared to pendimethalin applied plots (129.2 cm) and weedy check (86.3 cm). The hemp biomass was in correspondence with the plant height, and it was significantly higher at 168 kg ha^{-1} N (10.91 g) compared to 84 kg ha^{-1} N (9.3 g) and 0 N (4.9 g) kg ha^{-1} N. Optimum nitrogen rate with *S*-metolachlor as a PRE-herbicide has potential to control problematic grass weeds and enhance biomass yield for industrial hemp production.

Volatility Reduction Agents Influence on Dicamba and Glyphosate Spray Solution pH, Droplet Dynamics, and Weed Control. K Kouame*[1], TR Butts[1], R Werle[2], WG Johnson[3]; [1]University of Arkansas, Lonoke, AR, [2]University of Wisconsin-Madison, Madison, WI, [3]Purdue University, West Lafayette, IN (42)

Regulations in 2021 required the addition of a volatility reduction agent (VRA) to the latest dicamba formulation spray mixtures (Engenia, XtendiMax, Tavium); however, little was known on VRA's influence of various important application aspects. Laboratory and field experiments were conducted in 2021 across multiple locations (Rohwer, Arkansas, Lafayette, Indiana, and Arlington, Wisconsin) to evaluate the spray solution pH, weed control, and droplet dynamics (droplet size and velocity) of dicamba (Engenia®, 560 g ae ha^{-1}) and glyphosate (Roundup PowerMax II, 1261 g ae ha^{-1}) alone and in mixture as affected by VRAs [potassium acetate (VaporGrip® Xtra Agent, 1.5 L ha^{-1}) and potassium carbonate (Sentris, 0.6 L ha^{-1})]. Herbicides were applied with CO_2 backpack sprayers calibrated to deliver 140 L ha^{-1} and equipped with TTI 110015 nozzles. Visual assessments of weed control were taken 2 and 4 weeks after herbicide application (WAA). Additionally, density counts and weed biomass were recorded 4 WAA. The droplet size and velocity measurements were made using the VisiSize P15 Portable Droplet Image Analysis System installed within a Generation 4 Research Track Sprayer, equipped with a single TTI 110015 nozzle, and operated at 276 kPa. Results showed that adding glyphosate to dicamba decreased the solution pH by 0.63 to 1.85 units. Across locations, potassium carbonate increased the tank-mixture pH by 0.85 to 1.65 units, while potassium acetate raised the pH by 0.46 to 0.53 units. Glyphosate and dicamba in tank-mixture reduced Palmer amaranth control in Arkansas by 14 percentage points compared to dicamba alone. The tank-mixture also decreased barnyardgrass control by 12 percentage points compared to glyphosate alone 4 WAA in Arkansas. VRAs resulted in a 5-percentage reduction in barnyardgrass control 4 WAA. Common ragweed, common lambsquarters, and giant ragweed control were unaffected by herbicide solution nor VRA 4 WAA. Potassium acetate produced a larger droplet size than potassium carbonate for the $D_{v0.1}$ and $D_{v0.5}$ (droplet diameters in which 10 and 50% of the spray volume are of lesser diameters, respectively). Adding glyphosate to dicamba decreased droplet size from the entire spray droplet spectrum ($D_{v0.1}$, $D_{v0.5}$, $D_{v0.9}$). Mixing dicamba and glyphosate resulted in a reduction in spray pH, droplet size, and weed control leading to potential increases in volatility, physical drift, and weed escapes. Avoiding tank-mixtures of these herbicides and applying them sequentially to maximize effectiveness may be advisable. VRAs differed in their impacts on spray solution pH and droplet dynamics but resulted in a minimal negative to no effect on weed control. Keywords: VRA, tank-mixture, pH, antagonism, droplet size, droplet velocity

Control of ALS- and PPO-inhibiting Herbicide-resistant Redroot Pigweed (*Amaranthus retroflexus*) Populations with Common Postemergence Herbicides. EA Jones*, DJ Contreras, CW Cahoon, RG Leon, W Everman; North Carolina State University, Raleigh, NC (43)

Recently, two distinct ALS- and PPO-inhibiting herbicide-resistant redroot pigweed (*Amaranthus retroflexus*) populations were confirmed in North Carolina. The Camden County population carried a Trp_{574}Leu mutation in the *ALS* gene and Arg_{98}Gly mutation in the *PPX2* gene. The Pasquotank County population carried a Pro_{197}His mutation in the *ALS* gene and no mutation in the *PPX2* gene. Farmers in proximity to the fields where these populations were identified asked what herbicide(s) were still effective on these two redroot pigweed populations. Atrazine, glyphosate, glufosinate, mesotrione, 2,4-D, and dicamba were applied postemergence to plants from both populations with a discriminating rate. No plants from either population survived glufosinate treatment. 2,4-D and dicamba-treated plants exhibited survival 21 d after treatment but were controlled 28 d after treatment. The Pasquotank County population exhibited 17 and 37% survival when treated with atrazine and mesotrione, respectively. The Camden County population exhibited 0% and 14% survival when treated with atrazine and mesotrione, respectively. The Camden and Pasquotank County population were effectively controlled with glyphosate but a population from Yadkin County exhibited 13% survival. Subsequent dose-response assays were conducted with glyphosate and mesotrione to determine if the Yadkin and Pasquotank County populations were resistant, respectively. The lethal glyphosate dose to control 50% of the plants from Yadkin County was significantly higher (approximately two-fold) than the other tested populations. The lethal mesotrione dose to control 50% of the plants from Pasquotank County was significantly higher (approximately ten-fold) than the other tested populations. The results of the experiment provide effective herbicides to control ALS- and PPO-inhibiting herbicide-resistant redroot pigweed found in North Carolina, but two additional glyphosate- and mesotrione-resistant populations have been confirmed in the state. More research is needed to determine if the Pasquotank County population is atrazine-resistant.

The Efficacy and Synergistic Effect of Allelocompounds (Coumarin and Chlorogenic Acid) with Glyphosate- Resistant Palmer Amaranth. AL Miller*, T Tseng, V Varsha, JC Argenta, Z Yue, W Segbefia, TR de Oliveira, NA Maphalala; Mississippi State University, Starkville, MS (44)

Weedy plant species have been and continue to be an extreme issue affecting crops, including cotton. A specific weed species of a major nuisance to cotton (*Gossypium hirsutum*) is Palmer amaranth (*Amaranthus palmeri*). Palmer amaranth's unfortunate ability to form herbicide resistance has created a dire need for alternative methods that are more sustainable in controlling weed populations. Naturally occurring chemicals exudated from plants, known as allelochemicals, can be useful in suppressing weeds and positively influencing crop growth. Two naturally occurring allelochemicals, chlorogenic acid and coumarin, were tested as potential bioherbicides on Palmer amaranth. These two chemicals were either used alone or in combination with glyphosate to determine the synergistic or antagonistic effect, if any, on Palmer amaranth. Among the treatments, coumarin + glyphosate caused epinasty of Palmer amaranth stems, similar to symptoms of benzoic acid (such as dicamba). Future research on this topic will look at different rates of allelochemical in the mix and the addition of different nonionic surfactants to the treatments. The information from this study may be effective in combating herbicide-resistant weed species, including Palmer amaranth.

Use of a Fenclorim Seed Treatment to Safen Wheat to Metolachlor. SC Noe*[1], JK Norsworthy[2], TH Avent[2], NH Reed[2], CT Arnold[2], TR Butts[3]; [1]University of Arkansas, Fayetteville, KY, [2]University of Arkansas, Fayetteville, AR, [3]University of Arkansas, Lonoke, AR (45)

Italian ryegrass [*Lolium perenne* L. ssp. *multiflorum* (Lam.)] is one of the most problematic weeds of wheat (*Triticum aestivum* L.) production in the midsouthern U.S. Italian ryegrass interference in wheat can result in substantial yield loss and highlights the importance of season-long residual control. S-metolachlor is a WSSA Group 15 herbicide that provides residual control for grasses; however, wheat injury is possible from this herbicide. Experiments were conducted in the Fall of 2022 at the Milo J. Shult Research and Extension Center using two wheat varieties 'Smith's Gold' and 'Croplan 9606' to evaluate the tolerance of wheat to S-metolachlor with three rates of a fenclorim seed treatment (0, 0.5, or 2.0 g ai kg-seed) to delayed preemergence herbicide applications. Two formulations of S-metolachlor, an emulsifiable concentrate (EC) and a capsule suspension (CS), were evaluated at various rates of metolachlor (0, 370, 750, or 1,120 g ai ha^{-1}) to determine efficacy in wheat. Wheat injury was highest when averaged over herbicide treatments with the 2.0 g ai kg-seed rate of fenclorim 28 DAT with 16% for both 'Smith's Gold' and 'Croplan 9606' varieties. While the fenclorim rate of 0.5 g ai kg-seed showed a reduction in injury compared to the higher rate of fenclorim, there was no significant difference from the nontreated seed with either variety. As the rate of S-metolachlor increased, control of Italian ryegrass also increased, with no notable effect of formulation. While S-metolachlor provides effective residual control of Italian ryegrass, more work is needed to determine an effective rate of fenclorim for adequate herbicide safening.

Influence of Adjuvants on Hexazinone Efficacy for Smutgrass Control. S Regmi*[1], P Devkota[1], BA Sellers[2], J Dubeux Jr[3], CA R. Sales[2], S Mathew[1], OS Daramola[4]; [1]University of Florida, Jay, FL, [2]University of Florida, Ona, FL, [3]University of Florida, Mariana, FL, [4]University of Florida/IFAS, Jay, FL (46)

Giant smutgrass (*Sporobolus jacquemontii* K.) is a vigorously growing perennial weed species that commonly infests bahiagrass pastures in Florida and other areas of the Southeastern United States. Hexazinone is the only herbicide labeled for selective smutgrass control in bahiagrass pastures. However, its expensive nature and fluctuating activity under low and high rainfall conditions warrants ways of improving its efficacy. A field experiment was conducted in 2022 in smutgrass-infested bahiagrass pasture near Ona, FL to test the influence of adjuvants on hexazinone activity. Hexazinone at 0.56 and 1.12 kg ha^{-1} was applied with five different adjuvants: BrakeThru at 5% v/v, Grounded at 1% v/v, Hydrovant fA at 0.1% v/v, NanoPro at 0.1% v/v, and Sorbyx at 0.3% v/v in August. As expected, hexazinone applied at 1.12 kg ha^{-1} resulted in greater smutgrass control compared to 0.56 kg ha^{-1}. The hexazinone rate by adjuvant was significant for smutgrass visual rating. Hexazinone at 0.56 kg ha^{-1} showed highest damage of 40% with the adjuvant BrakeThru while hexazinone at 1.12 kg ha^{-1} applied with Sorbyx resulted 80% smutgrass damage. Although two adjuvants; NanoPro and Sorbyx when applied with 1.12 kg ha^{-1} resulted in at least 70% control and 50% density reduction, it wasn't statistically different from hexazinone applied without a surfactant. Collectively, these data suggest that these particular adjuvants were unable to enhance hexazinone activity.

Weed Management in Corn without Atrazine. LN Vallee*[1], DO Stephenson, IV[1], C Webster[2]; [1]Louisiana State University AgCenter, Alexandria, LA, [2]Louisiana State University AgCenter, Baton Rouge, LA (47)

In 2022, the evaluation of herbicide management programs in corn in the absence of atrazine or glyphosate was conducted at LSU AgCenter Dean Lee Research and Extension Center in Alexandria, La. The study was a randomized complete block that consists of 12 treatments with 4 replications. Preemergence (PRE) treatments were dimethenamid-P:saflufenacil at 611:11 g ai ha^{-1}, isoxaflutole:thiencarbazone-methyl at 92:37 g ai ha^{-1}, pyroxasulfone at 146 g ai ha^{-1}, rimsulfuron:thifensulfuron-methyl at 18:18 g ai ha^{-1}, and *S*-metolachlor at 2140 g ai ha^{-1} Postemergence (POST) treatments were dicamba:diflufenzopyr at 308:120 g ae ha^{-1}, mesotrione at 105 g ai ha^{-1}, mesotrione:rimsulfuron at 87:21 g ai ha^{-1}, nicosulfuron:rimsulfuron at 41:18 g ai ha^{-1}, tembotrione:thiencarbazone-methyl at 76:15 g ai ha^{-1}, and topramezone at 37 g ae ha^{-1}, and were applied to 20 cm corn.. All treatments were applied with a tractor mounted; compressed air sprayer calibrated to deliver 140 L ha^{-1} at 241 kPa. Visual control of barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv], ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.], Palmer amaranth [*Amaranthus palmeri* (S.) Wats], and prickly sida (*Sida spinosa* L.) control at 28 d after PRE (DAPRE), 28 d after POST (DAPOST), and at harvest. At 28 DAPRE, rimsulfuron:thifensulfuron-methyl controlled Palmer amaranth 66% and *S*-metolachlor controlled ivyleaf morningglory 85%. All other PRE treatments provided at least 95% control of barnyardgrass, ivyleaf morningglory, Palmer amaranth, and prickly sida. Only nicosulfuron:rimsulfuron and topramezone provided greater than 80% barnyardgrass control at 28 DAPOST. Dicamba:diflufenzopyr and topramezone provided Palmer amaranth control greater than 80% 28 DAPOST. All other treatments at 28 DAPOST provided at least 89% prickly sida control. At harvest, none of the PRE treatments provided greater than 70% control of barnyardgrass. Isoxaflutole:thiencarbazone-methyl and *S*-metolachlor PRE provided greater barnyardgrass control than dimethenamid-P:saflufenacil and pyroxasulfone PRE at harvest. All PRE treatments controlled ivyleaf morningglory at least 88% at harvest. At harvest, rimsulfuron:thifensulfuron:methyl controlled Palmer amaranth 48%, but all other PRE-treatments controlled Palmer amaranth at least 89% at harvest. At harvest, all PRE treatments provided 95% or greater control of prickly sida except *S*-metolachlor which provided 70% control. At harvest, the POST treatments, topramezone and nicosulfuron: rimsulfuron controlled barnyardgrass at 84 and 74%, respectively. All other POST treatments provided 50% or less barnyardgrass control. All POST treatments at harvest controlled ivyleaf morningglory 90% or greater. All POST treatments at harvest controlled Palmer amaranth at least 70%, but only dicamba:diflufenzopyr and topramezone differed from nicosulfuron:rimsulfuron. At harvest, all treatments provided at least 70% control, but POST treatment mesotrione controlled prickly sida greater than nicosulfuron:rimsulfuron and topramezone at harvest. No differences in yield was observed among all treatments. Study will be repeated in 2023.

Comparison of POST Applied Topramezone and Mesotrione with and without Atrazine for Weed Management in Corn. SB Stoker*[1], DO Stephenson, IV[1], C Webster[2]; [1]Louisiana State University AgCenter, Alexandria, LA, [2]Louisiana State University AgCenter, Baton Rouge, LA (48)

A study was conducted in 2022 at the LSU AgCenter Dean Lee Research and Extension Center near Alexandria, LA to compare POST applied topramezone and mesotrione with and without the addition of atrazine or atrazine plus *S*-metolachlor in corn. The experimental design was a 3x3+1 augmented factorial arrangement of treatments within a randomized complete block design with four replications. Factor A consisted of two HPPD- inhibiting herbicides, topramezone at 25 or 37 g ai ha^{-1} and mesotrione at 110 g ai ha^{-1}. Factor B consisted of no atrazine, atrazine at 560 g ai ha^{-1}, and atrazine plus *S*-metolachlor at 560 plus 1420 g ai ha^{-1}. A nontreated was included for comparative measures. All herbicide treatments were applied to 20 cm corn with a tractor mounted small plot sprayer calibrated to deliver 140 L ha^{-1} at 241 kPa. Visual control evaluations were collected for barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv], ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.], and Palmer amaranth [*Amaranthus palmeri* (S.) Wats] at 4 and 28 d after treatment (DAT). In addition to visual control ratings, crop injury ratings were also obtained with no crop injury reported observed. Corn yield was also collected. At 4 and 28 DAT, an increase in barnyardgrass control was observed when both HPPD inhibitors were co-applied with atrazine or atrazine plus *S*-metolachlor versus HPPD inhibitors applied alone. Control of barnyardgrass was 95% when either atrazine, compared to 89% control when HPPD inhibitors were applied alone 4 DAT. At 28 DAT, results suggested both use rates of topramezone provide greater barnyardgrass control when compared to mesotrione. At 4 and 28 DAT, all HPPD inhibitor treatments that included atrazine or atrazine plus *S*-metolachlor provided greater control of ivyleaf morningglory versus HPPD inhibitors applied alone. At both evaluation dates, similar Palmer amaranth control was observed when topramezone was applied alone at 37 g ai ha^{-1} and topramezone treatments that included atrazine or atrazine plus *S*-metolachlor, with at least 97% control 28 DAT. No yield differences were observed among treatments with mean yield ranging from 11,154 kg ha^{-1} to 12,249 kg ha^{-1} of corn. Based on preliminary results from 2022, when HPPD inhibitors are co-applied with atrazine or atrazine plus *S*-metolachlor greater weed control is observed. This study will be repeated in 2023.

The Quest for Selective Thermal Weed Control in Managed Turf System. N Godara*, S Askew, CG Goncalves; Virginia Tech, Blacksburg, VA (49)

Thermal weed control could be utilized as an alternative to chemical tools for managing problematic weeds. Only one peer-reviewed manuscript could be found regarding flame weed control in ornamental turf. Based on the paucity of scientific evidence for utilizing thermal weed control in turfgrass, we conducted field experiments evaluating direct flame exposure of cool-season and warm-season turfgrass species and weeds. Experiments were conducted in 2020 and 2021 in Blacksburg, VA, to examine the efficacy of flame-exposure duration for weed control in bermudagrass (*Cynodon dactylon*), hard fescue (*Festuca longifolia*), Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*), tall fescue (*Festuca arundinacea*), and zoysiagrass (*Zoysia japonica*). Treatments included uniform flaming of 1.1 m^2 turf plots for 1, 2, 3, and 4 minutes with a propane torch with 10-cm-wide flame. These durations of exposure would be approximately equivalent to the torch head operating linearly at 0.64, 0.32, 0.16, and 0.008 km/h, respectively. Data on weed control and turfgrass recovery were collected and analyzed. Almost all above-ground vegetation was incinerated by flame exposure regardless of exposure level. Bermudagrass and Kentucky bluegrass recovered the fastest among turfgrasses tested, and had 60% green turf cover 2 WAT and 90 to 95% green cover 3 WAT regardless of flame duration. In terms of general speed of recovery, tall fescue and zoysiagrass lagged approximately 1 and 2 weeks, respectively, behind that of bermudagrass and Kentucky bluegrass, and their recovery was also not dependent on flame duration. However, hard fescue and perennial ryegrass recovery was flame-duration dependent. After 9 weeks of recovery time, these grasses only reached greater than 80% green cover following 1-minute flame duration. At 4 minutes of flame duration, maximum green cover of perennial ryegrass and hard fescue 9 WAT was not more than 50%. Common chickweed was completely controlled regardless of flame duration. Annual bluegrass and white clover were controlled up to 85% depending on flame duration. Buckhorn plantain, dandelion, and horseweed were initially burned back by flaming but recovered by 7WAT regardless of flame duration. Among weeds tested, white clover was the most strongly divergent with respect to flame duration. At least 3 minutes of flame duration was needed for commercially acceptable control 9 WAT while white clover completely recovered following 1 or 2 minutes of flame exposure. These studies indicate that common turfgrass species vary in their response to flame, and weeds that lack robust tillering and perennial structures are controlled best by flame. General observations suggest that selective weed control by direct flame may vary with ambient temperatures and soil moisture level.

Prickly Sida Control in Cotton and Soybean. JL Reeves*, L Steckel; University of Tennessee, Jackson, TN (50)

Prickly 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 field study was conducted in 2022 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 – 5 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 preemergence or postemergence treatments 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, the postemergence control application of glyphosate + dicamba had less control compared to glyphosate + dicamba + pyrithiobac-sodium. In the soybean experiment there was a difference between treatments when rated at 21 days after application. Glyphosate + dicamba + flumetsulam (0.30 oz) had the highest control and glyphosate + dicamba provided less control. Control of prickly sida at 85 % or higher was observed across all treatments.

Weed-suppressing Potential of Sweetpotato Varieties Under Field Conditions. V Varsha*[1], W Segbefia[1], Z Yue[1], P Sharma[1], CJ Morris[2], MW Shankle[1], T Tseng[1]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Pontotoc, MS (51)

Weed interference poses a major threat to sweetpotato production by limiting the root yield and quality. The restricted use of synthetic herbicides makes weeds more difficult to control in organic production. A more sustainable approach to weed management is critical in agriculture to meet the growing need to feed the global population. The current study was conducted at two locations, Pontotoc and Starkville in Mississippi, under field conditions to determine the allelopathic effect of sweetpotato varieties on weed density. Five sweetpotato varieties (Heart-O-Gold, Centennial, Hatteras, Morado, and 529) previously confirmed to be allelopathic in a greenhouse experiment, plus a standard commercial cultivar, Beauregard (B14), were planted in two-row plots. The experiment was carried out in a randomized block design with four replications at both locations. Seeds of three weed species (Palmer amaranth, yellow nutsedge, and goosegrass) were sowed between the planted rows of each plot three weeks after transplanting. Weed cover by weed species was recorded at 14, 21, and 28 days after sowing (DAS) of the weed seeds, which included the native weeds present in the fields. At 14 DAS, only the native weeds could grow in the plots, and the growth of the native weeds was 20-90% higher even at 21 and 28 DAS than the three weed species under study. Analysis of variance showed that at 21 and 28 DAS, only broadleaf signalgrass cover was significantly variable in the presence of different sweetpotato varieties. At 21 DAS, varieties Morado and 529 reduced the overall weed density (%) by more than 65% compared to the weed control plot at both locations. At the Pontotoc location, weed density was highest in the presence of the variety Heart-O-Gold, followed by Beauregard. In Starkville, the overall weed density was lower in the presence of the five varieties than the commercial variety Beauregard. The findings of this study will help in identifying sweetpotato varieties able to suppress the growth of different weeds in the field and reduce the dependency on herbicides in sweetpotato fields.

Organic Chemicals for Non-selective Weed Control in Dormant Turf. D Koo*[1], CG Goncalves[2], S Askew[1]; [1]Virginia Tech, Blacksburg, VA, [2]University of California-Riverside, Ukiah, CA (52)

Warm-season turfgrass species such as bermudagrass (*Cynodon dacdactylon* (L.) Pers. Var. *dactylon*) and zoysiagrass (*Zoysia japonica* Steud.) remain dormant from late fall through the winter months in northern temperate climates. Winter annual weeds can still germinate during this time and infest the area while desirable turfgrass is not actively growing. Turf managers use selective and nonselective herbicides to control winter weeds during turf dormancy. Recent litigation issues regarding glyphosate, increasing cases of herbicide-resistant weeds, and heightened public pressure to reduce synthetic pesticide use have increased the need for alternative or organic weed control options in turfgrass. Field trials were conducted at the Glade Road Research Facility of Virginia Tech in Blacksburg, VA to evaluate organic chemicals to control winter annual weeds on "Patriot" bermudagrass and "Zeon" zoysiagrass fairways. Sequential applications of Axxe (ammonium nonanoate), AvengerAG (d-limonene), Green Gobbler (40% acetic acid), BurnOut (24% citric acid) were compared with a single application of glufosinate (1400 g ai ha^{-1}). Trials were arranged as randomized complete block design with 4 replications. Treatments were initiated in late winter on Feb 21, 2022. The trial by treatment interaction was significant for the annual bluegrass (*Poa annua* L.) control. Annual bluegrass appeared to be less mature at treatment time in the zoysiagrass, possibly due to increased zoysiagrass turf density. At 91 days after treatment (DAT), Green Gobbler controlled annual bluegrass 50 to 69% and 85 to 93% depending on location when applied 2 or 3 times, respectively, which was more than other organic products. In fact, organic products other than Green Gobbler did not control annual bluegrass greater than 43% at 91 DAT. Glufosinate applied once controlled annual bluegrass more than all organic products in bermudagrass and equivalent to Green Gobbler in zoysiagrass.

Deer Repellent and Bioinsecticidal Property of Weed Extracts. Z Yue*, CA Snoddy, P Sharma, TR de Oliveira, W Segbefia, MW Shankle, T Tseng; Mississippi State University, Starkville, MS (54)

Deer browsing of soybean was widely documented in the US. This is not only because of the large acreage of soybean in the country (No. 2 in soybean production in the world) and the relatively high deer density but also because soybean leaves are a preferred food by deer. Deer repellents are the primary ways to protect soybean from deer browsing besides fencing, which is usually unfeasible as soybean fields are typically large. Deer repellents generally fall into three categories: animal products, such as egg-based products like Liquid Fence and Deer Pro; plant products, such as a mint product like Deer Out; and chemically synthesized, such as Hinder and Thiram. Plant-derived deer repellents are secondary plant metabolites that usually function as plant defense and are extracted as deer repellents. During the past five years, we have prepared sicklepod extract as a deer repellent, experimented in captive deer facilities and forest environments, and compared it with Liquid Fence (egg-based) in terms of deer repellency. To integrate deer management with weed control in the soybean production system, we tested numerous tank-mix combinations of deer repellents and glyphosate herbicide. The advantage of this project was the possible integration of the deer repellent into the soybean production system, with no need for additional change and cost. The results showed the tank mix treated soybean had lower deer browsing than the herbicide only treatments but repellents only treated soybean showed even lower deer browsing due to weed shielding effects. From the results, we understand that the experiments must be conducted at weed-free conditions since weeds interfered with deer browsing.

Improved Herbicide Selectivity in Tomato by Safening Action of Benoxacor, Fenclorim, Melatonin, and 2,4, 6- Trichlorophenoxyacetic Acid. TR De Oliveira*, AA Tavares, V Varsha, Z Yue, JC Argenta, T Tseng; Mississippi State University, Starkville, MS (55)

Safeners are substances used to protect crops. The mechanism involves the ability to metabolize different compounds, including herbicides. The primary action of safeners includes raising the crop´s endurance to herbicide damage by inducing the protein(s) involved in herbicide metabolism and catalyzing their detoxification in the crop´s system. This study aimed to understand the biochemical effect of benoxacor safener for use in tomato culture, including the activation of the detoxifying enzyme glutathione S-transferase (GST). The experiment was conducted in a randomized factorial design 4x2, with four replications separated into two factors, (a) herbicide rates (0, 0.01, and 0.05x), and (b) safeners (benoxacor, fenclorim, melatonin, and control). Treatments were applied to the aerial part of the tomato seedlings. Visual injury at 3, 7, 14, and 21 days after application (DAA) and biomass at 21 DAA were evaluated. Leaf tissues were collected 0, 24, and 48 hours after herbicide application to determine GST activity. A close perusal of data indicates that seeds pre-treatment with safeners decreased injury, raised biomass, and showed high potential in increasing GST enzymatic activity, assisting the detoxification of plants caused by the herbicide. Knowledge of plant defense mechanism(s) will help improve our understanding of how safeners can offer protection against herbicides, thus leading to improved weed management strategies.

Weed Management with Axant™ Flex Cotton System. ZR Treadway*[1], J Dudak[1], TA Baughman[1], AC Hixson[2], G Baldwin[3]; [1]Oklahoma State University, Ardmore, OK, [2]BASF, Lubbock, TX, [3]BASF, Research Triangle Park, NC (56)

Weed management is a vital step for producers in maximizing cotton yield. Weeds are highly detrimental to crop yields when left uncontrolled. Producers are faced with the ever-growing issue of herbicide resistance. This requires a program approach to manage these weeds throughout the growing season. Previous studies have shown that cotton lint yield decreases as Palmer amaranth populations increase. BASF has developed a new system to aid producers in combatting herbicide resistance and troublesome weeds. The Axant™ Flex system utilizes Alite™ 27 herbicide as a new tool for cotton producers. Experiments were conducted at two locations in Oklahoma during the 2022 growing season, the Oklahoma State University Caddo research station near Fort Cobb and the Southwest Research and Extension Center near Altus to evaluate this new technology. Cotton was planted in May at both locations. Plots were 4 rows by 25 ft long and were arranged in a randomized complete block. In the residual programs trial, PRE herbicides included Caparol (24 fl oz/A), Prowl H_2O (32 fl oz/A), and Sinister (11.2 fl oz/A) applied alone, as well as tank mixed with Alite™ 27 (3 fl oz/A). POST combinations included Engenia (12.8 fl oz/A) or Liberty (32 fl oz/A) + Outlook (12.8 fl oz/A), Engenia (12.8 fl oz/A) + Alite™ 27 (3 fl oz/A) with and without Outlook (12.8 fl oz/A). All POST treatments were applied with Roundup at 30 fl oz/A. PRE treatments in the POST timing trial included: no PRE, Caparol (24 fl oz/A) and Prowl H_2O (32 fl oz/A) applied either alone or in combination with Alite™ 27 (3 fl oz/A). Each PRE treatment received a POST of either Engenia (12.8 fl oz/A) or Liberty (32 fl oz/A) applied in combination with Outlook (12.8 fl oz/A) + Roundup (30 fl oz/A) at 4 or 6 weeks after planting (WAP). Control of both Palmer amaranth (*Amaranthus palmeri* S. Watson) and annual grass 2 WAP was at least 95 % with all treatments in the residual program trial at both locations. Control of both weed species (4 WAP) was greater with treatments that included Alite™ 27 as a PRE. Following the POST applications, control of Palmer amaranth was at least 95% at Altus with all treatments but only exceeded 90% at Fort Cobb with Alite™ 27 + Prowl H_2O fb Engenia + Outlook + Roundup, and Caparol fb Engenia + Alite™ 27 + Roundup with or without Outlook. Control of annual grass was at least 90% with all treatments at both locations. Control at both Altus and Fort Cobb of both Palmer amaranth and annual grass was at least 96% with all PRE treatments 2 WAP in the POST timing trial. The addition of Alite™ 27 provided similar levels of control at when the POST application was applied at either 4 or 6 WAP. Control of annual grass was at least 97% with all treatments. An increase in weed control was observed when Alite™ 27 herbicide was included and increased flexibility with the POST timing. This research highlighted the need for a residual herbicide to maximize weed control. Future research will be conducted to continue to evaluate the Axant™ Flex cotton system and Alite ™ 27 herbicide.

Effect of Iron on *Eichhornia crassipes* and *Pistia stratiotes* Competition. EJ Littler*; University of Florida Center for Aquatic and Invasive Plants, Gainesville, FL (57)

Aquatic invasive plants are a major problem in the state of Florida, with management costing $15-20 million a year. Two of the most problematic plants are water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*). These species create dense mats on the surface of water bodies which block sunlight from reaching organisms underneath, as well as prevent aeration and transportation. Our experiment evaluated competition between these two species, and the effect of iron on their interspecific competition. Plants were placed in 94.6-L mesocosms at 5 different ratios of water hyacinth to water lettuce plants (0:10, 3:7, 5:5, 7:3, 10:0). All mesocosms were fertilized with 10 g of MiracleGro, and half of them received an additional 2 g of chelated iron. There were four mesocosms per treatment. We recorded plant number after 2 and 4 weeks, and harvested final biomass at 4 weeks. The experiment was conducted twice (2021, and 2022). In both trials, the number of water lettuce plants was significantly affected by species ratio, as well as the interaction of species ratio and the presence of iron. In both trials, the ratio of hyacinth to lettuce also had a significant effect on the number of water hyacinth after 4 weeks, as well as the biomass of both water lettuce and hyacinth. However, in trial two, the biomass of water hyacinth was also significantly affected by the presence of iron. Data showed that the presence of water hyacinth had a negative impact on the numbers of water lettuce. Iron increased numbers of water lettuce but made smaller individuals, with the opposite being true for water hyacinth.

Investigating Herbicide Safety on North Carolina Wildflowers. JH Lee*; North Carolina state university, Raleigh, NC (59)

During the summer of 2022, an initial screening of herbicide safety was conducted on five wildflower species currently being planted or considered by the N.C. Department of Transportation (NC DOT) Roadside Environmental Unit for inclusion in the wildflower program. The following five species were investigated: narrow-leaf sunflower (*Helianthus angustifolius*), black-eyed susans (*Rudbeckia hirta*), maximilian sunflower (*Helianthus maximiliani*), bidens (*Bidens aristosa*), and coreopsis (*Coreopsis grandiflora*). Coreopsis and black-eyed susans were planted at a roadside site near La Grange, NC by NC DOT in the fall of 2021. Maximilian sunflower, narrow-leaf sunflower, and bidens were planted by NC DOT in the spring of 2022 at a roadside site near Wilson, NC. NC DOT applied pendimethalin across all species at planting. The following herbicides were applied (rates in parenthesis): 2,4-DB (280 g ae ha-1), halauxifen (5 g ae ha-1), flopyrauxifen (29.6 g ae ha-1), thifensulfuron (4.4 g ae ha-1), pyrithiobac (56 g ae ha-1) and pyrithiobac (76 g ae ha-1), mesotrione (105 g ae ha-1), imazamox (35 g ae ha-1), tembotrione (92 g ae ha-1), fluometuron (1120 g ae ha-1), halosulfuron (13.1 g ae ha-1), tribenuron (17.5 g ae ha-1), sulfosulfuron (13.1 g ae ha-1), a premix of metribuzin + flufenacet (380 g ae ha-1), and fluridone (168 g ae ha-1). An untreated check was included for comparison. When required by label recommendations, crop oil concentrate, methylated seed oil, and non-ionic surfactant were added at a one-half percent, one percent, and one-quarter percent volume-per-volume basis, respectively. Black-eyed susans and coreopsis were treated on March 14, 2022. At the time of application, black-eyed susans and coreopsis were in the basal rosette stage and were 7.5 and 12.5 centimeters in diameter, respectively. At the Wilson site, treatments were applied on May 25, 2022, and the average heights of narrow-leaf sunflowers, maximilian sunflowers, and bidens were 7.5, 30, and 40 centimeters, respectively. Treated plots were three meters wide and varied from six to nine meters long, as space allowed. Treatments were not replicated at this time due to space constraints, with the intent of further replicated research on a reduced herbicide list in the future. Treatments were applied using a CO2 pressurized backpack sprayer equipped with Teejet flat-fan AIXR 11002 nozzles, calibrated to deliver 140 liters per hectare. Visual ratings were recorded at two, four, and eight weeks after treatment. Percent bloom reduction was also visually estimated for all species, with the exception of narrow-leaf sunflower, at their respective time of bloom. For maximilian sunflower, metribuzin + flufenacet, thifensulfuron, tembotrione, and fluometuron caused little to no injury and there was no reduction in bloom compared to the untreated check. For bidens, metribuzin + flufenacet and fluometuron caused little to no injury and there was no reduction in bloom compared to the untreated check. Halauxifen caused significant stunting, but no reduction in bloom and could be further investigated. In narrow-leaved sunflower, halauxifen, thifensulfuron, and metribuzin + flufenacet caused little to no injury. There was no injury or bloom reduction when black-eyed susans were treated with halauxifen or mertibuzin + flufenacet. Coreopsis showed either low or no injury or bloom reduction when treated with halauxifen, mesotrione, tembotrione, fluometuron, tribenuron, sulfosulfuron or imazamox. In conclusion, there appear to be several viable herbicide options which could be used over the top of each of these wildflower species. Herbicides that appear safe will be recommended for further replicated testing. After further testing, 24(c) labels can be perused so that these products may be incorporated into weed management plans by the NC DOT wildflower program.

White Clover Tolerance to Spring and Summer-Applied Forage Herbicides. DP Russell*[1], K Mullenix[2], G Thompson[1]; [1]Auburn University, Madison, AL, [2]Auburn University, Auburn, AL (60)

It is well documented that clover species often improve forage nutritive value and animal performance when incorporated into grazing systems. Managing weeds in these systems where clover is a highly desirable species presents many challenges to producers. Surveys of Southeastern forage and livestock producers have shown that a large majority do not conduct herbicide weed control due to their concern for damaging or killing clover stands. Alabama cattle producers have expressed this same concern. Therefore, the objectives of this study were to evaluate the tolerance level of established, perennial white clover to commonly used pasture herbicides and to understand white clover's contribution to forage quality. Experiments were established during the spring of 2020 at the Tennessee Valley Research & Extension Center (TVREC) in Madison, Alabama and at the E.V. Smith Research & Extension Center (EVS) in Shorter, Alabama on established white clover stands in mixed grass pastures. Spring treatments included Pursuit (105 g ai ha^{-1} imazethapyr), 2,4-D Amine (840 g ai ha^{-1} 2,4-D), Sharpen (25 g ai ha^{-1} saflufenacil), and a nontreated (check) while the summer treatments included DuraCor (117 g ai ha^{-1} aminopyralid + 12 g ai ha^{-1} florpyrauxifen-benzyl), GrazonNext HL (86 g ai ha^{-1} aminopyralid + 700 g ai ha^{-1} 2,4-D), ProClova (19 g ai ha^{-1} florpyrauxifen-benzyl + 1345 g ai ha^{-1} 2,4-D (GF-3731)), and a nontreated (check). All treatments were applied using a CO2-pressurized backpack sprayer in a carrier volume of 140 L ha^{-1} using AIXR11002 nozzles. Percent occurrence of clover was determined twice per plot by totaling the number of squares (of 25 total within $1m^2$) that contained clover once at the beginning of the study and then again one year after initial treatment. Data from these two evaluations were used to determine the percent change in clover occurrence over time which were subjected to ANOVA using PROC GLIMMIX and means separated using Fisher's Protected LSD at a=0.05. The percent change in clover occurrence over time was significantly different between the two locations (P=0.007) where TVREC had the greatest change. The greatest change in clover occurrence over time (>57% increase) was from 1) an application of 2,4-D followed by summer nontreated and 2) nontreated in both spring and summer. Clover occurrence recovered just as well with all other treatment combinations except for those where DuraCor was applied during summer. Spring applications of 2,4-D and Pursuit improved the Relative Forage Quality index to at least 172. These findings suggest that established white clover is quite tolerant of spring applications of 2,4-D Amine or Pursuit and has shown adequate recovery from summer applications of GrazonNext HL or ProClova.

Common Carpetgrass Tolerance to Postemergence Herbicides. AA Young*[1], E Begitschke[1], C Wang[1], KA Tucker[1], GM Henry[1], AL Wilber[2], JD McCurdy[2]; [1]University of Georgia, Athens, GA, [2]Mississippi State University, Starkville, MS (61)

Common carpetgrass [*Axonopus fissifolius* (Raddi) Kuhlm.] is a stoloniferous warm-season turfgrass that tolerates high soil moisture and low soil fertility. Adaptation to reduced light environments has created an interest in carpetgrass as groundcover in solar panel farms and similar low-input environments. However, weeds infesting these areas may provide additional challenges due to canopy height or inflorescence production; therefore, data evaluating carpetgrass tolerance to postemergence herbicides is warranted. Field research was conducted on a common carpetgrass rough at the Pine Hills Golf Course in Winder, GA during the summer of 2022. Herbicides were applied with a CO_2 backpack sprayer calibrated to deliver 375 L ha^{-1} at 241 kPa. Treatments were initiated on 24 June 2022 and consisted of MSMA at 2.3 kg ai ha^{-1}, dicamba + iodosulfuron + thiencarbazone at 0.18 kg ai ha^{-1}, metsulfuron at 21 g ai ha^{-1}, carfentrazone + 2,4-D + MCPP + dicamba at 0.34 kg ai ha^{-1}, halauxifen-methyl + fluroxypyr + dicamba at 0.23 kg ai ha^{-1}, penoxsulam + sulfentrazone + dicamba + 2,4-D at 0.34 kg ai ha^{-1}, mesotrione at 0.18 kg ai ha^{-1}, carfentrazone at 25 g ai ha^{-1}, and MCPA + fluroxypyr + dicamba at 1.4 kg ai ha^{-1}. A non-treated check was included. Carpetgrass phytotoxicity was 11 and 73% in response to dicamba + iodosulfuron + thiencarbazone and MSMA, respectively, 2 weeks after treatment (WAT), with corresponding NDVI of 0.68 and 0.37. Phytotoxicity increased to 46% 4 WAT in response to dicamba + iodosulfuron + thiencarbazone and decreased to 56% in response to MSMA. At 8 WAT, phytotoxicity was 19% in response to MSMA with NDVI of 0.72. No other treatment resulted in phytotoxicity or NDVI significantly different than the non-treated throughout the experiment. Greenhouse research was conducted at the Athens Turfgrass Research and Education Center in Athens, GA during the winter of 2022. Carpetgrass plugs were removed from a local population with a golf course cup cutter and transplanted into 1 L pots containing a 2:1 mixture of a Cecil clay loam soil and a Wakulla sand. Pots were allowed to mature in the greenhouse for a month before plants were cut to a height of 5.1 cm. The same treatments were applied to pots that were evaluated in the field. Percent phytotoxicity was rated visually 4 WAT. Pots were cut to 5.1 cm at 4 WAT and fresh biomass was weighed (g). Percent growth reduction (GR) was calculated by comparing biomass in response to each treatment to the non-treated check within the same trial replication. MSMA resulted in % phytotoxicity of 84% while all other treatments exhibited = %33 phytotoxicity. MSMA and dicamba + iodosulfuron + thiencarbazone resulted in % GR of 85 to 89%, while metsulfuron and fluroxypyr + dicamba resulted in 48% and 65% GR, respectively. Less than 30% GR was observed in response to all other treatments 4 WAT. This research identified several postemergence herbicides that can be safely applied to carpetgrass for broadleaf and grass weed control.

Utility of Alite 27 Combinations Across the Cotton Belt. J Dudak*[1], ZR Treadway[1], TA Baughman[1], G Baldwin[2], T Barber[3], J Bond[4], CW Cahoon[5], A Culpepper[6], PA Dotray[7], W Keeling[8], S Li[9], MW Marshall[10], R Noland[11], SA Nolte[12], L Steckel[13], DO Stephenson, IV[14], M Smith[15]; [1]Oklahoma State University, Ardmore, OK, [2]BASF, Research Triangle Park, NC, [3]University of Arkansas, Lonoke, AR, [4]Mississippi State University, Stoneville, MS, [5]North Carolina State University, Raleigh, NC, [6]University of Georgia, Tifton, GA, [7]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX, [8]Texas A&M AgriLife Research, Lubbock, TX, [9]Auburn University, Auburn, AL, [10]Clemson University, Blackville, SC, [11]Texas A&M University, San Angelo, TX, [12]Texas A&M AgriLife Extension, College Station, TX, [13]University of Tennessee, Jackson, TN, [14]Louisiana State University AgCenter, Alexandria, LA, [15]Texas Tech University, Lubbock, TX (62)

The application of preemergence (PRE) herbicides is a critical tool for early season weed management. The persistence of herbicide resistant weeds, including Palmer amaranth, make it challenging to achieve this goal. The introduction of new herbicide tolerance genes provides another option to overcome these issues. This research was conducted to evaluate PRE combinations of Alite 27 (isoxaflutole) as a potential weed management tool in cotton. Trials were established across the cotton belt during the 2021 and 2022 growing season. Locations included Altus, Bixby, and Fort Cobb, OK; Ideal and TyTy, GA; Clayton and Rocky Mount, NC; San Angelo and Lubbock, TX; Tillar, AR, Alexandria, LA, Stoneville, MS, Blackville, SC, and Jackson, TN. All treatments were applied PRE to bare ground. Treatments included Alite 27 (2 or 3 fl oz/A) applied alone and in 2-way combinations with Direx/Cotoran/Caparol (16-24/24-32/32 fl oz/A), Prowl H2O (32 fl oz/A), Sinister/Reflex/Brake(11.2/16-17/16 fl oz/A), or Warrant (32-48 fl oz/A). Weed control ratings were collected at approximately 2-3 and 4-8 weeks after application (WAA). Palmer amaranth control (2 WAA, 2021) was similar with Alite 27 at 2 or 3 fl oz /A except at South Carolina and Ideal, GA (13 of 15 locations). Alite 27 (2 fl oz/A) tank mixes were among the top treatments, except at South Carolina (+ Direx) and Tennessee (+ Prowl H2O). Season long Palmer amaranth control at 14 of 16 locations was similar with Alite 27 alone at 2 or 3 fl oz/A. However, the addition of Alite 27 at 3 fl oz/A increased control at Rocky Mount, NC (+ Prowl H2O and Warrant), Lubbock, TX (+ Prowl H2O), Tillar, AR (+ Prowl H2O and Warrant), Blackville, SC (+ Warrant and Direx), Stoneville, MS (+ Warrant and Direx), Moultrie, GA (+ Sinister) and Altus, OK (+ Direx) compared to these herbicides applied with Alite 27 at 2 fl oz/A.

TamArk™ Grain Sorghum: an Evaluation of Sensitivity to ACCase-Inhibiting Herbicides Across Multiple Environments. D Hathcoat*[1], JA Fleming[2], D Crozier[1], W Rooney[3], JK Norsworthy[2], MV Bagavathiannan[3]; [1]Texas A&M AgriLife Research, College Station, TX, [2]University of Arkansas, Fayetteville, AR, [3]Texas A&M University, College Station, TX (64)

Grain sorghum [*Sorghum bicolor* (L.) Moench] is an important grain crop in the United States (US). Controlling grass weeds in grain sorghum with POST herbicides has been a struggle for sorghum producers for many years. Group 1 herbicides have been commercialized for over 40 years, and they act by inhibiting the acetyl Coenzyme A carboxylase (ACCase) enzyme. TamArk™ grain sorghum, with resistance to the ACCase-inhibitors quizalofop and fluazifop, is being developed through a collaboration between Texas A&M University and the University of Arkansas. An experiment was conducted in the summer of 2022 in College Station, Texas (TX) and Fayetteville, Arkansas (AR) to observe grass control and crop injury with these two ACCase-inhibitor herbicides at various rates applied at the 15-cm tall sorghum growth stage (App A). At the TX location, a second application was also made to 30-cm tall sorghum plants (App B). In both locations, the experiments were conducted in a randomized complete block design with 4 replications. Crop tolerance and grass weed [large crabgrass (*Digitaria sanguinalis*) at AR and browntop panicum (*Brachiaria ramosa* (L.)) at TX] control observations were carried out at 28 days after application (DAA). In both locations, 1X and 2X rates were evaluated for each active ingredient. Additionally, a 4X rate of fluazifop was included in the TX location. An average of up to 90% grass control was achieved with these two herbicides in both locations, although there were considerable variabilities. Injury caused to the TamArk™ sorghum by either herbicide remained below 10% by 28 DAA for the different application rates. The crop injury was transient and the plants recovered from it rapidly. Results show the potential for utilizing quizalofop or fluazifop for grass weed control in TamArk™ sorghum. More research is necessary to investigate tank-mix combinations for improving season-long grass control as well as broadleaf weed control.

Comparing Cotton Tolerance and Residual Control of Palmer Amaranth When Using Loyant-Coated Fertilizer Applied at Various Growth Stages. SL Pritchett*[1], JK Norsworthy[1], M Zaccaro-Gruener[1], MC Castner[1], D Smith[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (66)

Cotton producers rely on residual and postemergence herbicides for season-long control of Palmer amaranth [*Amaranthus palmeri* (S.) Wats.]. It is vital to maximize Palmer amaranth control while minimizing cotton injury. This study was designed to determine which growth stage is optimal for the application of florpyrauxifen-benzyl coated on fertilizer and applied over-the-top of cotton. This study was planted on May 10, 2022, on a silt loam soil at the Lon Mann Cotton Research Station in Marianna, Arkansas. The study was designed as a two-factor factorial in a randomized complete block with four replications. The first factor was the application timing (growth stage). There were four application timings: the 1- to 2-leaf, 3- to 4-leaf, 5- to 6-leaf, and 10- to 12-node growth stages. The second factor was the presence or absence of florpyrauxifen-benzyl at 29 g/ha coated on fertilizer. The fertilizer blend utilized as the florpyrauxifen-benzyl carrier consisted of urea at 196 kg/ha and muriate of potash at 112 kg/ha. A preemergence application of fluometuron at 840 g/ha and paraquat at 700 g/ha was applied to all plots. Prior to each treatment application (and at the 1-to 2-leaf growth stage in treatments with applications at later growth stages) glyphosate at 1120 g/ha and glufosinate at 667 g/ha were applied to control emerged weeds. Cotton injury and Palmer amaranth control were assessed at 14 and 21 days after treatment (DAT). At 14 DAT, higher Palmer amaranth control was observed when florpyrauxifen-benzyl-coated fertilizer was applied at the 1- to 2 and 3- to 4-leaf growth stages. Glyphosate and glufosinate with florpyrauxifen-benzyl on fertilizer applied to 1- to 2-leaf cotton provided 95% Palmer amaranth control, whereas control was only 69% in the absence of herbicide coated on fertilizer. Applying florpyrauxifen-benzyl on fertilizer at the 3- to 4-leaf stage resulted in a total of 27-percentage point increase in Palmer amaranth control compared to the treatment without the herbicide. Palmer amaranth control was not improved in the other treatments. The 6- to 8-leaf treatments displayed the most crop injury. Cotton was injured 20% in the treatment containing florpyrauxifen-benzyl, and there was 13% injury to cotton without florpyrauxifen-benzyl for same application timing. Cotton was injured less than 15% by all other treatments. These findings demonstrate that there is potential in using florpyrauxifen-benzyl-coated fertilizers applied at selected growth stages due to improved Palmer amaranth control and minimal cotton injury. Additional site years are needed to support or refute these findings, and supplemental research is needed to determine yield loss due to florpyrauxifen-benzyl injury.

Effect of Adjuvants on Development and Formation of Arrested Ear Syndrome. RJ Edwards*[1], LA Boles[1], GK Dahl[2]; [1]WinField United, River Falls, WI, [2]Winfield United, Eagan, MN (67)

Arrested ear is a physiological condition that affects developing corn ears, resulting in deformed and shortened cobs with fewer overall kernels. Other physically distinctive characteristics for arrestedu ear that can be observed. When a higher percentage of ears exhibit these phenomena, an external cause is suspected. Increased incidence of arrested ear has been linked to applications of Non-Ionic Surfactant (NIS) containing nonylphenol ethoxylate (NPE) ingredients. MasterLock, which does not contain NPE, has the same drift reduction technology as InterLock with added DropTight surfactant, to improve canopy penetration and deposition. Internal studies have shown MasterLock does not increase arrested ear.

Evaluating the Control of Italian Ryegrass (*Lolium perenne spp. Multiflorum*) Using Chaff Lining in Winter Wheat at Harvest. HS Love*[1], T Legleiter[2]; [1]University of Kentucky, Lexington, KY, [2]University of Kentucky, Princeton, KY (68)

Evaluating the Control of Italian Ryegrass (*Lolium perenne spp. Multiflorum*) Using Chaff Lining in Winter Wheat at Harvest The continuous use and reliance of herbicides to control Italian ryegrass (*Lolium perenne spp. multiflorum*) has led to an increase in herbicide resistance in Kentucky. As herbicide resistance increases, producers are looking for new management options for Italian ryegrass. Harvest weed seed control is a potential tactic that could be used to control herbicide resistant Italian ryegrass in winter wheat. One method in particular is the use of a chaff lining in winter at harvest. The goal of this study is to investigate the utility of chaff lining in suppressing Italian ryegrass emergence in a wheat, double crop soybean, corn rotation in Kentucky.A site is Caldwell County, Kentucky with a known Italian ryegrass infestation was chosen for the site. A factorial experimental designed was used and included two factors: chaff lining orientation and double crop soybean planting direction. Chaff lining orientation included two orientations: with the wheat stubble or combine tire track and across the wheat stubble. Soybean planting direction also included two orientations: straddling the chaff line and across the chaff line. Each treatment was replicated four times in a split block design with individual plots measuring 9m by 9m. At wheat harvest, fine chaff was collected from each plot using an Almaco plot combine and marked with the appropriate plot of collection. 801,220 annual ryegrass seeds were mixed into the chaff from each plot. Chaff lines measuring .30 m. by 9 m. chaff were then established within each plot. The chaff lines were then oriented in accordance to the experimental design. Double crop soybean were planted in accordance to the experimental design to either straddle or cross the established chaff lines. Italian ryegrass emergence in the fall following soybean harvest was collected from two – 0.09 m^2 areas within each chaff line. Data was analyzed in SAS 9.4 using PROC GLIMMIX for ANOVA and mean separation was conducted using Tukey HSD. Our study included two factors: Ryegrass emergence within the chaff lines ranged from 131 to 193 plants per m^2. There was no influence of chaff line orientation or double crop soybean orientation or interaction of chaff line and double crop soybean orientation on ryegrass emergence in the fall following soybean harvest. Further research evaluating ryegrass seed viability and spring emergence following soybean harvest is being conducted.

Chemical Conversion of a Hybrid Bermudagrass Fairway to Zoysiagrass. E Begitschke*, C Wang, AA Young, KA Tucker, GM Henry; University of Georgia, Athens, GA (69)

Golf courses throughout the southern U.S. have begun converting fairways from hybrid bermudagrass (*Cynodon dactylon* × *C. transvaalensis* Burtt Davy) to new zoysiagrass (*Zoysia matrella* L. Merr.) cultivars. Historically, superintendents have sprayed glyphosate and fluazifop to eradicate hybrid bermudagrass prior to sprigging zoysiagrass. Recognition®, trifloxysulfuron + metcamifen, can be tank-mixed with fluazifop to gradually remove hybrid bermudagrass during the conversion process. Therefore, the objective of this research was to evaluate the effect of fluazifop + trifloxysulfuron + metcamifen rates and application timings on zoysiagrass establishment and hybrid bermudagrass eradication compared to a traditional conversion program. 'Zorro' zoysiagrass was sprigged into an existing 'Tiftuf' hybrid bermudagrass fairway at the Athens Turfgrass Research and Education Center in Athens, GA during summer 2022. Treatments included three application timings of a low (120 or 210 g ai ha^{-1}) and high (421 g ai ha^{-1}) rate of fluazifop with trifloxysulfuron + metcamifen (28 g ai ha^{-1}) and a non-ionic surfactant (0.25% v/v) compared to a traditional conversion program of glyphosate (3910 g ae ha^{-1}) + fluazifop (421 g ai ha^{-1}) and a non-treated control. Initial herbicide treatments were applied 25 days before sprigging (DBS), and sequential applications were made 6 DBS, 8 days after sprigging (DAS), 39 DAS, 50 DAS, 72 DAS, and 100 DAS. All fluazifop + trifloxysulfuron + metcamifen treatments other than the lowest rate of fluazifop (120 g ai^{-1}) provided similar zoysiagrass cover and bermudagrass suppression as the traditional program when rated 93 DAS. Additionally, no significant differences were detected in percent zoysiagrass cover or bermudagrass suppression between low and high rates of fluazifop + trifloxysulfuron + metcamifen when first applied either 6 DBS or 8 DAS. Future research should evaluate weed control during conversion in response to the aforementioned treatments.

Impact of Weedy Rice Size on Control with Oxyfluorfen. CH Arnold*[1], JK Norsworthy[1], MC Souza[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (70)

Oxyfluorfen is a WSSA group 14 protoporphyrinogen oxidase inhibitor that acts as a contact herbicide when applied postemergence. Oxyfluorfen may offer a control option for weedy rice in the ROXY® Rice Production System, but the influence of growth stage on effectiveness of the herbicide is not known. In 2021 and 2022, field trials were conducted at the Rice Research and Extension Center near Stuttgart, AR and Pine Tree Research Station near Colt, AR, to determine the effect of weedy rice growth stage on effectiveness of oxyfluorfen at three rates. Oxyfluorfen (ALB2024) was applied at 560, 1120, and 1680 g ai ha^{-1}, at the 1-leaf, 2-leaf, 3-leaf, and tillering rice growth stages. Weedy rice control was visibly rated at 7, 14, 21, and 28 days after treatment (DAT). At 14 DAT, weedy rice control ranged from 58 to 72% as the rate of oxyfluorfen increased from 560 to 1680 g ai ha^{-1}. Weedy rice control decreased as the rice growth stage increased with the exception of the 3-leaf growth stage application in 2021. In both years, the tillering application resulted in the lowest levels of control (58 and 30%). The findings from this study suggest that an early application of oxyfluorfen (ALB2024) is critical for weedy rice suppression, and postemergence weedy rice control will likely improve as the rate of oxyfluorfen increases.

Tolerance of Rice Cultivars to Preemergence Application of Fluridone. MC Souza*[1], JK Norsworthy[1], SL Pritchett[1], T Barber[2], TR Butts[2], MC Woolard[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (72)

Fluridone has been used as a preemergence herbicide in cotton fields with excellent performance on some of the most challenging weeds, especially Palmer amaranth (*Amaranthus palmeri* S. Wats.). Considering the need for new herbicide modes of action to deal with resistant weeds in rice, fluridone may be a worthy herbicide to be added to rice programs due to its broad-spectrum control. Therefore, a study aimed to evaluate the tolerance of rice cultivars to fluridone sprayed preemergence. Research was conducted on a silt loam soil in Colt, Arkansas in 2022, and the experiment was a two-factor factorial with four replications. The first factor was fluridone rate applied at 0, 168, and 336 g ai/ha. The second factor was cultivar, which included DG263L, Diamond, Titan, Jupiter, Lynx, XP753 (conventional), CLL15, CLL16 (Clearfield®), RT7321 FP, RT7521 FP (FullPage®), PVL03 (Provisia®), and RTV7231 MA (Max-Ace®). Injury was rated weekly after rice emergence and yield was collected at harvest (kg/ha). There was minimal rice injury prior to establishing the permanent flood. At 10 weeks after treatment (WAT), injury ranged from 7 to 45% when the cultivars were treated with the higher rate of fluridone. Of the cultivars evaluated, Lynx was injured more than any other cultivar at the higher rate of fluridone. Fluridone applied at 168 g/ha caused no injury to RTV7231, which was comparable to all other cultivars except DG263L (8% injury). The highest rate led to a yield penalty for the cultivars DG263L and Titan, while the lower dose did not reduce yield among cultivars. These findings indicate some differential tolerance to fluridone may exists among commercial cultivars and the injury is not totally associated with yield penalty.

Tolerance and Grass Control with Fluazifop and Quizalofop in TamArk Grain Sorghum. MC Castner*[1], JK Norsworthy[1], MV Bagavathiannan[2], JA Fleming[1]; [1]University of Arkansas, Fayetteville, AR, [2]Texas A&M University, College Station, TX (73)

Currently, grain sorghum (*Sorghum bicolor*) producers are limited in terms of postemergence (POST) chemical weed management strategies, specifically for annual grass species. As a solution, the University of Arkansas Systems Division of Agriculture and Texas A&M Agrilife Extension Service have collaborated in the development of TamArk® grain sorghum, which is a non-genetically-modified variety with resistance to POST applications of aryloxyphenoxypropionate (fop) herbicides. A field experiment was conducted in Fayetteville, Arkansas, in 2022 to determine the sensitivity of TamArk® grain sorghum to a single POST application of two differing fop herbicide at their respective 1 and 2X rates. In addition to crop phytotoxicity evaluations, weed control was assessed for the large crabgrass (*Digitaria sanguinalis*) population present in the field. Fluazifop at 210 and 420 g ai ha^{-1} or quizalofop at 73 and 146 g ai ha^{-1} was applied to 6- to 8-leaf TamArk grain sorghum. At 14 days after treatment (DAT), fluazifop at 210 and 420 g ai ha^{-1} injured grain sorghum 8 and 18% relative to the nontreated control, respectively, with =1% observed from either rate of quizalofop. By 35 DAT, crop phytotoxicity was transient and all treatments caused =4% injury. For large crabgrass control, efficacy was comparable at 14 DAT among all treatments, ranging from 76 to 83%. However, at 35 DAT, quizalofop at 73 (88%) and 146 g ai ha^{-1} outperformed fluazifop at 210 (80%) and 420 g ai ha^{-1}. TamArk® grain sorghum has displayed acceptable tolerance to both evaluated fop herbicides, but only one will likely become an option for producers as this technology is commercialized.

Confirmation and Control of Atrazine-resistant Palmer Amaranth (*Amaranthus palmeri)* in North Carolina. RJ Argueta*, EA Jones, DJ Contreras, CW Cahoon, W Everman; North Carolina State University, Raleigh, NC (74)

Atrazine has historically been efficacious herbicide in North Carolina, where almost every hectare of corn receives a pre- and postemergence application. In 2016, a farmer in Washington Co. North Carolina reported a control failure on *Amaranthus palmeri* S. Watson (Palmer amaranth) in a corn field treated with atrazine. The objectives were to evaluate the response of the putative atrazine-resistant population from Washington Co. (R) at different atrazine rates and determine effective herbicides to control the putative atrazine resistant population. Two atrazine-susceptible populations from Edgecombe Co. (S) and Johnston Co. (S) were used susceptible controls. The experimental design was completely randomized with four replications. Atrazine was applied at 0, 56, 177, 560, 1770, 5600 and 17,700 g ai ha^{-1} and included crop oil concentration (1% v v^{-1}). Treatments were applied to plants 7.6 to 9 cm in height. Plant survival was evaluated 21 days after treatment. The LD_{50} for each population were calculated from a three-parameter log-logistic model. A resistance ratio was calculated for each atrazine-susceptible population. The LD_{50} value was 1354 g ai ha^{-1} for R population. The R/S were 6.8 to 8.7 compared to the S populations. The Washington Co. population has evolved atrazine resistance. Subsequently, these *A. palmeri* populations were treated with 7 herbicide modes of action for further characterization under similar conditions and evaluations. All populations exhibited resistance to thifensulfuron and glyphosate with survival =70% and =30%, respectively. 2,4-D and dicamba provided variable control on all populations. The population is resistant to thifensulfuron, atrazine and glyphosate.

Utilization of the See and Spray^{TM} Ulimate Technology with Cover Crops in Cotton. TH Avent*[1], JK Norsworthy[1], TC Smith[1], WL Patzoldt[2], LM Lazaro[2], MM Houston[3]; [1]University of Arkansas, Fayetteville, AR, [2]Blue River Technology, Sunnyvale, CA, [3]Blue River Technology, Leland, MS (75)

The commercial release of See & Spray™ Ultimate could provide producers a method to reduce herbicide use through targeted broadcast applications. However, this new technology has yet to be evaluated in cover crop systems. Research was conducted at the Northeast Research and Extension Center near Keiser, AR to evaluate the performance of See & Spray in cotton (*Gossypium hirsutum* L.) with a hairy vetch and cereal rye cover crop system. The experiment consisted of two factors: A) herbicide application method – no application, broadcast (BC), and See & Spray only (SS), and See & Spray + broadcasted residuals (SS+BC); B) cover crop system – cereal rye, winter fallow, and hairy vetch. All application methods consisted of the same herbicide program with the cover crop terminated 2 weeks before planting. Applications of herbicides with a prototype See & Spray unit occurred preemergence (PRE), early-postemergence (EPOST), and mid-postemergence (MPOST) for treatment comparisons. At 14 days after the EPOST application, a slight reduction in Palmer amaranth control was observed from the See & Spray with 98, 94, and 97% control for the BC, SS, and SS+BC applications, respectively. By 14 days after the MPOST application, no differences existed among treatments and overall control was = 93%. Overall, SS+BC and SS applications reduced herbicide use at EPOST and MPOST applications by 18 to 74%. Additionally, the See & Spray applications performed well at all application timings and cover crop systems, including the ability to detect weeds through cover crop biomass. Based on the results of this study, the See & Spray Ultimate can be effectively used in systems involving cover crops.

Differentiation Between Yellow foxtail(Setaria *pumilla*) and Knotroot Foxtail (Setaria *parviflora*) Via Morphological Characteristics and Genetics Markers. MM Joseph*, JS McElroy, J Platel, CA Rutland; Auburn University, Auburn, AL (76)

Weeds are primarily identified through morphological characteristics. However, weed identification using morphological aspects requires botanical expertise and subtle differences between species can vary with subspecies or biotypic morphological differences. *Setaria pumila* (Poir.) Roem. & Schult. (1817) and *Setaria parviflora* (Poir.) Kerguelen, respectively known as yellow and knotroot foxtail, are two problematic weed species that share morphological similarities and are often misidentified. Yellow and knotroot foxtail have phenotypic plasticity which can bias their identification. The criteria to differentiate those two species, such as the seedhead and rhizomes appears late in the growth stage, long after identification is required for herbicide management. Nucleic acids, DNA or RNA, are obvious options for identifying yellow and knotroot foxtail across biological systems beyond physical or digital identification. Research was conducted in the herbicide resistance diagnostics laboratory at Auburn University in Alabama to differentiate yellow and knotroot foxtail beyond morphological characteristics using DNA barcoding. Twenty biotypes for each species were identified in Alabama using seedhead size, ligule size, and the presence of rhizomes. The presence of rhizomes was confirmed in knotroot foxtail, making this characteristic a major morphological difference. DNA for each biotype was isolated from the leaves and amplified using polymerase chain reaction (PCR) with primers targeting trnH-psbA and ITS regions. Sanger sequencing results demonstrate the presence of different single nucleotide polymorphisms in the sequenced regions that can differentiate yellow and knotroot foxtail. Some biotypes initially identified as knotroot foxtail were later correctly identified as yellow foxtail by DNA barcoding. This study demonstrated that applying these DNA barcodes is relevant in accurately identifying foxtail species at an early stage and thus helps effectively manage them using proper herbicide selection.

Palmer Amaranth Residual Control in Soybean with a Diflufenican Mixture Compared to Current Standards. MC Woolard*[1], JK Norsworthy[1], LB Piveta[1], TH Avent[1], TC Smith[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (78)

Palmer amaranth has confirmed resistance to nine sites of action. Diflufenican (DFF) is a WSSA group 12 herbicide that can control herbicide-resistant Palmer amaranth in soybean. In the U.S., there are no group 12 herbicides labeled for use in soybean production, which would make DFF unique. An experiment was conducted in 2022 at the Northeast Research and Extension Center in Keiser, AR to determine the length of residual control provided by a DFF mixture compared to commonly used preemergence-applied herbicides on a clay soil. The treatments evaluated included a labeled rate of Fierce MTZ, Boundary, Warrant, Tricor, a DFF mixture (components cannot be revealed at this time), a DFF mixture plus Tricor, and a DFF mixture plus XtendiMax with Vapor Grip Technology along with a nontreated check. At 2 weeks after treatment (WAT), Palmer amaranth density was lowest among the Fierce MTZ, the DFF mixture, and the DFF mixture plus XtendiMax treatments with Palmer amaranth density ranging from 0 to 6 plants m^{-2} compared to 312 plants m^{-2} in the nontreated. The DFF mixture was a more effective option than Warrant based on a nine-fold reduction in Palmer amaranth density relative to the later herbicide at 2 WAT. By 6 WAT, the DFF mixture was comparable or better than all other herbicides evaluated in suppressing Palmer amaranth emergence, except for Fierce MTZ plots that had an average density of 5 plants m^{-2}. Future research should determine if the DFF mixture has the potential to injure and negatively impact soybean yields. As an alternative site of action not currently labeled in soybean, the DFF mixture appears to be an additional tool for controlling Palmer amaranth.

Crop and Weed Identification Using Machine Learning . D Srivastava*, V Singh; Virginia Tech, Painter, VA (79)

Recent advances in machine learning (ML)/ artificial intelligence (AI)-based technologies have opened new opportunities for real-time weed monitoring and precision management of crop fields to address some of the challenges faced by growers these days. This research emphasizes developing a digital library of aerial images of weeds and crops to build reliable weed detection models. In the past few years, use of supervised computer vision algorithms for weed detection has skyrocketed. Supervised algorithms require time consuming process of labeling large datasets. In contrast, Self-supervised (SSL) is an evolving machine learning technique with an aim to solve the challenges associated with the over-dependence on labeled data. Although deep learning methods have shown remarkable success in the weed classification task, self-supervised learning has rarely been explored in weed science research. This research presents a self-supervised K-Nearest neighbour-based contrastive learning to detect Palmer amaranth (*Amaranthus palmeri* S. Watson) and common ragweed (*Ambrosia artemisiifolia* L.) in soybean (*Glycine Max* (L.) Merr.). The study was conducted in 2022 at Painter, VA, where Unmanned Aerial Systems (UAS)-based red, green, and blue (RGB) images were acquired at different growth stages of soybean, common ragweed, and Palmer amaranth using DJI M-300 flown at an altitude of 12 meters. Our self-supervised model provided a classification accuracy of 93.35% in predicting Palmer amaranth and 100% in predicting common ragweed. Study has shown promising results to revolutionize weed science research in terms of technology adoption 4.0, and tested self-supervised methods will be able to resolve challenges of labeling weeds and crop species to build reliable machine learning models.

Nozzle Selection and Drill Row Width Effects on Spray Coverage and Weed Management in Flooded Rice. NH Reed*[1], TR Butts[2], JK Norsworthy[1], J Hardke[3], T Barber[2], J Bond[4], HD Bowman[5], BM Davis[2], T Dillon[2], K Kouame[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR, [3]University of Arkansas, Stuttgart, AR, [4]Mississippi State University, Stoneville, MS, [5]Mississippi State University, Starkville, MS (80)

The use of integrated weed management (IWM) strategies, including cultural methods, is more important every year because of problematic weeds in Mid-South rice (*Oryza sativa* L.) production. Potential IWM strategies that could be incorporated into rice production are the manipulation of drill row width and nozzle selection for optimizing herbicide applications. As a result, the objective of this experiment was to evaluate the impact of drill row width and nozzle selection on spray coverage and weed control in flooded rice. A field experiment was conducted in 2021 and 2022 at Lonoke, Pine Tree, and Rohwer, AR as a randomized complete block split-plot design. The rice was drill-seeded in four drill row widths (13-, 19-, 25-, and 38-cm) as the whole plot factor. 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)] as the subplot factor. Barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] density was assessed at the 5- to 6-leaf rice stage (preflood) and preharvest. Water sensitive cards were sprayed preflood and collected to assess spray coverage of each nozzle type using DepositScan from the USDA-ARS. All data were analyzed using JMP Pro 16.1 and subjected to ANOVA using Tukey's HSD (a=0.05). Regardless of response variable or location, no interaction was observed between drill row width and nozzle type. Across locations and years at the preflood rice stage and preharvest stage, there was a 62 and 85% decrease in barnyardgrass density from the 13-cm drill row width compared to the 38-cm drill row width. The XR and AIXR nozzles had a 29% greater spray coverage than the TTI, TTI60, and AITTJ60. No increase in coverage was observed from dual-fan nozzles compared to single-fan counterparts. Narrower drill row width of 13-cm produced greater weed control than the widest 38-cm row width, and the smaller droplet-size producing nozzles provided better spray coverage than the larger droplet-size producing nozzles. Using a reduced drill row width and the selection of an appropriate nozzle such as the AIXR when making ground-applied herbicide applications could enhance rice weed management efforts.

Narrow-windrow Burning for Controlling Italian Ryegrass in Wheat and Palmer Amaranth in Soybean. ML Flessner*[1], MP Spoth[1], SC Haring[2], W Everman[3], C Reberg-Horton[3], WC Greene[1]; [1]Virginia Tech, Blacksburg, VA, [2]University of California-Davis, Davis, CA, [3]North Carolina State University, Raleigh, NC (81)

Narrow windrow burning (NWB) is a form of harvest weed seed control that concentrates crop residues and weed seeds exiting the combine into windrows and subsequently burned. Burning the harvest residue can kill or damage the weed seeds therein, thus preventing additions to the soil seed bank. The study aimed to determine 1) if NWB can kill seeds of Italian ryegrass (*Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot) in wheat and Palmer amaranth (*Amaranthus palmeri* S. Wats.) in soybean and 2) determine the relationship between NWB heat index (HI; the sum of temperatures above ambient) or effective burn time (EBT; the cumulative time temperatures exceed 200 C) and seed mortality. Average soybean and wheat windrow HI totaled 140,725 ± 14,370 and 66,196 ± 6224 C, and 259 ± 27 and 116 ± 12 seconds of EBT, respectively. NWB reduced germination by 79.7% in Italian ryegrass, and 86.3% in Palmer amaranth when comparing pre- to post-NWB samples. Non-linear two parameter exponential regressions of seed mortality versus either HI or EBT indicated NWB at a HI of 146,000 C and 277 seconds of EBT potentially kills 99% of Palmer amaranth seed. 76% of soybean NWB events resulted in estimated Palmer amaranth seed mortality rates > 85%. Italian ryegrass seed mortality was > 97% in all but two wheat NWB events, therefore relationships could not be determined. These results validate the effectiveness of NWB's ability to reduce seed survival, thus improving weed management and combating herbicide resistance. These results have recently been published in Weed Technology (doi:10.1017/wet.2022.70).

Effective Anthraquinone Derivative Dose; a Weed-based Deer Repellent for Soybean. NA Maphalala*, Z Yue, T Tseng; Mississippi State University, Starkville, MS (82)

Deer browsing of row crops such as soybean (*Glycine max* L.) is a perceived problem in the US. This costs farmers more than $4.5 billion each year. Currently, the only effective and widely used techniques to control deer in row crops are the establishment of fences and the application of repellents. In general, fencing is expensive and labor-intensive. The effectiveness of repellents depends on numerous factors, with active ingredients as the key factor. Our previous work reported that sicklepod (*Senna obtusifolia* (L.) H.S.Irwin & Barneby) extract was an effective deer repellent with the active ingredients of anthraquinone derivatives and their glycosides. As these two compounds have different properties and analyses, the lack of a practical method to analyze and evaluate the effectiveness of sicklepod extract limits the development of the deer repellent. This study aimed to find a suitable way to analyze the active ingredients and assess the extract's effective dose in repelling deer. Field tests were conducted in Andrews Forest and Wildlife Laboratory (AFWL), Mississippi State University. This is a 550-acre pine forest with extremely high deer pressure where commercial deer repellent-sprayed soybean plants were entirely browsed without distinction within two days. Sicklepod seed extract-sprayed soybean leaves that survived deer browsing for two weeks to two months were sampled and analyzed. The leaves were hydrolyzed for 4 hours to completely release free anthraquinone derivatives; the results were emodin + chrysophanol in a total concentration of 14 ppm in fresh leaves. This is considered an effective rate to repel deer. As emodin and chrysophanol were only the dominant anthraquinone derivatives in the seed extract, and there are more than ten anthraquinone derivatives in the seed, the total anthraquinone derivative content may be twice as much. Keywords: *soybean, deer repellent, sicklepod, anthraquinone*

Effect of Simulated Drift Rates of Reviton (Tiafenacil) on Rice and Soybean. LM Collie*[1], TR Butts[1], T Barber[1], J Bond[2], D Miller[3], K Kouame[1], NH Reed[4], BM Davis[1], L Adams[5], DO Stephenson, IV[6], C Webster[7], L Steckel[8]; [1]University of Arkansas, Lonoke, AR, [2]Mississippi State University, Stoneville, MS, [3]Louisiana State University AgCenter, St Joseph, LA, [4]University of Arkansas, Fayetteville, AR, [5]Mississippi State Univeristy, Starkville, MS, [6]Louisiana State University AgCenter, Alexandria, LA, [7]Louisiana State University AgCenter, Baton Rouge, LA, [8]University of Tennessee, Jackson, TN (83)

Reviton (tiafenacil) is a new PPO-inhibiting herbicide labeled for burndown applications. However, as burndown applications can be stretched across a wide range of dates in the Mid-South, there can be a high potential for off-target movement to occur onto emerged crops. As a result, research was needed to determine the effects of simulated drift rates of Reviton to rice (*Oryza sativa*) and soybean *(Glycine max)*. In 2022, an experiment was established to assess the tolerance of rice and soybean to simulated drift rates of Reviton [3.1, 1.55, 0.77, 0.387, 0.194, and 0.096 g ai ha^{-1} (1/8th to 1/256th of a label rate)]. Experiments on rice (3) were conducted in Lonoke, Arkansas, Stoneville, Mississippi, and St. Joseph, Louisiana while the experiments on soybean (4) were conducted in Newport, Arkansas, Milan, Tennessee, St. Joseph, Louisiana, and Alexandria, Louisiana. Applications were made to one-leaf rice (EPOST), three-leaf rice (MPOST), and one-leaf soybean. Visual estimations of crop injury and plant heights were recorded for both rice and soybean experiments. Rice and soybean were harvested using a plot combine, and yield was adjusted to 13% moisture and recorded. Averaged across locations, rice exposed to the highest rate of Reviton (3.1 g ai ha^{-1}) at EPOST resulted in the most visual injury (47%) 1 week after application (WAA), but was reduced to only 13% injury by 3 WAA. Less than 6% rice injury was observed 3 WAA when rice was exposed to Reviton EPOST at rates equal to or less than 1.55 g ai ha^{-1}. Less than 20% visual injury 1 WAA was observed for all rates of Reviton at the MPOST timing and no crop response was observed 3 WAA. No height or rough rice yield differences resulted from exposure to simulated drift rates of Reviton. In soybean when averaged across locations, the most visual injury was observed 1 WAA (82%) when exposed to the highest rate of Reviton (3.1 g ai ha^{-1}) and remained at 72% visual injury by 4 WAA. At 4 WAA, less than 16% visual soybean injury was observed from simulated drift rates of 0.77 g ai ha^{-1} or less. Soybean height and yield reduction was substantial at the two highest exposure rates of 3.1 and 1.55 g ai ha^{-1}, Reviton caused greater visual injury to rice at higher simulated drift rates when exposure occurred at an early growth stage; however, rice recovered without yield reduction. In soybean, Reviton exposure caused substantial visual injury, height reduction, and yield reduction at the two highest simulated drift rates. Although only the higher simulated Reviton drift rates caused soybean yield reduction and no yield reduction was observed for rice, appropriate measures should always be taken to reduce off-target movement from herbicide applications.

Florpyrauxifen-benzyl & Aminopyralid Yield Impacts on Warm-Season Forages. 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]University of Florida, Gainesville, FL (84)

Tropical warm-season forage grasses are the primary source of nutrients and energy for livestock in Florida. Weed management has increasingly become challenging for producers as weeds have developed resistance to essential pasture herbicides. Weeds in pastures can cause reductions in forage yield, and toxic plants can be detrimental to livestock production through direct or indirect toxicity. As a result, new herbicide molecules and premixes have been developed as resources to control problematic weeds in perennial grass pastures. Florpyrauxifen-benzyl & aminopyralid is one of the premixes introduced. However, there has not been conclusive research to determine if this premix will result in injury and yield reduction of warm-season tropical forages. Studies were conducted in central Florida to determine the tolerance of stargrass (*Cynodon nlemfuensis*), bermudagrass (*Cynodon dactylon*), and limpograss (*Hemarthria altissima*) to florpyrauxifen-benzyl & aminopyralid and usual tank-mix herbicide partners to each forage species. Bermudagrass and stargrass demonstrated tolerance to the premix and tank mixes with no significant injury or reduction in biomass production of the forages. Limpograss demonstrated a reduction of nearly 25% in biomass at 30 days after treatment (DAT) with florpyrauxifen-benzyl & aminopyralid (9 + 93 g ai ha-1), compared to the control. This initial reduction of biomass production was not reflected at 60 DAT. Despite these results, caution should be emphasized when applying florpyrauxifen-benzyl & aminopyralid to limpograss.

Influence of Seed Impact Mills on Combine Horsepower Needs, Fuel Use, and Speed During Soybean Harvest. EC Russell*, ML Flessner, MP Spoth, K Bamber; Virginia Tech, Blacksburg, VA (85)

Seed impact mills are aftermarket modifications that are integrated into the back of the combine. This addition results in changes to the amount of horsepower used and fuel consumed by the combine in order to power the mill. Additionally, harvest speed could be affected if the horsepower draw of the mill is too great for the combine to handle. Therefore, the purpose of this research was to determine how using a seed impact mill affects a combine's horsepower needs, fuel use, and speed during soybean harvest. Testing was conducted using the Redekop Seed Control Unit (SCU) installed on a John Deere S680 combine. For testing, fields were divided into two sections. The first section was harvested using the seed impact mill, while the second section was harvested without using the seed impact mill. Fuel usage and engine capacity increased when the Redekop SCU was used. Increases in fuel usage ranged 14 to 34% with an average increase of 23%. Increases in engine capacity ranged 28 to 73% with an average increase of 42%. There was no difference in travel speed when using the Redekop SCU versus not. These data indicate that using seed impact mills does impact fuel usage and engine capacity but does not affect travel speed. Seed impact mills could be effective tools that would not affect the speed of harvest operations.

Target-site Mutations in ALS-inhibitor-resistant Jungle Rice *(Echinochloa colona)*. H Camci Arik*, TT Mundt, MV Bagavathiannan, NK Subramanian; Texas A&M University, College Station, TX (86)

Weed management is one of the major challenges for rice production worldwide. *Echinochloa crus-galli* (barnyard grass) *and E. colona* (jungle rice) are two major troublesome weed species in rice cropping systems globally. *Echinochloa* spp., a diverse group of highly adapted weeds, have developed resistance to several herbicides. In this study, attempts were made to understand the mechanism of resistance to the acetolactate synthase (ALS)- inhibiting herbicide imazethapyr in jungle rice, the most common *Echinochloa* sp. found in the Texas Rice Belt. A total of 55 populations of *E. colona* were collected from Texas rice fields during the 2016 and 2017 field seasons and were screened previously for resistance to a number of herbicides, including imazethapyr. In this study, the potential occurrence of target-site mutations in the resistant populations were investigated using Sanger sequencing. DNA was extracted using the CTAB method and used for PCR amplification of the ALS gene. Preliminary results of the molecular analysis will be presented.

Controlling Larger Than Labeled Palmer Amaranth with the Enlist and Xtendflex Systems.
K Bamber*, ML Flessner; Virginia Tech, Blacksburg, VA (87)

Postemergence herbicides control weeds most effectively when applied to weeds at or below label-recommended sizes, but circumstances can delay herbicides applications such that weeds are larger. Therefore, two field studies were established in Nottoway County, Virginia in 2022 to evaluate the efficacy of herbicide options in the Enlist and XtendFlex systems for controlling larger than label-recommended Palmer amaranth (*Amaranthus palmeri* S. Wats.) in soybean (*Glycine max* (Merr.) L.). The studies were randomized complete block designs that included nontreated checks, no plots were treated with preemergence herbicides, and plots were treated with postemergence herbicides once or twice (sequentially, 14 days apart) when Palmer amaranth reached an average height of 45 cm. Treatments included glufosinate applied singly and sequentially, an auxin (2,4-D in Enlist and dicamba in Xtendflex) + glyphosate applied singly and sequentially, glufosinate + an auxin applied singly and sequentially, and glufosinate followed by an auxin + glyphosate or an auxin + glyphosate followed by glufosinate. The efficacy of all herbicide treatments was rated on a scale of 0 to 100% relative to the nontreated check two, four, six, and eight weeks after initial herbicide application, where 0% control means no discernible difference between treated plots and nontreated plots and 100% control means total weed tissue necrosis. Grain yield was measured at the end of the season and reported on a 13% grain moisture basis. By eight weeks after initial herbicide application in the Enlist study, glufosinate + 2,4-D applied sequentially resulted in the best Palmer amaranth control (96%), and control from all other treatments ranged from 48 to 75%. Grain yield in the Enlist study was low and inconsistent, with nontreated check plots averaging 160 kg ha^{-1} and treated plots averaging 490 to 1500 kg ha^{-1}. Plots treated twice with herbicide were more likely than plots only treated once to result in higher grain yield than the nontreated check plots. By eight weeks after initial herbicide application in the XtendFlex study, sequential applications in which the initial treatment was glufosinate controlled Palmer amaranth the most consistently at 63 to 74%, and control from all other treatments ranged from 0 to 53%. Grain yield in the XtendFlex study was low and inconsistent, with nontreated check plots averaging 430 kg ha^{-1} and treated plots averaging 870 to 1800 kg ha^{-1}. Only glufosinate applied sequentially resulted in higher grain yield than the nontreated check. These data provide important information for Virginia soybean growers needing to control Palmer amaranth that is larger than label-recommended sizes.

Residual Herbicide Timings with the Xtend Soybean System. K Beneton*, JL Dudak, ZR Treadway, TA Baughman; Oklahoma State University, Ardmore, OK (88)

As weed control becomes more difficult due to the increasing number of weeds resistant to herbicides, producers must diversify their weed management programs. One strategy is using residual herbicides at planting, as they persist in the soil for a few weeks reducing early season weed competition. This effectiveness of these strategies depend on multiple factors, such as: herbicide(s), mode-of-action, weed population, weather, solubility of the product, and timing of activating rainfall. A three-year (2017-2019) study was conducted at the Oklahoma State University Mingo Valley Research Station near Bixby, Oklahoma to evaluate the effect of application timing on various residual herbicides in a dicamba tolerant soybean system. Treatments included both preemergence (PRE) and postemergence (POST) application timings. Residual herbicides included PRE and POST applications of Cinch (21.3 fl oz a^{-1}), Warrant (48 fl oz a^{-1}), Reflex (16 fl oz a^{-1}), Warrant Ultra (48 fl oz a^{-1}), and Zidua (1.5 fl oz a^{-1}). A POST application of Engenia (12.8 fl oz a^{-1}) + Roundup Powermax (32 fl oz a^{-1}) + Induce (0.25 % v/v) was applied at approximately 3 weeks after planting (WAP). The POST residual herbicides were tank-mixed with this application. An additional POST application of Engenia + Roundup Powermax + Induce was applied at approximately 7 WAP to all treatments. Herbicides were applied to the middle two rows using a CO2 backpack sprayer equipped with TTI 110015 nozzle, at 10 GPA and 3 mph. Soybean injury, large crabgrass (*Digitaria sanguinalis (L.) Scop.*) control, and yield (bushels/A) were collected. Data were subject to ANOVA and separated using Fisher's Protected Least Significant Differences at (P=0.10). In 2017, large crabgrass control was 100% with all treatments except with Reflex POST evaluated at 4 and 8 weeks after POST (WAPT). In 2018, at 4 WAPT, the PRE applications of Cinch, Warrant Ultra, and Zidua and the POST application of Warrant Ultra resulted in greater than 95% control of large crabgrass. All treatments provided 100% control by 8 WAPT. Similarly, to 2017, in 2019, all treatments resulted in 100% grass control at both 4 and 8 WAPT. Soybean yield was similar between herbicides regardless of application timing in 2017 and 2018. In 2019, soybean yield was lower with the PRE versus the POST application timing with Cinch, Reflex, and Warrant. Rainfall could have played a key role in the yield differences over the years. Though injury levels were similar between 2018 and 2019 the rainfall was above average in 2019 possibly resulting in the differences in yield between timings. In conclusion, timely application of residual herbicides and the application of Cinch and Zidua as a PRE consistently controlled grass throughout the season all three years.

Graduate Course Instruction in Weed Science in the SWSS. T Mueller*[1], JD Byrd, Jr.[2];
[1]University of Tennessee, Knoxville, TN, [2]Mississippi State University, Starkville, MS (89)

Education of graduate students has long been a priority of the SWSS, yet little information related to this topic is presented. Symposia and oral or poster presentations may have titles related to education, but are actually often more extension-related. Course instruction in Weed Science in the SWSS is a topic rarely discussed at the meeting. To that end, the authors queried faculty at member schools within the SWSS region for a more comprehensive list of courses. Faculty at member schools within the SWSS region received the following survey questions: 1) List graduate and undergraduate classes taught at your institution (your department or other departments) that have a primary focus on weed science, weed management, undesirable plants, herbicides, or other forms of weedy plant management, etc; 2) Please list the number of credit hours, and the instructor of record for each class. Classes that were multi-disciplinary (such as IPM) were not included. Classes related to weed contest prep were not included. The authors also made several decisions to list/not list courses with multiple instructors, etc.. Most schools had some offering related to herbicide Mode of Action at the graduate level. Courses primarily related to Weed Biology were offered at about half (7/15) schools, and Herbicide Environmental Fate was offered at 3/15 schools. These important concepts could be covered in the various other courses, so over simplification would be probable. Opportunities for SWSS to provide short courses related to Environmental fate or Weed Biology may avail students to learn directly, or faculty to update their lectures on these important topics. If there is sufficient interest, a working group of interested faculty could be formed to set up educational opportunities for SWSS members, perhaps starting on the Sunday or Monday AM prior to our annual meeting.

Evidence of Soil Temperature and Moisture Alteration as a Mechanism of Weed Suppression by Cereal Rye Cover Crop. G Camargo Silva*, MV Bagavathiannan; Texas A&M University, College Station, TX (90)

Cover crops have become one of the main conservation practices in recent years. The most popular cover crop species is cereal rye, which apart from offering soil and water conservation benefits, has great potential for integrated weed management. Cereal rye controls weeds through several mechanisms, but the extent to which each contributes to total weed suppression is uncertain and depends on many environmental and management factors. One of the potential mechanisms is cereal rye's ability to decelerate soil warming in the spring, which could delay weed emergence in the summer. This project seeks to determine the effect of cereal rye biomass levels on soil temperature and water, as well as how this change may affect weed emergence patterns in a cotton crop. 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 the cash crop), totaling 12 treatments to generate a wide range of biomass. Soil water and temperature were continuously monitored using automatic weather sensors. Cereal rye biomass production was determined at termination, which was carried out using glyphosate (870 g ae ha^{-1}). Cotton was planted into the cereal rye residues with a no-till drill. Weed density and emergence were assessed during early summer. Preliminary results show that high (>5000 kg ha^{-1}) cereal rye biomass levels reduce the soil thermal amplitude by 10ºC at the cash crop planting time. The cereal rye residue also reduced the evaporation of soil water by 0.2 m^3 m^{-3}. Weed emergence was both reduced and delayed in cereal rye plots compared to the fallow ones, the extent of which had a slightly positive relationship with cereal rye biomass levels. A reduction in the amplitude of soil temperature is intrinsically tied to a reduction in soil water evaporation, and this mechanism plays a significant role in weed suppression by cereal rye cover crops.

Adjuvant Effects on Herbicide Performance. SC Baker*, DM Dodds, CK Meyer, GA Stephens, AA Tavares, JA Patterson; Mississippi State University, Starkville, MS (91)

Herbicides are a vital component of soybean weed management programs. Furthermore, herbicides are routinely used in combination with adjuvants to maximize herbicide performance. However, while the selection of herbicide amendments made available continuously increases, many of their advertised benefits remain unsubstantiated. Therefore, this study was conducted to determine the most effective herbicide-adjuvant combination for control of *Amaranthus* spp., *Sida spinosa*, and *Echinochloa crus-galli* in soybean. Studies were conducted at Starkville, MS and Brooksville, MS using acifluorfen (280 g ai ha^{-1}), fomesafen (421 g ai ha^{-1}), cloransulam-methyl (17.6 g ai ha^{-1}), clethodim (136 g ai ha^{-1}), quizalofop-p-ethyl (139 g ai ha^{-1}), and fluazifop-p-butyl (421 g ai ha^{-1}). The following adjuvants were evaluated at both locations: Agri-Dex (COC), Penetrator Plus (COC), Dyne-A-Pak (S/N), Class Act NG (S/N), Induce (NIS), Liberate (NIS), StrikeLock (HSOC), Zarr (MSO), MSO Concentrate with Leci-Tech (MSO), and Verifact (HSOC). Visual weed control ratings were taken at 7, 14, 21, and 28 days after treatment (DAT). At 21 DAT, herbicide-adjuvant combinations had no effect on barnyardgrass control when compared among treatments. Application of quizalofop and clethodim produced the greatest barnyardgrass control at 84 and 82%, respectively. At 28 DAT, herbicide-adjuvant combinations resulted in broadleaf weed control differences. Application of fomesafen and acifluorfen produced the greatest control of Amaranthus species with 59 and 56% control, respectively. Application of acifluorfen prompted greatest prickly sida control at 78%. Adjuvants had little to no effect on weed density and control. Therefore, growers are advised to utilize the adjuvant that best meets the requirements of their weed control program and follows the herbicide label.

Dicamba Cotton Technology Provides Flexibility Georgia Growers Value. JC Vance*, A Culpepper, TM Randell-Singleton; University of Georgia, Tifton, GA (92)

During 2020, over 90% of Georgia's 486,622 hectares of cotton (*Gossypium hirsutum*) was planted with dicamba-resistant varieties. An in-person survey of 445 growers representing nearly one third of Georgia's cotton was conducted determining the importance of this technology to farmers. Ninety percent of those participating confirmed the technology was important to their operation. Of those growers, 32, 36, 6, 18, and 8% of them noted the technology returned 0-63, 64-125, 126-188, 189-250, and over \$250 per ha^{-1} to their operation. The return on investment was primarily a result of improved Palmer amaranth (*Amaranthus palmeri* S. Watson) control. Over half of the growers reported the dicamba program improved control of this weed by more than 50% with another third of them suggesting control was improved 20 to 50%. Survey results also suggested growers hypothesized that Palmer amaranth could be controlled more effectively with a dicamba-based versus a glufosinate-based weed management program due to application timing flexibility. To test their hypothesis, an experiment was conducted during 2022 and included five treatments replicated four times: 1) timely dicamba-based program, 2) timely glufosinate-based program, 3) delayed dicamba-based program, 4) delayed glufosinate-based program, and 5) a non-treated control arranged in a randomized complete block design. Each herbicide program included sequential postemergence applications applied 10 d apart with the respective herbicide (dicamba 0.56 kg ae ha^{-1} or glufosinate 0.60 kg ai ha^{-1}) mixed with glyphosate (1.27 kg ae ha^{-1}) fb a directed application of glyphosate plus diuron (1.13 kg ai ha^{-1}) 14 d later. Palmer amaranth and pitted morningglory were 8 to 13 cm tall when timely programs were initiated; delayed programs consisted of the first application occurring 9 days later when both weeds were 15 to 25 cm. Herbicide applications were made with a backpack calibrated to deliver 142 L ha^{-1} with dicamba applications using Teejet TTI 110015 nozzles with ultra-coarse droplets; glufosinate applications were made with Teejet AIXR 11002 nozzles with coarse droplets. Plots were 5.48 m wide by 15.24 m in length and the soil consisted of a Tifton loamy sand. Both timely systems recorded similar statistical results when comparing late-season values for Palmer amaranth control (100% dicamba, 98% glufosinate), Palmer amaranth population (dicamba 0 plants ha^{-1}; glufosinate 120 plants ha^{-1}), morningglory control (99% for both), cotton growth (dicamba 105 cm; 104 cm glufosinate), and seed yield (dicamba 3105 kg ha^{-1}; glufosinate 3115 kg ha^{-1}). For delayed programs, all variables measured for cotton growth and Palmer amaranth control were negatively influenced, while morningglory control was not. For Palmer amaranth control and population counts, the delayed dicamba program had 86% control with 1210 plants ha^{-1} which was less effective than the timely dicamba program, but more effective than the delayed glufosinate program where 56% Palmer amaranth control and 7955 plants ha^{-1} were observed. Cotton growth was influenced by early-season weed competition similarly within each delayed program as heights were 33 to 38% less than those in the timely systems. Yields in the delayed dicamba program (1342 kg ha^{-1}) were far less than those observed in the timely dicamba program, but greater than the delayed glufosinate system (878 kg ha^{-1}). Results suggest growers can achieve greater flexibility in application timeliness with a dicamba-based system compared to a glufosinate-based system although less weed control and lower yields are to be expected when programs are not implemented in a timely fashion.

Overlapping Residual Herbicides for Season Long Weed Control in Soybean (*Glycine max*).
CK Meyer*[1], DM Dodds[1], GA Stephens[1], SC Baker[1], JA Patterson[1], A Correa Tavares[2]; [1]Mississippi State University, Starkville, MS, [2]University of Nebraska-Lincoln, North Platte, NE
(93)

Weed control is one of the critical tasks growers face each year. Numerous preemergence (PRE) herbicide options are available in soybean and utilization of these herbicides can provide significant weed control benefits and alleviate the pressure on postemergence (POST) herbicides for weed control in soybean. Many of these PRE herbicides may also be applied POST, creating a situation where the residual life of these herbicides in the soil may be overlapped to aid in control of weed seedling emergence. In this study, different combinations of soil applied herbicides were evaluated to determine if overlapping residual herbicides would be as effective as a standard soybean herbicide program in Mississippi. Preemergence herbicides were applied at-planting, followed by a second application 14 days after planting, and a third application 28 days after planting. Morningglory spp. and barnyardgrass 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 2022. Sulfentrazone + flumioxazin PRE followed by pyroxasulfone EPOST, and *S*-metolachlor LPOST provided similar morningglory control as the grower standard treatment (*S*-metolachlor + metribuzin PRE followed by fomesafen + *S*-metolachlor + glyphosate + dicamba EPOST and glyphosate + dicamba LPOST) and the weed free check . In Brooksville, MS, sulfentrazone + flumioxazin PRE followed by *S*-metolachlor EPOST and pyroxasulfone LPOST as well as metribuzin PRE followed by *S*-metolachlor EPOST, and pyroxasulfone LPOST provided similar barnyardgrass control as the grower standard treatment and the weed free check. In Starkville, MS, sulfentrazone + flumioxazin PRE followed by pyroxasulfone EPOST and S-metolachlor LPOST provided similar barnyardgrass control as the grower standard application and the weed free check. Similar soybean yields were observed following application of all herbicide treatment combinations. This data suggests that some herbicide programs with overlapping residuals can be used to maximize weed control and soybean yield, and growers should choose herbicide programs based on economics, maximizing yield, maximizing weed control, and resistance management.

Volunteer Rapeseed Infestation in Corn and its Management. V Kumar*[1], V Singh[1], ML Flessner[2]; [1]Virginia Tech, Painter, VA, [2]Virginia Tech, Blacksburg, VA (94)

The study was conducted to evaluate the effect of different termination timings for rapeseed on biomass production, termination efficiency, and volunteer rapeseed infestation in the successive cash crop (corn), and control of volunteer rapeseed with herbicides. Delaying the termination from 28 days before planting corn (DBP) to 14, 5, or 1 DBP, increased rapeseed biomass by 85, 148, and 158%, respectively. Rapeseed termination efficiency was greatest 28 DBP (99%) followed by 14 DBP (92%) and 5 DBP (89%) with the combined use of a roller-crimper and 2,4-D (534 g ae ha^{-1}) + glufosinate (657 g ai ha^{-1}). Whereas, sole use of roller-crimper 1 DBP provided only 56% termination. Zero volunteer rapeseed plants were observed in the successive cash crop with 28 DBP termination treatment, however, 14 DBP resulted in 5 volunteer rapeseed plants m^{-2}, followed by 12 and 22 plants m^{-2} at 5 and 1 DBP. Regression analysis showed that variation in volunteer rapeseed density can be better explained by termination efficiency ($R^2 = 0.80$) as compared to rapeseed biomass at termination ($R^2 = 0.46$). Among pre-emergence (PRE) herbicides, mesotrione, rimsulfuron, and flumioxazin provided more than 95% volunteer rapeseed control, and 92-94% control with PRE-application of atrazine, isoxaflutole, metribuzin, and pyroxasulfone. Among post-emergence (POST) herbicides, atrazine and glyphosate provided 99% control of rapeseed followed by glufosinate (89%). Results indicate that ineffective termination or delayed termination of rapeseed can result in volunteer rapeseed infestation in successive crop, which can be controlled by PRE and POST-herbicides at early stage.

Is the Biological Response of Purple and Yellow Nutsedge Altered by Elevated CO_2 and High Temperatures? KN Reddy*, S Pinnamaneni; USDA-ARS, Stoneville, MS (95)

Most climate models predict a rise in global air temperature and elevated CO_2 levels in the earth's atmosphere. This climatic change could have a positive or negative impact on biology of weed species. Growth chamber experiments were conducted in 2022 to determine effects of elevated CO_2 and temperature on growth and development of two weeds, purple nutsedge (*Cyperus rotundus* L.) and yellow nutsedge (*C. esculentus* L.). Plants were grown in pots, irrigated, fertilized as needed. In one experiment, plants were subjected to five day/night temperatures of 20/12, 25/17, 30/22, 35/27, and 40/32 ^{o}C from 3-day old propagules to until harvest. In another experiment, plants were subjected to three CO_2 levels of 420, 570, and 720ppm at two day/night temperatures of 30/22 and 35/27 ^{o}C to assess CO_2 and temperature interactions. A randomized complete block design with 5 to 6 replications was used and the experiments were repeated. Purple and yellow nutsedge shoot biomass was harvested after 5 and7 weeks of growth, respectively. After clipping one set of both species were allowed to regrow for two weeks and regrowth shoot biomass recorded. Data on plant height, shoot number, shoot biomass, root biomass and regrowth shoot number, regrowth shoot height, regrowth shoot biomass, and regrowth root biomass were collected. A temperature regime of 30/22 ^{o}C appears to be optimum for both species and purple nutsedge was more impacted by the temperature deviation on either side of the 30/22 ^{o}C for shoot production, shoot biomass, and root biomass in the first and regrowth harvests. The 40/32 ^{o}C temperature had detrimental effect particularly on shoot production and flowering of yellow nutsedge than purple nutsedge. A significantly higher shoot number, shoot height, shoot and root biomass were recorded at elevated CO_2 levels and at30/22 ^{o}C temperature regime compared to 35/27 ^{o}C regime. The species differences were conspicuous as yellow nutsedge recorded higher shoot number, shoot biomass, root biomass and regrowth root biomass compared to purple nutsedge. The temperature and CO_2 level interactions were significant for most of the traits. The flowering appeared to be compromised at elevatedCO_2 levels coupled with higher temperature of 35/27 ^{o}C in both species. The yellow nutsedge did not flower even when allowed to grow for 10 weeks at either 720 ppm CO_2 with 30/22 or 35/27o C temperature. The yellow nutsedge could produce tubers at 420 and 570 ppm but tuber initiation stalled at 720 ppm CO_2 level while purple nutsedge could not initiate tuber production even at 420 ppm CO_2 level. This study demonstrated that both species exhibited differential biological responses to elevated CO_2 levels and both species had increased invasiveness through biomass production, shoot number, shoot length and regrowth at a temperature of 30/22 ^{o}C coupled with elevated CO2 levels of 570 and 720 ppm.

Rainfall Activation Requirements for PRE Applied Soybean (*Glycine max*) Herbicides. CK Meyer*[1], GA Stephens[1], SC Baker[1], JA Patterson[1], A Correa Tavares[2], DM Dodds[1]; [1]Mississippi State University, Starkville, MS, [2]University of Nebraska-Lincoln, North Platte, NE (96)

Preemergence (PRE) herbicides require rainfall to become active in the soil. However, data are lacking in amount of rainfall/overhead irrigation needed to activate PRE herbicides in order to maximize efficacy. Greenhouse studies were conducted to assess rainfall activation requirements for soil-applied herbicides in soybean production. Soil with differing textures (sandy loam, loam, and clay loam) were collected from various locations in MS. Velvetleaf (*Abutilon theophrasti*) and barnyardgrass (*Echinochloa cruis-galli*) control were evaluated after following application of herbicides including metribuzin at 702 g ai ha^{-1}, sulfentrazone at 368 g ai ha^{-1}, pryoxasulfone at 183 g ai ha^{-1}, and *S*-metolachlor at 1784 g ai ha^{-1} with the following rainfall amounts applied immediately after application of all herbicides: 2.54 cm ha^{-1}, 1.27 cm ha^{-1}, 0.95 cm ha^{-1}, 0.64 cm ha^{-1}, 0.32 cm ha^{-1}, and 0 cm ha^{-1}) to each soil type. Metribuzin provided less barnyardgrass biomass reduction following application to loam soil and 1.27cm of simulated rainfall than when grown on clay loam or sandy loam soil. Sulfentrazone provided less barnyardgrass biomass reduction following application to clay loam soil with no simulated rainfall than when grown in a sandy loam soil. Sulfentrazone provided less barnyardgrass biomass reduction when applied to a loam soil followed by 0.32 cm of simulated rainfall than when grown in a clay loam or sandy loam soil. Velvetleaf biomass reduction was less when grown in a loam soil compared to a clay soil following application of all herbicides and simulated rainfall amounts. *S*-metolachlor provided less velvetleaf biomass reduction than all other herbicides except when 1.27cm and 2.54cm of simulated rainfall was applied immediately after herbicide application. This data suggests that rainfall recommendations vary by herbicide and soil type, and some herbicides were effective at controlling weed species at low rainfall amounts (>1.27cm). This should ease growers' concerns of applying a PRE herbicide regardless of rain forecast, which helps introduce more modes of action into a season long weed control program.

Factors Influencing Effectiveness of Cover Crops for Weed Suppression in Soybean. W Reiter*[1], DP Russell[2]; [1]Auburn University, Auburn, AL, [2]Auburn University, Madison, AL (97)

Control of herbicide resistant weeds is a growing problem for Southeastern row crop producers. Sole reliance on chemical weed control is not a sustainable option in many production systems. Thus, utilizing alternative programs that integrate winter cover crops with postemergence herbicides is likely a more effective form of weed management. Timely establishment of cover crops like cereal rye and crimson clover in the fall is important to produce the high biomass needed for inhibiting weed seed germination in the spring. However, few studies have evaluated the combination of factors that lead to higher cover crop biomass and improved weed suppression. An experiment was conducted at the Tennessee Valley Research and Extension Center in Madison, AL in 2021 to evaluate the ability of different cover crop management practices in conjunction with preemergence herbicides for weed suppression in soybeans. The experiment was designed as a 2x2x3 factorial arrangement of treatments with four replications. Main factors were two seeding rates of cereal rye + crimson clover, two nitrogen fertilization rates, and three preemergence herbicide treatments (untreated, S-metolachlor, and acetochlor) applied to soybean. Cover crop biomass was collected to observe effects of seeding and fertilization rates on aboveground biomass production. Weed counts were conducted 2, 4, 6, and 8 weeks after soybean emergence in two m^2 areas within each plot. Common weed species were large crabgrass (*Digitaria sanguinalis*), Palmer amaranth (*Amaranthus palmeri*), prickly sida (*Sida spinosa*), and morningglories (*Ipomoea spp.*). Cover crop biomass ($P=0.0001$) and herbicide treatment ($P=0.0152$) both had a significant effect on weed emergence. Weed emergence was lower for the acetochlor and S-metolachlor treatments (5-6 weeds/m^2) compared to those with no herbicide, cover only (13 weeds/m^2). A negative linear correlation was observed as the amount of above ground biomass increased. This preliminary data suggests that higher nitrogen and cover crop seeding rates did not lead to higher cover crop yields (6349 kg ha^{-1}) compared to low nitrogen and seeding rates (5996 kg ha^{-1}), but that timely fall planting and preemergence herbicides were most important factors influencing weed suppression in soybeans.

Survey of Palmer Amaranth Resistance in South Carolina. MB Williams*, MW Marshall; Clemson University, Blackville, SC (98)

Herbicide tolerant traits are present in nearly 100% of soybean and cotton production today. Palmer amaranth resistance to glyphosate, glufosinate, dicamba, and PPO-inhibitors herbicides have been confirmed in the United States. A previous survey of South Carolina in 2009-10 confirmed wide-spread Palmer amaranth resistance to glyphosate and ALS-inhibitors. Palmer amaranth populations resistant to dicamba, glufosinate, and PPO-inhibitors in surrounding states have been confirmed; therefore, a survey of Palmer amaranth in South Carolina was initiated in 2020 and continued through 2022 to determine the level of resistance (if any) to herbicides used in corn, cotton, and soybean production for Palmer amaranth control. Palmer amaranth female seed heads were collected from across the main crop producing regions of South Carolina in the fall of 2020, 2021, and 2022. Seed heads were oven dried, threshed, and mature seed were 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 in this study 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. A field soil was collected and sanitized before placing in the flats for PRE study. The soil used in this study was a Fuquay sandy loam with 88% sand, 10% silt, and 2% clay content. Palmer amaranth seed were planted in the flats by population and then treated with the PRE herbicides. The herbicides were then watered in 12 hours later. Due to low seed volume for the 2020 collections, the PRE herbicides were not applied. For the postemergence study, seed were similarly planted in flats by population containing a commercial potting mix. After the Palmer amaranth populations reached the 2-3 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 PRE and POST flats were evaluated by counting any Palmer amaranth survivors. A population was deemed controlled if all Palmer were desiccated (POST) or did not emerge (PRE) with a control percentage ranging from 0 to 100, based off the number of survivors in each population compared to the control. As expected, all Palmer amaranth populations exhibited resistance (0%) at the 1X and 2X rate of glyphosate and thifensulfuron across all sampling years. These two modes-of-actions were confirmed in the 2009-10 survey. The remaining POST herbicides, glufosinate, fomesafen, 2,4-D choline, and dicamba effectively controlled (100%) all populations at both the 1X and 2X rate for all three sampling years. The 2021 populations were completely controlled (0%) by isoxaflutole. For s-metolachlor, average control percentage for all the populations ranged from 46% to 88% at the 1X rate and 46% to 98% at the 2X rate. Hampton and Marlboro counties populations exhibited the most resistance for both control rates. The average control percentage for the 1X rate of atrazine ranged from 33% to 94% and 50% to 98% at the 2X rate. The Barnwell (33%) and Dorchester (48%) populations had the lowest control percentage at the 1X rate with Dorchester possessing a 58% control percentage at the 2X rate. In the 2022 populations, four out of twenty-five populations were completely controlled (100%) at the 1X and 2X rate of s-metolachlor. However, Anderson and Barnwell populations had less than 50% control in the 1X and 2X rates of s-metolachlor. Aside from the Anderson population, all populations were controlled at the 1X and 2X rates of atrazine. Anderson populations had 78% and 96% control at the 1X and 2X rate, respectively. All populations were controlled at the 1X and 2X rate for isoxaflutole except for Lee (86%) and Colleton (96%). In summary, there is suspected Palmer amaranth resistance in South Carolina to atrazine and s-metolachlor. Future research includes continued population monitoring and further evaluation of suspected s-metolachlor resistant populations from this survey.

Weed Suppression by Cotton Chromosome Substitution Lines at Different Cover Crop Production Systems. AL Miller*, T Tseng, JC Argenta, Z Yue, V Varsha, NA Maphalala, W Segbefia, TR de Oliveira, GA Fuller; Mississippi State University, Starkville, MS (99)

Weedy plant species have been and continue to be an extreme issue affecting crops, including cotton. A specific weed species of a major nuisance to cotton (*Gossypium hirsutum*) is Palmer amaranth (*Amaranthus palmeri*). Palmer amaranth's unfortunate ability to form herbicide resistance has created a dire need for alternative methods that are more sustainable in controlling weed populations than the most common method of control by using chemicals. The cover crop species hairy vetch, rye, and wheat were planted in two separate locations. After cover crop termination, six different cotton chromosome substitution (CS) lines and one fallow were planted so that each CS line occurred with each cover crop treatment three times per location. Weed count was taken per weed species at 7, 14, 21, 28, and 35 days after planting. Cotton yield was recorded at the end of the growing season. The CS line MNTN 4-15 suppressed pigweed weed species the least compared to the other CS lines planted. Across all weed species, the cotton lines TM-1 and UA48 were the least suppressive. Among the cover crop treatments, the cotton yield was greater in plots planted with hairy vetch or wheat. Across the CS lines, the yield was highest for B01, B04, B16, and MNTN 4-15, while TM-1 and UA48 produced the lowest yields. Information on competitive crop lines (such as allelopathic cotton CS lines) and cover crops that suppress hard-to-control weedy species is highly valuable to crop breeders in developing weed-suppressive cotton lines and to growers to effectively manage problematic weeds.

Preemergence Control of *Amaranthus palmeri* with Isoxaflutole Combinations. M Smith*[1], PA Dotray[2], AC Hixson[3]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX, [3]BASF, Lubbock, TX (100)

Axant™ Flex cotton from BASF will soon provide growers the opportunity to use a novel mode of action in-crop. Isoxaflutole, an HPPD inhibitor, has been available for use in corn production for many years. *Amaranthus palmeri* S. Wats. (Palmer amaranth) is a difficult-to-control weed in cotton production on the Texas High Plains and across the cottonbelt. The addition of isoxaflutole to current cotton herbicide programs will increase the diversity of herbicide mode of actions to control Palmer amaranth and other troublesome weeds. Non-crop field studies were conducted in 2021 and 2022 at the Texas A&M AgriLife Research Center in Halfway, Texas. The objective was to evaluate preemergence control of Palmer amaranth using isoxaflutole tank-mix combinations. Field trials were established to evaluate several cotton residual herbicides applied alone and in tank-mix combinations with isoxaflutole at 0.07 or 0.105 kg ai ha^{-1}. Overhead sprinkler irrigation at 2.5 cm was used within 72 hours to activate all preemergence treatments. In 2021, isoxaflutole at 0.07 kg ai ha^{-1} plus S-metolachlor controlled Palmer amaranth 93% when evaluated 49 days after application. Isoxaflutole tank-mixed with dimethenamid-P, fluridone, or fomesafen controlled Palmer amaranth =70%. In 2022, isoxaflutole at 0.07 kg ai ha^{-1} tank-mixed S-metolachlor controlled Palmer amaranth >84% 42 days after application. Isoxaflutole tank-mixed with dimethenamid-P or fluometuron controlled Palmer amaranth =92%. In 2021, isoxaflutole at 0.105 kg ai ha^{-1} tank-mixed with acetochlor controlled palmer amaranth 90% 49 days after application. Isoxaflutole tank-mixed with diuron, fluometuron, or pendimethalin control Palmer amaranth >81%. In 2022, isoxaflutole at 0.105 kg ai ha^{-1} tank-mixed with dimethenamid-P controlled palmer amaranth 95% 42 days after application. Isoxaflutole tank-mixed with acetochlor, diuron, fluometuron, fluridone, fomesafen, prometryn, pendimethalin, or S-metolachlor controlled Palmer amaranth >82%. The opportunity to use isoxaflutole preemergence in cotton will aid in the management of Palmer amaranth.

Penetration of Residual Soybean (*Glycine max* L.) Herbicides into Cover Crop Stands. SC Baker*, DM Dodds, CK Meyer, GA Stephens, AA Tavares, JA Patterson; Mississippi State University, Starkville, MS (101)

Cover crops are purported to provide soybean producers with multiple benefits; however, the residue left behind could hinder soil-applied residual herbicides thus diminishing long-term weed control efficacy. Adjuvants cause a reduction in surface tension that may allow soil-applied herbicides to penetrate dense crop residue facilitating better soil contact. Therefore, this study was conducted to evaluate the effectiveness of non-ionic and silicone-based surfactants for improving herbicide efficacy using soil-applied herbicides in a cover crop system. Studies were conducted near Starkville, Brooksville, and Verona, MS using *S*-metolachlor (1788 g ai ha^{-1}), flumioxazin (105 g ai ha^{-1}), pyroxasulfone (183 g ai ha^{-1}), and metribuzin (147 g ai ha^{-1}). The adjuvants, Induce™ (NIS) and Kinetic™ (OS), were evaluated at each location with each herbicide. Rhodamine-B dye (5% v/v) was added to each treatment solution in order to quantify deposition using fluorimetry. Visual weed control ratings were taken at 14, 28, and 42 days after treatment (DAT). A Shimadzu RF-6000 spectrofluorometer was utilized to analyze Rhodamine-B dye concentration. Overall, Application of *S*-metolachor provided the greatest weed control without addition of an adjuvant at each location. Application of flumioxazin with or without NIS resulted in greater performance than other treatments in Brooksville and Verona. Application of metribuzin with OS frequently did not perform as well as when applied with NIS or alone. Application of pyroxasulfone with addition of adjuvant did not influence herbicide performance in 50% of evaluations. Adjuvants had little to no effect on residue penetration and soil contact. Growers are encouraged to implement the herbicide and adjuvant combination that best fits their weed control objectives and follows label requirements.

Estimating Weed Density and Potential Yield Reduction in Soybean Using Machine Learning.
D Srivastava*, V Singh, V Kumar; Virginia Tech, Painter, VA (102)

Effective weed management depends on efficient monitoring to identify dominant weed species and their spatial distribution within a field. Traditional practices of manually monitoring weed species are not efficient over large farm areas especially under unfavorable weather conditions; it is often inaccurate due to poor spatial coverage and human subjectivity. Advancements in new technologies, such as, Unmanned Aerial Systems (UAS) and machine learning, allow timely data collection on weed distribution and density to help growers in implementing short- and long-term strategies for weed management. The current research seeks to provide a robust estimation of weed density and distribution using machine learning and UAS. The study was conducted between 2021 to 2022 in the Eastern Shore region of Virginia where UAS-based red, green, and blue (RGB) images were acquired at different growth stages of soybean and common ragweed (*Ambrosia artemisiifolia* L.) at two research sites and three farmers' fields. A majority of weed detection machine learning methods are based on supervised learning which requires a huge amount of manually annotated images. As a result, these supervised algorithms are economically infeasible for the individual farmer because of the wide variety of crops being cultivated. The objective of the current study was to find a way for reducing the cost associated with building a robust weed detection model based on different classifications and object detection method architectures. For classification, self-supervised K-Nearest neighbor-based contrastive learning obtained 100% classification accuracy in predicting common ragweed. Object detection model 'You Only Look Once' (YOLOv6) was the best performing model to detect common ragweed in soybean with precision and recall greater than 81% at an average inference speed of 7.56 milliseconds on NVIDIA GeForce RTX 2080 GPU. After identification of weed-infested regions, weed density based on weed pixels was calculated to correlate with variation in crop yield due to weeds. This research on weed identification and density estimation will enable effective and inexpensive site-specific weed management practices.

Response of Stevia (*Stevia rebaudiana*) to Herbicides Applied Post. SJ Ippolito*[1], KM Jennings[1], DW Monks[1], DL Jordan[1], S Chaudhari[2], LD Moore[1]; [1]North Carolina State University, Raleigh, NC, [2]Michigan State University, East Lansing, MI (103)

Stevia (*Stevia rebaudiana* Bertoni) is a zero-calorie sweetener, 200 to 400 times sweeter than sucrose. Stevia is sensitive to weed competition, especially early in the season. However, few herbicides have been registered for use in stevia. As a result, post-transplant weed control options are limited in Stevia. Greenhouse studies were conducted to evaluate the safety of conventional herbicides applied over-the-top of stevia 2 wk after transplanting. Treatments included S-metolachlor, acifluorfen, linuron, halosulfuron, ethalfluralin, pendimethalin, metribuzin, trifloxysulfuron, pyroxasulfone, and carfentrazone. At 1 WAT, aciflourfen, metribuzin and carfentrazone caused 30 to 45% injury across both experimental runs. In contrast across both runs at 1 WAT, S-metolachlor, linuron, halosufluron, ethalfluralin, pyroxasulfone, pendimethalin, and tryfloxysulfuron caused 20% or less injury to stevia. By 4 WAT, injury to stevia from all treatments caused = 19% injury, except metribuzin and trifloxysulfuron which caused 84 and 69%, respectively. *S*-metolachlor, linuron, ethalfluralin, pendimethalin and pyroxasulfone did not cause a significant reduction in above ground biomass relative to the nontreated check 28 DAT. Below ground biomass was not impacted by linuron, ethalfluralin, pendimethalin, and pyroxasulfone. Ethalfluralin, linuron, pendimethalin, and pyroxasulfone appear to have potential for use in stevia and if registered in stevia would represent new herbicides for in-season weed management in the crop.

Effect of Three Cultivation Regimes on Weed Control and Sweetpotato Cultivar Yield and Quality. CD Blankenship*[1], KM Jennings[1], DW Monks[1], DL Jordan[1], SL Meyers[2], J Schultheis[1], DH Suchoff[1], LD Moore[1]; [1]North Carolina State University, Raleigh, NC, [2]Purdue University, West Lafayette, IN (104)

Field studies were conducted in 2020 and 2021 to determine whether selected sweetpotato (*Ipomoea batatas* L.) cultivars (Covington, Murasaki, and Monaco) with different canopy architectures respond differently to cultivation and weed interference. Cultivation treatments included no cultivation weedy and weed-free checks, cultivation weekly and biweekly (every 2 weeks) from 2 to 6 weeks after planting (WAP), 6 WAP cultivation only, cultivation at 2 WAP followed by hand removal from 2 to 6 WAP, and cultivation at the first and first two weed emergences. Cultivation treatments generally provided better Palmer amaranth control in 2021 than in 2020, except for the 2-week followed by hand removal and one cultivation at 1st weed emergence at 10 WAP rating. In 2020 all cultivation treatments resulted in poor control at the 10 WAP rating except for the 2 wk cultivation followed by hand removal from 2 to 6 WAP. Murasaki provided significantly greater Palmer amaranth control than Covington; Palmer amaranth control from Monaco was not statistically different from that of either Murasaki or Covington. Selected cultivar treatments exhibited no interactions with cultivation treatments. For total sweetpotato yield (sum of canner, No. 1, and jumbo grades) the biweekly, 2 WAP followed by hand removal, weekly, two cultivations at the first two weed emergences, and one cultivation at the first weed emergence treatments did not differ in total yield compared to the non-treated check. The 6 WAP only and non-cultivated weedy treatments resulted in a significant reduction in total yield compared to the non-cultivated weedy treatment.

In-Water Activity of Glyphosate, 2,4-D, and Diquat on Waterhyacinth (*Eichhornia crassipes*).
HJ Brown*[1], BP Sperry[2], CM Prince[3], J Ferrell[3]; [1]University of Florida Center for Aquatic and Invasive Plants, Gainesville, FL, [2]US Army Corps of Engineers, Gainesville, FL, [3]University of Florida, Gainesville, FL (105)

Waterhyacinth is an aggressive floating macrophyte that has been traditionally managed using foliar applications of 2,4-D and diquat. Recent research suggests that 20-25% of herbicide is lost to the water column. Here, we evaluated the relative efficacy of subsurface applications of 2,4-D, diquat, and glyphosate to determine if spray loss from foliar applications provides additional efficacy through absorption from roots and submersed leaves. Plants were established in mesocosms and treated with diquat at rates of 100, 200, 400, 800, 1600, or 3200 µg/L. Both 2,4-D and glyphosate were applied at rates of 125, 250, 500, 1000, 2000, 4000, or 8000 µg/L. Total plant biomass was harvested after 28 days of static exposure. Results suggest that subsurface diquat applications are effective at waterhyacinth control, with total plant death observed at 3200 µg/L and biomass reductions of 92% at 1600 µg/L. Neither 2,4-D or glyphosate were effective at reducing waterhyacinth biomass regardless of application rate. Results suggest that spray loss from glyphosate and 2,4-D applications represents wasted product and cost, while spray loss from diquat may provide additional efficacy on waterhyacinth.

Bahiagrass Response and Smutgrass Control with Hexazinone Co-applied with Liquid Urea Ammonium Nitrate. S Regmi*[1], P Devkota[1], BA Sellers[2], J Dubeux Jr[3], CA R. Sales[2], S Mathew[1], OS Daramola[4]; [1]University of Florida, Jay, FL, [2]University of Florida, Ona, FL, [3]University of Florida, Mariana, FL, [4]University of Florida/IFAS, Jay, FL (106)

Bahiagrass (*Paspalum notatum* F.) is a widely utilized forage in Florida and many areas of the Southeastern United States. Smutgrass (*Sporobolus* spp.) is an invasive species that can quickly dominate bahiagrass pastures, especially in central and south Florida. Hexazinone is the only selective herbicide labeled for smutgrass control in bahiagrass pastures; however, its expensive nature, injury to bahiagrass, and inconsistent control due to environmental extremes necessitate the evaluation of ways to improve efficacy. The objective of this study was to evaluate the bahiagrass response and smutgrass control with the co-application of hexazinone and nitrogen. Two field experiments were conducted in 2022, one on pure stands of 'Pensacola' bahiagrass and another on smutgrass infested bahiagrass pasture. Hexazinone at 0.56 and 1.12 kg ha^{-1} was applied with liquid urea ammonium nitrate (UAN; 32%) at 0, 14, 28, 42, and 56 kg ha^{-1} in May, July, or September as early, mid, and late season applications, respectively. Only the main factors of time of application, hexazinone rate, and UAN rate were significant for cumulative bahiagrass biomass. Biomass of bahiagrass treated with 0.56 kg ha^{-1} hexazinone was 1.2-fold greater than that treated with 1.12 kg ha^{-1}. As expected, increasing the co-applied nitrogen dose increased bahiagrass biomass by at least 1.2-fold at UAN rates at or above 0.28 kg ha^{-1}. The hexazinone rate by time of application as well as the main factors of time of application and hexazinone rate were significant for smutgrass control. Overall, smutgrass control was below 60% across all treatments; however, smutgrass control was 1.5-times greater when applied at mid or late season. As expected hexazinone applied at 1.12 kg ha^{-1} resulted in greater smutgrass control. However, no significant control was observed under varying rates of nitrogen. These data suggest co-application of hexazinone with nitrogen enhances bahiagrass recovery but will not likely increase the consistency of hexazinone use for smutgrass control.

Improved Herbicide Selectivity in Tomato by Safening Action of Benoxacor, Fenclorim, Melatonin, and 2,4, 6- Trichlorophenoxyacetic Acid. TR De Oliveira*, AA Tavares, V Varsha, Z Yue, JC Argenta, T Tseng; Mississippi State University, Starkville, MS (107)

Safeners are substances used to protect crops. The mechanism involves the ability to metabolize different compounds, including herbicides. The primary action of safeners includes raising the crop´s endurance to herbicide damage by inducing the protein(s) involved in herbicide metabolism and catalyzing their detoxification in the crop´s system. This study aimed to understand the biochemical effect of benoxacor safener for use in tomato culture, including the activation of the detoxifying enzyme glutathione S-transferase (GST). The experiment was conducted in a randomized factorial design 4x2, with four replications separated into two factors, (a) herbicide rates (0, 0.01, and 0.05x), and (b) safeners (benoxacor, fenclorim, melatonin, and control). Treatments were applied to the aerial part of the tomato seedlings. Visual injury at 3, 7, 14, and 21 days after application (DAA) and biomass at 21 DAA were evaluated. Leaf tissues were collected 0, 24, and 48 hours after herbicide application to determine GST activity. A close perusal of data indicates that seeds pre-treatment with safeners decreased injury, raised biomass, and showed high potential in increasing GST enzymatic activity, assisting the detoxification of plants caused by the herbicide. Knowledge of plant defense mechanism(s) will help improve our understanding of how safeners can offer protection against herbicides, thus leading to improved weed management strategies.

Evaluation of Choline Triclopyr, Imazapyr and Glyposate Hack and Squirt Applications for Control of Undesirable Midstory Hardwood Species in the Georgia Piedmont. AJ Swafford*[1], DC Clabo[2]; [1]University of Georgia, Athens, GA, [2]University of Georgia, Tifton, GA (108)

Hack and squirt herbicide applications are an important method of timber stand improvement to release desirable crop trees, control individual undesirable or invasive trees and shrubs, and improve stand species composition. In oak forest types, this application method can used for midstory removal to improve light conditions and recruitment of valuable intermediate shade tolerance oaks. In recent years, a new choline salt formulation of triclopyr was released with hack and squirt as a labeled application method for forestry sites. The objective of this study was to test the efficacy of two labeled rates of this triclopyr product versus industry standards including one rate of imazapyr and two rates of a hack and squirt labeled glyphosate product for control of common undesirable Piedmont hardwood species. Two study areas (named Good and Moderate site) were located in Putnam County, Georgia on B.F. Grant Wildlife Management Area. The Good site averaged 28.7 m^2 basal area per ha and averaged 2,352 suppressed or intermediate crown class stems per ha (trees greater than 1.4 m tall). The most common codominant and dominant crown class species were red oaks (*Quercus* spp.) (14.7%), natural loblolly pine (*Pinus taeda*) (14.3%), sweetgum (*Liquidambar styraciflua*) (12.6%), and white oaks (12%). Suppressed and intermediate hardwoods consisted primarily of maples (*Acer* spp.), eastern hophornbeam (*Ostrya virginiana*), hickories (*Carya* spp.), sweetgum, elms (*Ulmus* spp.), eastern redbud (*Cercis canadensis*), and flowering dogwood (*Cornus florida*). The Moderate site had an average basal area of 27.9 m^2 per hectare and averaged 1,813 suppressed or intermediate stems per hectare greater than 1.4 m tall. Codominant and dominant crown class species composition consisted primarily of natural loblolly pine (19.4%), yellow-poplar (*Liriodendron tulipifera*) (18.2%), red oaks (18.2%), and white oaks (12%). Intermediate and suppressed crown class species composition was similar to the Good Site. During October 2020, six 0.4-hectare square plots were established at each site. Test trees within each plot were assigned a crown class rating 1 through six (with rating 1 was 100% live crown and no signs of damage, rating 2 was 1-25% of crown dead or unhealthy, rating 3 was 25.1 to 50% crown mortality, rating 4 was 50.1 to 75% crown mortality, rating 5 was 75.1% to 100% crown mortality but stem or branch resprouts may be present, and rating 6 was crown and stem completely dead with no resprouting), measured for diameter at breast height (dbh), identified to species, and painted with tree marking paint with designated species-specific colors. Each plot was randomly assigned one of six treatments. Hack and squirt treatments included: (1) a 20% v/v solution of a 1.8 kg acid equivalent imazapyr applied at 1 mL per 7.6 cm of stem diameter (I20); (2) a 50% v/v solution of a 2.3 kg glyphosate acid applied at 1 mL per frill with frills made around the circumference of treated stems (G50); (3) an undiluted application of 2.3 kg glyphosate acid applied at 1 mL per frill with frills made around the circumference treated stems (G100); (4) a 50% v/v solution of 1.8 kg choline salt triclopyr applied at 1 mL per frill in frills made around the circumference of treated stems (T50); (5) undiluted 1.8 kg choline salt triclopyr applied at 0.5 mL per frill in frills around the circumference of the treated stem (T100); and (6) an untreated control. Frills were created using hatchets (wounds were made into the cambium layer) and spray bottles were periodically calibrated throughout each work day to ensure correct application rates. One year after treatment, individual trees were re-identified by paint color and were assigned a crown rating (1-6) and number of basal or epicormic sprouts were counted for stems that were still alive. Results revealed statistical differences at the Good site and that crown dieback ratings were significantly greater for the I20 treatment (5.364) compared to the control (1.196) and G50 (4.18) treatments, while the G100, T50, and T100 treatments were statistically similar but greater than the control. At the Moderate site, results were similar, except the I20 treatment (5.31) was statistically greater than the G100 treatment (4.73) instead of the G50 treatment. Differences in sprout counts for the

treatment x site interaction term were detected. At both sites the control trees had the fewest average sprouts per stem as expected. While at the Good site, the T50 (4.2) and T100 (2.9) had the fewest sprouts per tree on average other than the control. At the Moderate site, the control (0.7) and I20 (0.2) treatments had the fewest sprouts on average. And were closely followed (T50=2.2, T100=1.7) by the two choline salt triclopyr treatments. Tree diameter impacts on herbicide efficacy was only significant for the G50 treatment. A moderate negative correlation was found (?=-0.41), indicating that larger diameter trees tended to have lower crown dieback ratings for this treatment. This trial revealed that choline salt triclopyr is a viable option for control of many Piedmont hardwood species, and may perform better in some instances than hack and squirt labeled glyphosate.

Evaluating the Spray Patterns Produced by Four Boomless Nozzles at Varying Speeds. TH Duncan*, JD Byrd, Jr., KL Broster; Mississippi State University, Starkville, MS (109)

Because they can produce a wide spray swath without the need of a spray boom, boomless nozzles offer a more convenient method of broadcast applications for vegetation management in areas such as pastures, forestry, roadside and utility rights of way, and wildlife habitat restoration, where rough terrain and obstructions can damage or impede the use of conventional boom sprayers. However, few studies have evaluated the spray distribution of these nozzles to determine how best to account for the effective swath to ensure uniform applications as compared to what's published by manufacturers. Two studies were conducted at Mississippi State University (MSU) to evaluate the swath widths of four boomless nozzles at three operating speeds. The first study was an indoor study conducted at the Mississippi Horse Park, while the second study was conducted outdoors on unimproved turf at the RR Foil Plant Science Research Center. Both studies were a 3 by 4 factorial arrangement of treatments, with nozzle and application speed as factors. Nozzles used were the Boominator 1400ST (no advertised swath, static was measured at 13 m), Boominator 1870 (advertised to cover 11 m), Hamilton #10 (advertised to cover 15 m), and the Boom Buster 187 (advertised to cover 12 m). Applications for both studies were made with a 3-point hitch tractor sprayer with a Hypro roller pump operated at 1.6, 3.2, and 6.4 KPH. For the indoor study, a solution of water and FD&C Blue #1 food dye (Flavors and Color) was applied over six replicate rows of 21.5 X 28 cm Kromekote paper sheets (CutCardstock), spaced every 0.3 m perpendicular to the swath of each nozzle out to 0.6 m past the advertised swath. Once dried, the sheets were scanned at a resolution of 600 dots per inch (DPI) and analyzed using the USDA Automatic Paper Analysis tool in the DepositScan software add-on for ImageJ (Version 1.38X) to obtain coverage data, which was then used to develop relative deposition curves to determine the total and effective swaths of each nozzle at each speed. The field study was conducted on a flat, grassy area with mixed species of grass and clover. This study was conducted in a similar manner to the indoor study, minus the Kromekote paper and with 10.5% v/v MSMA 6 Plus (monosodium methyl arsenate) added to the water-dye solution. The field application was made August 8, 2022, with total swaths measured immediately following application. Kill swaths were measured 3 days after treatment (DAT) when visual injury was obvious. Data were analyzed with RStudio (Version 2022.07.1) and two-way ANOVA, with means separated by Fisher's Protected LSD (a=0.05). Effective swath data from the indoor study were converted to a percent ratio of the total swath measured to create a relative effective swath to better compare between nozzles and the effect of speed on observed spray patterns. Pattern overlap was then simulated for each nozzle at each speed, with the overlap uniformity determined by Christiansen's Uniformity Coefficient (CU). Each nozzle was then analyzed separately across speed as each nozzle responded differently. As speed increased past 1.6 KPH, the relative effective swath of each nozzle decreased except for the Boom Buster 187, which increased as the speed increased from 3.2 KPH to 6.4 KPH. There were no differences in the CUs measured between each nozzle and speed combination. When comparing the effective swaths measured and observed uniformity of each spray pattern, the Boom Buster 187 maintained the widest effective swath at all speeds with similar uniformity being observed to other nozzles, potentially requiring fewer passes for uniform coverage in the field.

Isoxaflutole Tank Mixtures Efficacy on Volunteer Peanut and Weed Control. L Pereira*, S Li, RD Langemeier, JT McCaghren; Auburn University, Auburn, AL (110)

The use of cotton-peanut rotation is common among growers in the southeastern U.S. due to increased yield and disease mitigation. However, volunteer peanuts can act as weeds, as well as reservoirs for disease and insects for future peanut crops. The future release of Axant Flex cotton, which is tolerant to isoxaflutole, dicamba, glyphosate, and glufosinate potentially allows for new volunteer peanut control and broadleaf weed control options. The objective of this study was to evaluate isoxaflutole preemergence tank mixtures efficacy on volunteer peanut and weed control in future Axant Flex cotton. The study was conducted at Henry County and Baldwin County, AL as well as Pickens County, SC during June and July of 2022. Treatments consisted of isoxaflutole in combination with dicamba and/or fomesafen. All treatments were applied preemergence using TeeJet TT 11002 nozzles for AL sites and FLAEVE 8002 nozzles for SC site. The data collection consisted of peanut stand count, visual control, and broadleaf weed control at 14, 28, and 42 days after planting (DAP). At 42 DAP, data collection also included broadleaf weed counts, weed biomass by species, and peanut biomass. Results showed that the higher rates of isoxaflutole in combination with dicamba resulted in 85 - 90% visual peanut and morningglory (*Ipomea* spp.) control for all sites for all ratings. This was similar to isoxaflutole alone. Treatments that did not include isoxaflutole did not perform as well for volunteer peanut and broadleaf weed control across all sites and ratings. Peanut stand count in SC was not significantly different from the non-treated control for any rating. Baldwin Co. presented significant differences for peanut stand count at 14 and 28 DAP ratings, while Henry Co. presented significant differences for all ratings. At 42 DAP in Henry Co. treatments either with lower rates or without isoxaflutole showed a higher peanut population. Broadleaf weeds biomass presented no significant differences. However, at Henry Co. and Baldwin Co. treatments without isoxaflutole or the combination of isoxaflutole with dicamba and fomesafen resulted in higher biomass, while Pickens Co. showed no biomass significance. Isoxaflutole shows potential for growers to increase both broadleaf weed and volunteer peanut control. For integrated weed and volunteer peanut control, the addition of dicamba and/or fomesafen will lead to better efficacy.

Managing Paraquat-Resistant Italian Ryegrass with Cover Crops and Fall Residuals. JH de Sanctis*, CW Cahoon, W Everman, T Gannon; North Carolina State University, Raleigh, NC (111)

North Carolina growers have long struggled to control Italian ryegrass (*Lolium perenne ssp. multiflorum*), especially in the south-central region, where no-till systems are largely adopted due to soil conservation practices. In these settings, Italian ryegrass is traditionally managed with burndown herbicides in the spring shortly before planting. Recent studies conducted with populations collected from the same area have confirmed the presence of populations resistant to nicosulfuron, glyphosate, clethodim, and paraquat. To avoid the spread of such biotypes and provide effective control of Italian ryegrass, it is crucial to integrate alternative management approaches. The objectives of this study were to evaluate Italian ryegrass control with cover crops and fall applied residual herbicides and investigate the level of cover crop injury from residual herbicides. This study was conducted near Salisbury and Clayton, NC, during the fall/winter of 2021-2022. Cover crops were seeded on Oct/20/2021 and Oct/18/2021 in Salisbury and Clayton, respectively, and residual herbicides were applied immediately after planting. The study was designed as a 3x5 strip-plot; strips included the three cover crop treatments (no-cover, cereal rye at 80 kg ha^{-1}, and crimson clover at 18 kg ha^{-1}) and subplots consisted of five residual herbicide treatments (S-metolachlor at 1420 g ai ha^{-1}, flumioxazin at 60.6 g ai ha^{-1}, metribuzin 470 g ai ha^{-1}, pyroxasulfone at 119 g ai ha^{-1}, and no-pre). Data collection consisted of bi-weekly visual estimates of Italian ryegrass control and cover crop injury, cover crop stand, and Italian ryegrass density. Cover crop and Italian ryegrass biomass were collected in the spring of 2022, at 24 weeks after planting (WAP). S-metolachlor and pyroxasulfone resulted in the least amount of cover crop injury and at 24 WAP all treatments with aforementioned herbicides resulted in <14% injury, regardless of the cover crop type and location. Furthermore, at 24 WAP metribuzin injured cereal rye and crimson clover 64% and 53%, respectively. At 8 WAP, cover crop treatment had little effect on Italian ryegrass control; cereal rye and crimson clover resulted in comparable control (83% and 81%, respectively). Furthermore, at the same timing all herbicides provided satisfactory Italian ryegrass control, ranging from 73% to 88%. However, at 24 WAP Italian ryegrass control in plots with cereal rye was 82% compared with 47% from plots with crimson clover. In addition, at 24 WAP, metribuzin was the least effective treatment and resulted in 34% Italian ryegrass control; poor Italian ryegrass control by plots receiving metribuzin is likely due to severe cover crop injury. Findings from this study suggest that although residual herbicides resulted in satisfactory control on Italian ryegrass initially, cover crop biomass was more important to season-long suppression of the weed. For example, 24 WAP, cereal rye with no residual herbicide suppressed Italian ryegrass comparable to cereal rye plus flumioxazin, pyroxasulfone, or *S*-metolachlor and suppressed the weed greater than cereal rye plus metribuzin which greatly injured the cereal rye and resulted in lower cover crop biomass production.

Glyphosate Formulations Influence Weed Control in Adverse Environmental Conditions. N Godara*, S Askew, CG Goncalves; Virginia Tech, Blacksburg, VA (112)

Herbicide formulators must combine numerous chemicals to improve mixing and spray properties, storage life, odor profiles, weed control efficacy, and safety to humans and the environment. Demands for formulations changes may come quickly due to client or regulatory issues. When formulation changes are made, weed control efficacy must be confirmed by comparing new formulations to standards. Under optimal conditions for weed control, such comparisons often do not separate as one would expect given varying surfactant load or other admixtures designed to improve performance. We have found the best way to separate different formulations of the same product or adjuvant admixtures for a given product is to create environmental conditions designed to reduce herbicide absorption or translocation. Light, rainfall, and temperature have been reported to be primary factors affecting glyphosate weed control. Previous research has shown how adjuvants may improve weed control by glyphosate when rainfall occurs soon after application. In 2021, three separate experiments were conducted under controlled environmental conditions evaluating the effect of glyphosate formulations on weed control under simulated rainfall events and varying light intensities and temperature extremes. Simulated rainfall (SRF) decreased velvetleaf and yellow nutsedge control from all treatments in a stepwise fashion from greatest to least control following no SRF, SRF at 2 HAT, and SRF at 0.5 or 1 HAT. At 28 days after treatment (DAT), the highest numeric yellow nutsedge control of 96% resulted from Glystar Original and only ALB012 controlled yellow nutsedge less (88%). ALB012, however, had the least difference between no rainfall and simulated rainfall at 0.5 HAT and resulted in statistically better control than Glystar Original when simulated rainfall was applied 0.5 HAT. Generally speaking, treatments that had the highest yellow nutsedge and velvetleaf control in absence of rainfall had the greatest reduction in weed control following simulated rainfall. Under low light, low temperature, and high light, high-temperature conditions, >94% control was observed for all weed species except 73% control of ivyleaf morninglory, irrespective of glyphosate formulations when evaluated at 28 DAT. Glyphosate formulations improved rainfastness for velvetleaf and yellow nutsedge in some cases, but did not influence plant response to varied light and temperature.

Crabgrass and Texas Panicum Control with Group 15 Herbicides Applied Preemergence. L Pereira*, S Li, RD Langemeier, JT McCaghren; Auburn University, Auburn, AL (113)

Gramineous weeds continue to be challenging to control in crops, especially in crops where herbicide tolerance traits are not available. The objective of this study was to compare the efficacy of four Very Long-chain Fatty Acid Inhibiting herbicides for preemergence control on two grass species with different seed sizes. The study was conducted in two sites in central and south Alabama during the 2022 growing season. The seeds of *Digitaria anguinalis* and *Panicum texanum* were spread onto tilled 1.83 x 1.83 m plots and incorporated with a rotary tiller, and then treated with herbicides immediately after. Plots were hand weeded to remove all other weed species as needed. Data collection involved weed counts and visual rating at 14, 28, and 42 days after treatment (DAT). Additionally, a handheld greenseeker and a multispectral imaging camera on an unmanned aerial vehicle were used to assess growth plus biomass collected at 42 DAT. Imagery was analyzed in QGIS 3.22 and statistics were conducted in SAS 9.4. The results showed a control over 94% for all products on *Digitaria*, and overall *Panicum* presented more difficult to control. The treatment that consisted of pyroxasulfone plus carfentrazone had the highest level of control for *Panicum*, while all treatments had same level of control for *Digitaria* when compared to non-treated control (NTC). Both *Panicum* and *Digitaria* presented no significant difference for stand counts across products even at 42 DAT, but pyroxasulfone plus carfentrazone was numerically lower for both species. Similar to stand count, no significant difference for dry biomass for *Digitaria*. However, pyroxasulfone plus carfentrazone was the only treatment significantly lower than NTC for *Panicum*. The research highlights the species-specific differences, indicating the need for site-specific recommendations depending on the weed species.

Evaluation of Residual Herbicide Programs in Soybean. ZR Treadway*, J Dudak, TA Baughman; Oklahoma State University, Ardmore, OK (114)

A vital step in maximizing soybean yield is proper weed management. Producers are facing the ever-growing issue of herbicide resistance and how to combat it. 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 useful method for combatting herbicide resistance is through the use of PRE residual herbicide combinations with multiple modes of action. Experiments were conducted from 2020-2022 to evaluate four modes of action for PRE residual weed control in dicamba-tolerant soybean. Treatments included FirstRate (0.6 oz/A), Spartan (4.5 fl oz/A), Tricor (12 fl oz/A), or Zidua (2.5 fl oz/A). Herbicides were applied alone, as well as in two and three way combinations. Treatments were followed by a POST application of Engenia (12.8 fl oz/A) + Roundup (32 fl oz/A). Soybean injury never exceeded 10% with any treatment at any point during the growing season. Palmer amaranth (*Amaranthus palmeri* S. Watson) was present in five of seven site years. Control of Palmer amaranth 2 WAP was 93% or greater with all three-way combinations across all locations. In three of the five site years where Palmer amaranth was present, all PRE combinations provided at least 94% control. At 4 WAP, control of Palmer amaranth was 90% or greater with all three-way combinations in four of the five site years. Control was at least 98% at three of the five site years, with Zidua in a two or three-way combination with FirstRate and Tricor, and FirstRate + Tricor + Spartan. Following the POST application of Engenia + Roundup, control of Palmer amaranth was at least 97% with all three-way combinations across all site years, as well as Zidua in combination with FirstRate or Tricor. Large crabgrass (*Digitaria sanguinalis* (L.) Scop.) was present in five of seven site years. Control 2 WAP was at least 90% at all locations with any treatment that included Tricor except in combination with Spartan. Large crabgrass control 4 WAP was at least 91% in four of five site years with all two- and three-way combinations that included Tricor. Following the POST application, control of large crabgrass was 90% or greater with all treatments 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 FirstRate 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 Zidua yielded equal to or greater than the trial average. These experiments highlight the importance of a residual herbicide program to combat troublesome weeds across varying geographical and environmental conditions. Additionally, producers are able to aid in protecting new POST herbicide technologies through the use of residual herbicides.

Effects of a Winter Cover Crop on Weed Competition for Nitrogen with Corn. C Sias*, S Pokhrel, ML Flessner, WE Thomason, R Maguire, K Bamber, C Bishop; Virginia Tech, Blacksburg, VA (115)

There is growing interest in the use of cover crops as an additional tool to control herbicide resistant weeds. Although cover crops have been shown in previous research to reduce weed competition and supply nitrogen independently, the effect of this interaction on available nitrogen is unclear. Experiments were conducted in 2021 and 2022 at three locations in Virginia to determine the effect of a cereal rye + hairy vetch winter cover crop on weed competition for nitrogen in a corn crop. This experiment was a 2 x 2 x 6 factorial in which the levels consisted of the following treatments: cover crop or no cover, weedy or weed free herbicide programs, and six different nitrogen side dress rates. Yield data were collected at harvest, as well as corn grain nitrogen. This experiment served to confirm that side-dress nitrogen applications are still needed to maximize corn yield, regardless of cover crop presence or weed control program. Additionally, the presence of a cover crop helped increase yield under dry conditions, mostly due to the retention of moisture for the crop. Understanding these agronomic relationships provides information for growers interested in cover cropping for weed suppression, and can ease their uncertainty on how their weed management program will affect their nitrogen inputs.

Determining Grain Sorghum Susceptibility to Simulated Carryover Applications of Terbacil and Fomesafen. NJ Shay*, EP Prostko; University of Georgia, Tifton, GA (116)

The climate in the Coastal Plain region of Georgia provides excellent growing conditions with ample precipitation and favorable temperatures to grow numerous crops nearly year-round. Growers can benefit from double-cropping rotational crops such as grain sorghum (*Sorghum bicolor*) following watermelon [*Citriullus lanatus* (Thunb.) Mastum. & Nakai] to maximize land use and add economic value to their operation. However, capitalizing on the economic advantages of harvesting two crops within one season must account for potential injury to subsequent crops from herbicide residues. An integrated weed management strategy that includes a preemergence application of fomesafen (Reflex®) or terbacil (Sinbar®) is one of the options University of Georgia (UGA) Extension recommends for ensuring a clean start against problematic weeds in watermelon production. Current plant-back restrictions require a minimum of 10 and 24 months for fomesafen and terbacil, respectively. Therefore, the objective of this research was to determine the tolerance of grain sorghum to preemergence applications of fomesafen and terbacil applied 100 days before planting. Experiments were conducted from 2019-2022 at the UGA Ponder Research Farm located near Ty Ty, GA. The experimental design was a randomized complete block with 4 replications. Five rates of fomesafen (35.0, 70.0, 140.0, 210.0, 280.0 g ai ha^{-1}), four rates of terbacil (3.5, 7.0, 10.5, 14.0 g ai ha^{-1}) and a non-treated control, were evaluated. All data were subjected to ANOVA using PROC GLIMMIX and means were separated using the Tukey-Kramer method (P = 0.10). Results indicated that both fomesafen and terbacil, regardless of rate, did not negatively impact sorghum density 14 days after planting (DAP) (P = 0.87). Although visual symptomology of fomesafen did occur throughout the growing season, especially at the highest rate, carryover did not negatively impact sorghum height (P = 0.15). Sorghum yield response to terbacil and fomesafen did not differ from the non-treated control with yields ranging from 2869 to 3700 kg ha^{-1} (P = 0.18). Based upon the results of this multi-year study, sorghum was not critically sensitive to carryover of terbacil and fomesafen when planted ~100 days after application.

Investigating Novel Application Methods to Mitigate Auxin + Graminicide Herbicide Antagonism. JA Patterson*, DM Dodds, AA Tavares, CK Meyer, SC Baker, GA Stephens; Mississippi State University, Starkville, MS (117)

Herbicide antagonism is an economically and environmentally destructive issue that many growers across the United States are experiencing. Published literature indicates that certain herbicides, when mixed together in solution, antagonize one another resulting in decreased weed control compared to each herbicide applied independently. While herbicide antagonism is well documented, it is less known if methods exist which can overcome antagonism without increasing herbicide rates or making repeated applications. Field experiments were conducted in 2022 at the Black Belt Branch Experiment Station near Brooksville, MS to evaluate grass weed control in response to the application of dicamba, 2,4-D, glyphosate, and clethodim using a commercially available direct-injection system compared to tank-mix combinations of these herbicides. A sprayer equipped with a commercially available direct-injection system was used to apply treatments as follows 1) the two herbicides tank-mixed and sprayed through a single boom, 2) the auxin herbicide applied from the bulk tank and the grass herbicide direct-injected into the spray boom, 3) the grass herbicide applied from the bulk tank and the auxin herbicide direct-injected into the spray boom, and 4) the grass herbicide applied alone. Each herbicide combination was applied with the application methods listed above. At 14 and 28 days after treatment, regardless of which auxin herbicide was included, glyphosate provided greater barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] control than clethodim. At 14 and 28 days after treatment, when dicamba was used, no differences in barnyardgrass control were observed within glyphosate- nor clethodim-containing treatments. At 14 days after treatment, when clethodim was injected into 2,4-D, increased control was observed compared to when 2,4-D was injected into clethodim or the two herbicides were tank-mixed. These findings suggest that, in general, auxin + graminicide treatments applied via direct-injection do not provide greater barnyardgrass control compared to tank-mix treatments. However, these results do indicate that, regardless of application method, glyphosate is more efficacious in controlling barnyardgrass than clethodim. Although no differences in barnyardgrass control were observed with dicamba, there is still value in utilizing this application method to potentially alleviate tank-contamination.

Confirmation of a Glufosinate-resistant Palmer Amaranth (*Amaranthus palmeri*) Population in North Carolina. EA Jones*, J Dunne, DJ Contreras, CW Cahoon, KM Jennings, RG Leon, W Everman; North Carolina State University, Raleigh, NC (118)

A putative glufosinate-resistant *Amaranthus palmeri* population was reported in 2015 in Anson County, North Carolina. In the field, two different *A. palmeri* cohorts exhibited differential responses of death and survival suggesting the population is still segregating for resistance. Dose-response assays conducted in the greenhouse determined the Anson County population exhibited reduced susceptibility to glufosinate compared to three glufosinate-susceptible populations. The LD_{50} values (210-267 g ai ha^{-1}) for the Anson County populations were always significantly higher than the LD_{50} values (118-158 g ai ha^{-1}) for the tested glufosinate-susceptible population from the dose-response assays. Anson County plants that survived lethal glufosinate rates (267-450 g ai ha^{-1}) were reciprocally crossed with a glufosinate-susceptible plants to create F_1 genotypes and treated with a lethal rate of glufosinate (267 g ai ha^{-1}) to determine the distribution of injury and survival for each biparental cross compared to a cross including two glufosinate-susceptible parents. The distribution of injury was non-normal for the biparental crosses containing an Anson County plant compared to the cross with a susceptible male and female. Survival was 68-84% for biparental crosses containing an Anson County plant, while the survival was significantly reduced to 35% for the susceptible plant cross. Chi-square goodness of fit tests were used to test inheritance models to describe survival of the progeny of each biparental cross. The RM × SF and SM × RF_2 cross were best described with a heterozygous two loci with incomplete dominance model compared to the RM × RF_1 cross that was best described with a heterozygous single loci with incomplete dominance model. These results suggest that the Anson County *A. palmeri* population has evolved glufosinate resistance and the inherited mechanism is oligogenic with incomplete dominance from heterozygous parental genotypes with a possible maternal effect.

Utilization of Herbicides and Hormones as Gametocides for Reproductive Suppression of Palmer Amaranth (*Amaranthus palmeri*). SE Kezar*[1], NK Subramanian[1], G Morgan[2], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Cotton Incorporated, Cary, NC (119)

Gametocide applications are historically made in hybrid seed production to induce male sterility. However, the potential of gametocides for reproductive control of late-season escapes is yet to be explored. The objective of this study is to understand the potential impact of various chemicals at sub-lethal doses to suppress reproductive capabilities of Palmer amaranth (*Amaranthus palmeri*), a major weed in cotton and other crops in the United States. This study was conducted in a greenhouse setting at the TAMU-Norman Borlaug Greenhouse Facility, using a Palmer amaranth population originated from the Texas High Plains. A total of 21 treatments grouped into acetolactate-synthase inhibitors, auxins, chemical hybridizing agents, and hormones were applied at three growth stages: peak vegetative stage, seedhead initiation to seedhead development, and early to late flowering. A research track sprayer mounted with two flat-fan 800067 nozzles (TeeJet Technologies) was utilized to apply treatments in a 30 ml carrier volume. Observations inlcuded the viability of male and female gametes as well as seed production and seed characteristics. Overall, it was found that both male and female Palmer amaranth reproduction was impacted by chemical gametocide application, though the effects varied across the treatment and growth stage at application. Gametocides such as Monosulphuron Ester Sodium (MES, chemical hybridizing agent group) and Trifluoromethanesulfonamide (TFMSA, chemical hybridizing agent group), were effective across a wide growth window from peak vegetative to seedhead development wherein pollen viability was reduced by 90% compared to the non-treated control (NTC). Impact on seed viability and dormancy was more dependent on the stage of application. For example, females sprayed at seedhead development with Gibberellic Acid (hormone group) and females sprayed at peak flowering with Estrone (hormone group) showed >25% reduction in viability. Additionally, seed size and vigor were also impacted by several gametocides, indicating that the progeny could be less fit. Results of this study demonstrate that gametocides can be effectively used to disrupt weed seedbank contributions of late-season Palmer amaranth escapes through reproductive suppression.

Alternative Herbicide Options for Paraquat in Treatments Targeting Palmer Amaranth (*Amaranthus palmeri*). GA Mangialardi*[1], J Bond[2], TW Eubank[3], TD Burrell II[2]; [1]Mississippi State University, Shelby, MS, [2]Mississippi State University, Stoneville, MS, [3]Mississippi State University, Greenville, MS (120)

Paraquat is a non-selective group 22 herbicide inhibiting photosynthesis at photosystem I. Paraquat was applied to U.S. crops in totals of 769,292 kg to cotton, 407,325 kg to corn, and 49,441 kg to rice in 2020. Palmer amaranth has been noted causing more economic damage than all glyphosate-resistant weeds in the southern United States, and paraquat is often utilized at planting for Palmer amaranth control. Uncertainty of paraquat's future due to high mammalian toxicity and few treatments for accidental poisoning provokes the need to study alternative herbicide options for control of Palmer amaranth. Two studies were conducted at the Delta Research and Extension Center in Stoneville, MS, in 2022 to evaluate control of Palmer amaranth with different herbicides and adjuvants. Both studies were designed to simulate herbicide treatments targeting Palmer amaranth applied immediately following planting. Both studies were conducted in fallow areas and were arranged as a two-factor factorial within a randomized complete block design with four replications. In the Herbicide Treatment Study, Factor A was herbicide treatment and included paraquat at 841 g ai ha^{-1} plus metribuzin at 140 g ai ha^{-1}, glyphosate at 1,121 g ae ha^{-1} plus tiafenacil at 25 g ai ha^{-1}, glyphosate at 1,121 g ha^{-1} plus tiafenacil at 50 g ha^{-1}, glyphosate at 1,121 g ha^{-1} plus dicamba at 560 g ae ha^{-1}, glufosinate at 656 g ai ha^{-1}, glyphosate plus 2,4-D choline at 2,164 g ae ha^{-1}, and 2,4-D choline at 1,065 g ae ha^{-1} plus glufosinate at 656 g ha^{-1}. All treatments containing paraquat or dicamaba included NIS (Non-Ionic Surfactant) at .5% v/v, while treatments containing tiafenacil included MSO (Methylated Seed Oil) at 1% v/v. Factor B was application timing with treatments applied when Palmer amaranth was 7 or 25 cm in height. In the Adjuvant Study, Factor A was herbicide treatment and included paraquat 841 g ha^{-1} plus metribuzin at 280 g ha^{-1}, two different iosopropylamine salts of glyphosate (IPA-1, IPA-2) at 1,121 g ha^{-1} plus tiafenacil at 25 g ha^{-1}. Factor B was adjuvant and included no adjuvant, MSO at 1% v/v, AMS (Ammonium Sulfate) at 1.25% v/v, COC (Crop Oil Concentrate) at 1% v/v, MSO at 1% v/v plus AMS at 1.25% v/v, and COC at 1% v/v plus AMS at 1.25% v/v. All treatments were applied to 15 cm Palmer amaranth. In the Herbicide Treatment Study, only paraquat plus metribuzin and 2,4-D choline plus glufosinate controlled 3- and 10-inch Palmer amaranth > 90% across all evaluations. Glyphosate plus both rates of tiafenacil, glyphosate plus dicamba, glufosinate, and glyphosate plus 2,4-D choline controlled 3-inch Palmer amaranth similar to paraquat plus metribuzin and 2,4-D choline plus glufosinate. These treatments did not provide comparable control of 10 Palmer amaranth. In the Adjuvant Study, paraquat plus metribuzin provided the greatest control of Palmer amaranth (≥97%) regardless of adjuvant. Methylated Seed Oil mixed with IPA-1 and COC mixed with IPA-2 plus tiafenacil were the only treatments to provide Palmer amaranth control similar to paraquat plus metribuzin treatments. In summary, control of Palmer amaranth with paraquat is still very effective. Through this research, it is believed that there are other potential herbicide options for control of Palmer amaranth if used correctly.

Allelopathic Effects of Cotton Chromosome Substitution Lines Against Glyphosate-resistant Palmer Amaranth in Field Conditions. W Segbefia*[1], V Varsha[1], NA Maphalala[1], Z Yue[1], TR De Oliveira[1], T Garrett[2], P Sharma[1], MW Shankle[1], T Tseng[1]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Pontotoc, MS (121)

Allelopathy is where some crops can produce substances (called allelochemicals) that ward off weed competition. Allelochemicals are subject to environmental conditions and can be released in various ways. Field trials are necessary to evaluate the effectiveness of weed-suppressing herbicides because greenhouse and lab tests are limited in their capacity to mimic natural ecological settings and interactions. For this research, a 2-row plot at Pontotoc, Mississippi, was planted with eight cotton chromosomal substitution lines. After three weeks of planting (WAP), seeds of three weed species—redroot pigweed (*Amaranthus retroflexus*), morning glory (*Ipomoea spp.*), and common lambsquarters—were sown between the cotton rows. The heights of cotton plants were measured every week for six weeks, and the density of each weed species in the field, including native weeds, was recorded. Enlist cotton resulted in the least weed density reduction (32%), followed by UA48 (35%). T26lo reduced the weed density the most (52%), followed by BNTN 16-15 (60%). In a world where herbicide resistance in weeds is growing, allelopathy may be an effective and sustainable alternative to weed management.

Herbicide Program Impact on Population Dynamics of Palmer Amaranth *(Amaranthus palmeri)* in Long-Term Cover Crops and Living Mulch. HC Lindell*[1], D Weisberger[1], G Morgan[2], C Bocz[1], NT Basinger[1]; [1]University of Georgia, Athens, GA, [2]Cotton Incorporated, Cary, NC (122)

Palmer amaranth (*Amaranthus palmeri* S. Wats) is a highly prevalent and fecund weed in Southeastern U.S., notably creating problems for cotton producers. With increases in herbicide resistance, integrated weed management practices, such as cover crops, are necessary for control. A three-year cotton study from 2020 to 2022 observing the effects of two annual cover crops (cereal rye [CR] and crimson clover [CC]), a perennial living mulch (Durana® white clover, [LM]), and a bare ground (BG) control on Palmer amaranth population dynamics in Watkinsville, Georgia. To examine cover crop effect on weed population dynamics, no herbicides were used in the first two years. To determine synergistic effects of herbicide and cover crops, post emergence herbicides were added in year three (2022) for impacts of the integrated practices on Palmer amaranth population dynamics. Data collected included, cover crop biomass, Palmer amaranth seedling emergence, end-of-season plant counts, and biomass, as well as, light interception, yield and its parameters. In 2022, LM and BG produced ~1,331 kg ha^{-1} less biomass compared to CR and CC. LM coverage had sufficient light interception early in the cotton season (2 to 4 weeks after planting [WAP]) but reduced significantly at 11 to 16 WAP. Palmer amaranth recruitment cohorts emerged 3 WAP (63%), increasing 19% at 7 WAP (83%) and concluding final 16% cohorts 8 to 13 WAP (~99%). During 2022 end-of-season, LM Palmer amaranth plant counts surpassed CR, CC, and BG by 33,847 plants ha^{-1}, reflecting with Palmer amaranth biomass (537 kg ha^{-1} greater than CR, CC, and BG). Cotton yield was similar across all cover crop treatments in each year. This indicates that cover crops and living mulches provide additional weed suppression of Palmer amaranth without affecting cotton productivity. Cover crop systems and herbicide synergism provide weed suppression while effecting Palmer amaranth population dynamics.

Impact of Chaff Flow Rate on Redekop Seed Control Unit's Seed Kill and Horsepower Draw in Wheat and Soybean. EC Russell*[1], ML Flessner[1], MP Spoth[1], K Bamber[1], C Sias[2], WJ Stutzman[1]; [1]Virginia Tech, Blacksburg, VA, [2]Texas A&M University, College Station, TX (123)

Yield is never consistent across a field. Therefore, the flow rate of harvest residue through the combine is always changing. Combine modifications, like the Redekop Seed Control Unit, are impacted by varying residue flow rates, which affect the weed seed kill of the mill and the horsepower required to power it. So, the purpose of this research was to determine how chaff flow rate affects weed seed kill and horsepower draw by the mill in wheat and soybean. Four chaff flow rates, 0.75, 1.5, 2.25, and 3 kg sec-1, were tested for both wheat and soybean, which spans approximately 0.5 to 2 fold a combine's capacity. All testing was conducted using a stationary test stand. Three weed species were tested for wheat, Italian ryegrass (*Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot), canola (*Brassica napus* L.), and hairy vetch (*Vicia villosa* Roth), and four weed species were tested for soybean, Palmer amaranth (*Amaranthus palmeri* S. Wats.), common ragweed (*Ambrosia artemisiifolia* L.), barnyardgrass (*Echinochloa crus-galli* (L.) P. Beauv.), and morningglory spp. (*Ipomoea* spp.). Horsepower requirements increased by 17.8 and 17.2 horsepower for wheat and soybean, respectively, for every 1 kg sec-1 of chaff that flows into the mill. Seed kill was not affected as the chaff flow rate increased for most of the species. However, seed kill for common ragweed and Italian ryegrass decreased by 0.17% and 3.4%, respectively, for each 1 kg sec-1 of chaff that flows through the mill. Despite this decrease, seed kill was still >99% and >88% for common ragweed and Italian ryegrass, respectively, at the highest tested chaff rate. Therefore, horsepower requirements increase as chaff flow rate increases, but seed kill was not as affected. These data indicate that the Redekop Seed Control Unit can be an effective tool during harvest that can handle fluctuations in chaff flow while still delivering high kill rates.

Interaction of See & Spray™ Model Sensitivity and Application Timing in Cotton. TH Avent*[1], JK Norsworthy[1], MC Woolard[1], WL Patzoldt[2], LM Lazaro[2], MM Houston[3], W Everman[4], DJ Contreras[4]; [1]University of Arkansas, Fayetteville, AR, [2]Blue River Technology, Sunnyvale, CA, [3]Blue River Technology, Leland, MS, [4]North Carolina State University, Raleigh, NC (124)

The performance of See & Spray™ Ultimate in row-crops tends to be comparable to broadcast standard programs, but these results are dependent upon several factors. Thus, trials were conducted in Keiser, AR; Greenville, MS; and Kinston, NC to determine which factors will influence the likelihood of weeds being treated with See & Spray in cotton (*Gossypium hirsutum* L.). Weeds within a plot were staked and noted for height, width, species, and location in regards to crop before a herbicide application. After initial data collection, plots were treated with glufosinate and blue dye with a low, medium, or high sensitivity or a broadcast application 14, 21, and 28 days after planting. After application, the presence of blue dye on staked weeds was recorded to determine if weeds were treated with herbicide or not. Based on the results for Palmer amaranth (*Amaranthus palmeri* S. Watson), as weed size increased the likelihood of plants being treated increased. Also, higher sensitivity settings treated more Palmer amaranth than the low sensitivity, especially when the weeds were small. Differences between location (whether the weed was located within the crop canopy or furrow) did not affect the likelihood of plants being treated. Lastly, as application timing was delayed weed size increased and the likelihood of Palmer amaranth being treated also increased. Results from this study demonstrate the ability of See & Spray to detect Palmer amaranth in cotton and should caution users of this technology from solely using the low sensitivity setting.

Does Seed Quality Influence Cotton Tolerance to PRE Herbicides? J Forehand*[1], CW Cahoon[1], G Collins[2], K Edmisten[1], M Phillips[1], ZR Taylor[3], JH de Sanctis[1], BA Dean[1], H Lee[1], L Snyder[1]; [1]North Carolina State University, Raleigh, NC, [2]North Carolina State University, Bailey, NC, [3]North Carolina State University, Sanford, NC (125)

Today's larger farms must cover more acres in a limited amount of time, resulting in cotton planted under suboptimal conditions, therefore increasing the risk of PRE herbicide injury on young cotton seedlings. The purpose of this study was to investigate the relationship between cool germ percentage and cotton PRE herbicide tolerance. In this study we used three different varieties with differing cool germ percentages (Var1 at 56%; high cool germ, Var2 at 45%; mod cool germ, and Var3 at 25%; low cool germ). Each variety had a non-treated check and was subjected to different herbicides at one (1X) and two (2X) times the labeled rate. These herbicides included acetochlor (1261 and 2522 g a.i./ha), fomesafen (280 and 560 g a.i./ha), diuron (841 and 1681 g a.i./ha), and fluometuron (1121 and 2242 g a.i./ha). Plots were arranged in a RCB design in two locations, one at the Peanut Belt Research Station in Lewiston, NC which was planted on May 4, 2022, and another location at the Upper Coastal Plain Research Station in Rocky Mount, NC which was planted on May 10, 2022. Plots were kept weed free with multiple applications of glyphosate and glufosinate. Cotton stand and injury (visual 0-100%) were collected 7, 14, and 21 days after planting (DAP). Crop biomass at 21 DAP and lint yield were also collected. Data was subjected to analysis of variance using R software, and means were separated using Fisher's Protected LSD at an alpha value of 0.05. The main effects of cool germ and location was significant for cotton stand. In Lewiston, high cool germ, mod cool germ, and low cool germ had stands of 117, 108, and 103 plants/12m of row, respectively. In Rocky Mount, high cool germ, mod cool germ, and low cool germ had stands of 112, 100, 83 plants/12m of row, respectively. Crop biomass was similar across herbicides with the exception of diuron 2X at one location. Diuron was the most injurious PRE herbicide; cotton response to the 2X rate of diuron was influenced by cool germ with the high cool germ, mod cool germ, and low cool germ varieties being injured 20, 26, and 31%, respectively. Early season injury was transient and did not impact lint yield.

Optimizing Impregnated Pyroxasulfone for Cotton. BA Dean*, CW Cahoon, Z Taylor, JH de Sanctis, J Forehand, H Lee; North Carolina State University, Raleigh, NC (126)

Palmer amaranth (*Amaranthus palmeri*) is a troublesome weed now confirmed resistant to 9 herbicide modes of action. Moving forward, cotton farmers will need all available tools to successfully manage herbicide-resistant Palmer amaranth. One such tool is the use of granular fertilizers impregnated with residual herbicides. During 2022, two separate experiments were established near Rocky Mount and Clayton to determine the optimal rate of granular ammonium sulfate (AMS) impregnated with pyroxasulfone and the optimal timing for use in cotton. Cotton cultivar 'DP2115 B3XF' was planted on 11 May and 12 May at Rocky Mount and Clayton, respectively. For the rate study, AMS rates included 161, 214, 292, 321, 374, 428, and 482 kg ha^{-1}, equivalent to 34, 45, 56, 67, 79, 90, and 101 kg N ha^{-1}, respectively. Pyroxasulfone was impregnated on granular AMS to achieve a final herbicide rate of 118 g ai ha^{-1} across all AMS rates. For the timing study, 118 g ai ha^{-1} pyroxasulfone was impregnated on granular AMS applied at a rate of 321 kg ha^{-1} (67 kg N ha^{-1}) to 5- to 7-leaf, 9- to 11-leaf, and 1st bloom cotton. For both studies, weed control and cotton tolerance to impregnated pyroxasulfone was compared to pyroxasulfone (118 g ai ha^{-1}) applied postemergence over-the-top (POST) and postemergence-directed (POST-DIR). A nontreated was also included for comparison. Prior to pyroxasulfone applications, all plots (including the nontreated) were kept weed free using multiple applications of glyphosate + glufosinate; no residuals were used prior to pyroxasulfone applications. Visual estimates of Palmer amaranth control and cotton injury were collected bi-weekly until 70 days after application (DAA) and Palmer amaranth density and biomass were collected prior to cotton defoliation. At the conclusion of the season, cotton was machine harvested and weighed to determine yield. For both studies, cotton injury was minimal outside of some foliar necrosis in response to some AMS sticking to damp foliage. For the rate study, Palmer amaranth was controlled 58 to 89% and 63 to 86% 70 DAA at Clayton and Rocky Mount, respectively. Furthermore, there were no differences in late season Palmer amaranth control across AMS rates and all pyroxasulfone impregnated AMS treatments performed similarly to pyroxasulfone applied POST and POST-DIR. For the timing study, 70 DAA, Palmer amaranth was controlled 73 to 90% and 82 to 99% at Clayton and Rocky Mount, respectively. Like the rate study, there were no differences in late season Palmer amaranth control across timings nor when comparing pyroxasulfone impregnated AMS to pyroxasulfone applied POST or POST-DIR. For both studies, cotton yield among plots receiving pyroxasulfone impregnated on AMS, POST, or POST-DIR were similar regardless of AMS rate or timing.

Optimizing Living Mulch Vegetation-Free Strip Width Across Two Edaphic Regions in Georgia Cotton. S Shome*, N Gaur, HC Lindell, C Bocz, NT Basinger; University of Georgia, Athens, GA (127)

Living mulch is defined as unterminated cover crops grown synchronously with a cash crop. They provide ecosystem services such as smothering weeds, improving water holding capacity, fixing atmospheric nitrogen, increasing soil organic carbon, and attracting beneficial insects for pollination. Living mulches have not been studied in cotton production in the Southeastern (SE) US. Therefore, the objective of the study is to optimize Vegetation-Free Strip Width (VFSW) and planting rates for living mulch systems for SE cotton. The study was conducted over two years (2021-2022) at two locations: J. Phil Campbell Research and Education Center (JPCREC) in Watkinsville, Georgia (GA), and the Southeast GA Research Center (SEGREC) in Midville, GA, which represent two unique cotton growing environments. The experiment used a randomized block design with a factorial arrangement of treatments. Factors included VFSW (0, 0.15, 0.30, 0.60, and 0.90 m) and seeding rate (6.6 and 13.2 seeds m^{-1}) resulting in 10 treatments. Data were collected biweekly for cotton height, nodes, Leaf Area Index (LAI), and Soil Plant Analysis Development (SPAD). Except for 0 m VFSW, stand establishment was similar for all VFSW at both sites and years. Before harvest, 10 plants $plot^{-1}$ were selected randomly to evaluate cotton yield parameters (boll $plant^{-1}$, lint $boll^{-1}$, seed cotton yield, and lint yield). 0 m VFSW reduced cotton stands regardless of planting density. Analysis from 3-parameter Gompertz model showed that optimal VFSW for JPCREC was 0.30 m while 0.90 m (bare ground) was the only acceptable VFSW at SEGREC to maximize yield. Seeding rate did not impact yield at either location for both years. Hence, 6.6 seeds m^{-1} is more advantageous for growers. Based on the study, 0.3 m VFSW is a viable option for growers on heavier clay soils. Living mulch is not recommended for growers on sandy soils.

Palmer Amaranth Control with a Moldboard Plow in a Cotton Production System. TC Smith*[1], JK Norsworthy[1], T Barber[2], RB Farr[1], LB Piveta[1], MC Woolard[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (128)

Palmer amaranth is the most problematic weed in cropping systems throughout the United States. In a cotton system where canopy closure is prolonged, Palmer amaranth can continue to emerge and thrive. In 2018 an experiment was initiated at the Lon Mann Cotton Research and Extension Center near Marianna, Arkansas, to evaluate how integrated weed management strategies affect Palmer amaranth emergence over a four-year period. The long-term experiment consists of 16 treatments with 4 replications, and treatments combined strategies such as tillage, cover cropping (cereal rye), herbicide programs, and zero-tolerance. After four years, the use of zero tolerance, cover crop, or a plow event have reduced Palmer amaranth emergence by 56, 58, and 63%, respectively. When a plow event was combined with a dicamba-based herbicide program or a plow event is combined with a dicamba-based program, and cover crop Palmer amaranth emergence was reduced by 93%. Results show that these strategies alone can reduce Palmer amaranth emergence; however, the combined use can provide a greater reduction in emergence. Overall the possible combinations of the use of a plow event and a dicamba-based program would be most effective for producers.

Alternate Application Methods of Dicamba in Texas Cotton to Reduce Off-target Movement.
HR Taylor*[1], SA Nolte[2], JA McGinty[3], PA Dotray[4], ZS Howard[5]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Extension, College Station, TX, [3]Texas A&M AgriLife Extension, Corpus Christi, TX, [4]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX, [5]Texas A&M Univeristy, College Station, TX (129)

Dicamba provides Texas cotton growers relief when battling troublesome weeds. With the onset of glyphosate resistant weeds, the mode of action of dicamba has proven to be a useful rotation method. However, due to the likelihood of dicamba to drift off-target, growers should be well equipped when applying this herbicide. In this study, we will observe alternative spray applications to reduce the potential for off-target movement deposition, both from physical drift and volatility. The study was conducted at three Texas A&M locations in Lubbock, Corpus Christi, and College Station. Two sites of dicamba tolerant cotton were planted and applied with dicamba and a drift reducing agent to simulate a practical early-season application. Both sites were compared using different boom application methods; one being a standard open nozzle boom, one being a modified post-direct drop nozzle boom. In Lubbock, a third testing site was established for a hooded sprayer. The sites were sprayed simultaneously under wind displaying less than ideal speeds. To detect physical drift, potted non-dicamba tolerant indicator species were placed in three transects downwind of the spray in the College Station and Corpus Christi locations. In Lubbock, non-dicamba tolerant cotton was field-planted surrounding the treated area. The indicator cotton was evaluated at distances of 3m, 5m, 10m, 20m, 30m, 40m and 50m where a filter paper was placed for deposition analysis. Weather data at each spray location was implemented at 5-minute intervals. In conclusion of the application, the filter paper was collected and the indicated species were moved to a location off site. A percent injury rating of the indicator species was taken at 14 and 28 days after treatment. Filter paper analysis results showed that the use of a hooded sprayer in Lubbock reduced the amount of drift when compared to an open standard nozzle boom. Additionally, the use of a modified post-direct drop nozzle boom significantly reduced the amount of drift deposition at most locations. Providing Texas growers with these data will be useful with increasing restrictions on dicamba use. With further information on application methods, cotton growers can confidently apply dicamba despite the variety of climates in Texas.

Hard Water Effect on Glyphosate Grass Control in the Enlist Weed System. JT McCaghren*, S Li, RD Langemeier, L Pereira; Auburn University, Auburn, AL (130)

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 was repeated in summer of 2022 in Henry County, 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.

The Effect of Glyphosate Salts and Volatility-Reducing Agents (VRA) on Dicamba Volatility.
NT Glenn*[1], DB Reynolds[1], JK Norsworthy[2], KW Bradley[3], BG Young[4]; [1]Mississippi State University, Starkville, MS, [2]University of Arkansas, Fayetteville, AR, [3]University of Missouri, Columbia, MO, [4]Purdue University, Brookston, IN (131)

The Effects of Glyphosate Salts and Volatility-Reducing Agents (VRA) on Dicamba Volatility
Nicole Glenn, Daniel Reynolds, Sam Reeves, Ben Blackburn, Graham Oakley, Beau Varner
Dicamba is often tank mixed with glyphosate to increase herbicidal efficacy but may contribute to off-target movement (OTM). In recent years, volatilization has become problematic for dicamba-containing herbicides, resulting in increased regulatory requirements necessitating the use of volatility-reducing agents (VRA) for application. Research was conducted in 2021 and 2022 using low tunnels in a field environment and humidomes in a greenhouse environment to further assess how glyphosate salts and VRAs affect dicamba volatility. Our data indicate that the inclusion of glyphosate to dicamba can increase dicamba volatility, depending on the glyphosate salt used. The inclusion of the evaluated VRAs will decrease dicamba volatility when applied to a tank mixture of dicamba plus potassium salt of glyphosate from 94 to 97 percent in humidomes and 25 to 72 percent using low tunnels.

Control of Annual Grasses Using New Sorghum Herbicides. BA Patton*[1], PA Dotray[2]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX (132)

With the release of new grain sorghum [*Sorghum bicolor* (L.) Moench] hybrids, the number of sorghum hectares planted may increase. Troublesome grassy weeds continue to be a problem, but improved control may be accomplished with the introduction of new sorghum herbicide technologies. Non-crop field study were conducted in 2021 and 2022 at the Texas Tech University New Deal Research Farm to evaluate the effectiveness of imazamox, nicosulfuron, and quizalofop to control barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv], large crabgrass [*Digitaria sanguinalis* (L.) Scop], and Texas millet [*Urochloa texana* (Buckley) R. Webster] at different heights (10 cm and 20 cm). Two different rates of imazamox (0.0526 and 0.079 kg ai ha^{-1}), nicosulfuron (0.0352 and 0.07 kg ai ha^{-1}), and quizalofop (0.0463 and 0.0695 kg ai ha^{-1}) were applied in separate trials that were seeded to each weed species. Herbicides were applied using TT11002 nozzles and a CO_2-pressurized backpack sprayer delivering a carrier volume of 15 gallons per acre. Plots, two 102-cm rows by 7.62 m, were replicated four times for each grass species. Quizalofop at 0.0695 kg ai ha^{-1} provided >70% control of all species both years. Grass control from imazamox (0.079 kg ai ha^{-1}) did not exceed 50% in 2021 but provided >75% control of barnyardgrass in 2022. Nicosulfuron at 0.07 kg ai ha^{-1} controlled Texas millet 70% 14 days after treatment in 2021. In 2022, the application of nicosulfuron controlled all grass species at 10 cm and 66 to 80% when applied at 20 cm. In all studies, grassy weeds were most consistently controlled by quizalofop.

Quinclorac-Resistant Smooth Crabgrass (*Digitaria ischaemum*): Confirmation and Mechanism of Resistance. AD Putri*, T Tseng, V Varsha, JD McCurdy; Mississippi State University, Starkville, MS (133)

Quinclorac is effective against crabgrass (*Digitaria* spp.) in both cool- and warm-season turfgrass species. Herbicide-resistant smooth crabgrass biotypes evolved as a result of intense selection pressure from repeated use of quinclorac. Due to failed control during routine applications, two Mississippi populations of smooth crabgrass (MSU1 and MSU2) were suspected of quinclorac resistance. A study was carried out to confirm and identify the resistance mechanism of these biotypes. They were studied using standard greenhouse rate-response screens to determine their tolerance relative to a known susceptible population (SMT). MSU1 and MSU2 required 80 and 5 times more quinclorac, respectively, to achieve 50% biomass reduction than SMT, confirming their suspected resistance. The resistance mechanism was then investigated. MSU1, MSU2, and SMT were sprayed with 0.42, 0.84, 2.52, and 7.6 kg quinclorac ha^{-1} at the three-leaf stage. The SMT populations accumulated three times more cyanide than the resistant MSU1 and MSU2. Further research investigated glutathione *S*-transferase (GST) activity as a possible contributor to non-target site resistance. GST activity was found to be increased in the MSU1 and MSU2 populations. These findings point to a non-target site-based resistance mechanism involving cyanide accumulation. This study also found that the GST family of enzymes was responsible for quinclorac herbicide detoxification in resistant populations. This may provide a scientific foundation for understanding the occurrence of quinclorac-resistant smooth crabgrass, but more research is needed to investigate potential target-site resistance mechanisms.

Palmer Amaranth Interference in Furrow-irrigated Rice. TA King*[1], JK Norsworthy[1], CH Arnold[1], TC Smith[1], NH Reed[1], T Barber[2], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (134)

Furrow-irrigated rice (FIR) is becoming more common in Arkansas, and the lack of a continuous flood allows for more weed emergence than a conventional flood-irrigated system. A FIR system creates an environment conducive for Palmer amaranth (*Amaranthus palmeri* S. Wats.) emergence and growth throughout the growing season. Palmer amaranth in FIR can reduce yields and increase the number of herbicide applications during the growing season. A field trial was conducted at the Milo J. Shult Agricultural Research and Extension Center in Fayetteville, AR, in 2022 to assess the impact of Palmer amaranth on furrow-irrigated rice. Newly emerged Palmer amaranth plants were marked every 7 days, beginning 1 week prior to rice emergence through 4 weeks after rice emergence. Palmer amaranth biomass decreased by 43 g, on average, every 7 days after the initial emergence of the weed. Most Palmer amaranth plants that emerged at 2 weeks after rice emergence and beyond failed to survive. Palmer amaranth plants that emerged one week prior to and one week after the crop produced 270,000 and 11,000 seeds per plant, respectfully. Palmer amaranth plants that emerged 1 week prior to the crop reduced rough rice yield by 68% at 15 centimeters from the weed. These results show that Palmer amaranth time of emergence is a critical factor influencing rough rice yields, weed seed production, and the biomass of the weed. In order to reduce yield loss from Palmer amaranth, herbicide control options should be used to delay Palmer amaranth emergence or control the weed shortly after emergence.

Italian Ryegrass Control Using Fall-Applied Residual Herbicides in Rice. TD Burrell II*[1], J Bond[1], HD Bowman[2], TW Eubank[3], GA Mangialardi[4]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Starkville, MS, [3]Mississippi State University, Greenville, MS, [4]Mississippi State University, Shelby, MS (135)

Italian ryegrass (*Lolium perenne*) is one of the most troublesome weeds of rice in Mississippi. Its resistance to multiple modes of action has made it more difficult to control in recent years. Residue remaining following control measures is often present at the time of rice seeding, and this can compromise planting efficiency. The most effective and economical management strategy to control Italian ryegrass is fall-applied residual herbicides; however, the most effective products are not labeled for use in the fall prior to rice seeding. Therefore, research was conducted in Stoneville, MS, to evaluate the effect of fall-applied residual herbicides on rice growth and development. Treatments were arranged as a factorial of application rate and herbicide treatment within a randomized complete block design and four replications, and the study was repeated in time. Residual herbicides were applied at one and two times (1 and 2x) the labeled rates for control of Italian ryegrass in Mississippi. Herbicide treatments included flumioxazin, acetochlor, acetochlor plus flumioxazin, clomazone, clomazone plus flumioxazin, dimethenamid-p, and dimethenamid-p plus flumioxazin. Labeled (1x) rates for each treatment were flumioxazin at 29 g ai ha^{-1}, acetochlor at 513 g ai ha^{-1}, clomazone at 340 g ai ha^{-1}, and dimethenamid-p at 340 g ai ha^{-1}. Treatments were applied in October or November, and plots were left undisturbed until rice seeding. A nontreated control that received no fall-applied residual herbicide treatment was included for comparison. Visible estimates of rice injury were recorded 7, 14, 21, and 28 d after rice emergence (DAE). Rice seedling density was determined 14 DAE, and rice height was recorded 14 DAE and at maturity. The number of days to 50% heading was recorded as an indication of maturity. At maturity, rough rice grain yields were recorded and adjusted to 12% moisture. All data were subjected to ANOVA and estimates of the last square means were used for mean separation at $p \leq 0.05$. No main effects or interactions with application rate were detected among the parameters analyzed. Visible rice injury 21 DAE was 37 and 39% with acetochlor and acetochlor plus flumioxazin, respectively; however, no injury was recorded following other herbicide treatments. Rice density was lower in plots receiving treatments containing dimethenamid-p or acetochlor compared with flumioxazin alone or treatments with clomazone. Additionally, acetochlor reduced rice density more than dimethenamid-p. After the beginning of reproductive growth, negative effects of dimethenamid-p were not evident. Maturity and yield were similar in plots treated with dimethenamid-p and those receiving flumioxazin alone or treatments with clomazone. Acetochlor delayed maturity 4 d and reduced rough rice yields 10 to 15% compared with other treatments. Acetochlor should not be applied in fall targeting Italian ryegrass in fields where rice is scheduled for seeding the following spring. Although maturity and rough rice yield were not reduced in plots receiving dimethenamid-p, early-season growth and development of rice was compromised. Clomazone remains the only viable treatment as a fall-applied residual herbicide in rice areas.

Gambit and Propanil Interactions for Broadleaf Weed Control in Water-seeded Rice. JA Williams*, C Webster; Louisiana State University AgCenter, Baton Rouge, LA (136)

Competition from many grasses, broadleaves and sedges can be economically detrimental to rice production. The wide variety of problematic weeds has made mixing two or more herbicides a common practice to broaden the control spectrum. Additionally, applying herbicides in mixtures reduces application costs and can aid in preventing or delaying the development of herbicide resistance. Combining two or more herbicides in a single application will result in either syngergistic, additive/neutral, or antagonistic effects, and these effects are often species dependent. Antagonism occurs when the result of mixing two or more herbicides decreases performance when compared to the herbicides applied separately. Reductions in alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb.] control have been reported when a prepackaged mixture of halosulfuron plus prosulfuron (Gambit®) is mixed with propanil.Studies were conducted in 2021 and 2022 at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate the interaction between a prepackaged mixture of halosulfuron plus prosulfuron and an emulsifiable concentrate formulation of propanil (Stam®). Plot size was 1.5 by 5.2 m^{-2} with hybrid 'RT7321 FP' rice at 47 kg ha^{-1}. Three alligatorweed and grassy arrowhead [*Sagittaria graminea* Michx.] plants were hand transplanted into separate 30.5 cm in diameter plastic rings at the front of each plot. This study utilized 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 either no mix partner or a pre-packaged mixture of halosulfuron plus prosulfuron at 55 or 83 g ai ha^{-1}, halosulfuron (Permit®) at 35 or 53 g ai ha^{-1}, or prosulfuron (Peak®) at 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. 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 and grassy arrowhead were recorded at 28 and 35 days after treatment (DAT). Results from both 28 and 35 DAT indicate a reduction in alligatorweed control when halosulfuron plus prosulfuron was mixed with propanil. At 28 DAT, halosulfuron plus prosulfuron applied alone at 55 and 83 g ha^{-1} controlled alligatorweed 78 and 81% respectively; however, when mixed with propanil control was 32 and 43%, respectively. Similarly, at 35 DAT halosulfuron plus prosulfuron applied alone at 55 and 83 g ha^{-1} controlled alligatorweed 69 and 83%, respectively, but when mixed with propanil control was 39 and 54% at 28 and 35 DAT, respectively. Similar results were observed for grassy arrowhead control.

Root System Architectural Traits and Genes Linked to Allelopathic Effects in Weedy Rice.
NA Maphalala*[1], A Tucker[1], BC Schumaker[1], S Shrestha[1], SD Stallworth[1], N Roma-Burgos[2], T Tseng[1]; [1]Mississippi State University, Starkville, MS, [2]University of Arkansas, Fayetteville, AR (137)

Weed management is often considered a leading factor limiting rice *(Oryza sativa* L.*)* productivity, and among the weeds, barnyard grass is most damaging to rice, causing up to 70% loss in rice grain yield. The exceptional hardiness of weedy rice species allows them to thrive in dynamic and stressful environments, suggesting a potential use in weed control. Weedy rice (*Oryza sativa f. spontanea)* thrives because it has retained traits such as the potential to grow taller, produce more tillers, and consume more nutrients. One such trait is allelopathy, a process where the secondary metabolites one plant species produces suppress the growth and development of neighboring species. These findings collectively suggest that weedy rice is an untapped source of novel genes for competitive traits that can be used in rice breeding programs, especially sustainable weed management, since they are of the same species as cultivated rice. Our preliminary study with a small subset of weedy rice accessions (10 accessions) identified two accessions able to suppress barnyard grass *(Echinochloa crus-galli* L.*)* weed seedlings by causing more than 50% height reduction. One weedy rice accession caused greater than 75% height reduction. Allelopathy can, therefore, be bred into rice and act as a natural and sustainable weed control strategy. However, the extent to which weedy rice varieties exhibit superior competitive traits such as allelopathy is unknown, as are the genetic pathways potentially associated with allelopathy. Thus, there is a critical need to identify the specific allelopathic weedy rice accessions and the precise mechanisms through which these varieties are allelopathic. This study aims to identify root system architectural changes associated with allelopathic phenotypes; and use genome-wide association study to map root system architectural traits associated with allelopathy in weedy rice. As plant breeders often explore wild relatives for crop improvement programs, 54 weedy rice accessions- weedy relatives of cultivated rice were evaluated for their interference or weed suppressive potential against barnyard grass and Amazon sprangletop. Accession B2 (61%) had a higher interference potential against barnyardgrass, and accession B81 (52%) had the greatest interference potential against Amazon sprangletop (*Leptochloa panicoides* (J. Presl) Hitchc.). Accession B81 had more than 50% inhibition on the growth of both barnyard grass and Amazon sprangletop, two major weeds of rice. Nei's genetic diversity among weedy rice (0.45) was found to be higher than cultivated rice (0.24) but less than allelopathic rice (0.56). Accession B2, which had high weed suppressive potential, was genetically distinct from other weedy rice accessions. This knowledge will be vital in further understanding the physiological mechanisms associated with allelopathy in weedy rice, thereby utilizing such knowledge in rice/crop improvement. This information will also be helpful for marker-assisted breeding in the future. Keywords: *allelopathy, weed management*, *weedy rice, genetic pathways*

Fenclorim-Treated Rice Seed Partially Safens the Crop to Metolachlor on a Clay Soil. SC Noe*[1], JK Norsworthy[2], LB Piveta[2], CT Arnold[2], MC Castner[2], TH Avent[2]; [1]University of Arkansas, Fayetteville, KY, [2]University of Arkansas, Fayetteville, AR (138)

Barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] is a highly problematic weed in flooded rice that can result in significant yield losses when left unchecked. To preserve high yields in Arkansas rice production, new methods of barnyardgrass control will be needed. *S*-metolachlor is a chloroacetamide herbicide that targets grasses and small-seeded broadleaf weeds; therefore, an experiment was conducted in Keiser, AR, to evaluate the efficacy of metolachlor in a rice system in conjunction with a fenclorim seed treatment to mitigate crop injury. Three rates of metolachlor (560, 1,120, and 1,680 g ai h^{-1}) were applied delayed-preemergence to 'Diamond' rice that was treated with fenclorim at 0 or 2.5 g ai kg-seed. Stand counts were taken at 14 and 28 days after treatment (DAT). Injury to rice and control of barnyardgrass were rated in comparison with the nontreated and were evaluated throughout the season. Rice yield was evaluated after harvest. The presence of fenclorim reduced stand loss at every rate of metolachlor, but rice stand was reduced as herbicide rate increased. While rice injury initially was high, around 70%, by 35 DAT without fenclorim, the low rate of metolachlor combined with a fenclorim seed treatment caused less than 15% injury. The low rate of metolachlor provided 82% barnyardgrass control 35 DAT. Overall, the presence of fenclorim reduced injury to rice at each rate of *S*-metolachlor while not impacting weed control. Rice yield was comparable with the nontreated at a rate of 560 g ai h-1 of metolachlor with a fenclorim seed treatment. However, increasing rates of metolachlor reduced yield. The combination of a low rate of metolachlor with a fenclorim seed treatment provided a high level of barnyardgrass control while not reducing yield compared to the nontreated. If metolachlor becomes labeled for use in rice, this would provide an alternative site of action for weed control without requiring a herbicide-resistance trait.

Efficacy of Alite™ 27 When Used Preplant Incorporated or Preemergence. M Mills*[1], PA Dotray[2], S Asher[3], G Baldwin[4], AC Hixson[3], B Rodriguez[5]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX, [3]BASF, Lubbock, TX, [4]BASF, Research Triangle Park, NC, [5]Texas A&M AgriLife Research and Extension, Lubbock, TX (139)

Palmer amaranth (*Amaranthus palmeri* S. Wats) is a summer annual weed native to the southwestern United States and is particularly troublesome across the Cotton Belt. The use of soil residual herbicides is crucial for cotton producers in the Texas High Plains attempting to achieve early season control of Palmer amaranth and other problematic weeds. A bare-ground field study was conducted in 2022 at the Texas A&M AgriLife Research Center in Halfway, Texas to evaluate weed control efficacy of Alite™ 27 (isoxaflutole) applied preplant incorporated (PPI) or preemergence (PRE). Herbicide treatments consisted of pendimethalin applied alone or in a tank mix with isoxaflutole applied PPI, followed by (fb) PRE applications of prometryn, fluometuron, diuron, fluridone, fomesafen, acetochlor, or S-metolachlor applied alone or tank mixed with isoxaflutole. No treatment contained isoxaflutole at more than one application timing. Visual Palmer amaranth control 15 days after PRE applications (DAA) was =91% in treatments containing isoxaflutole applied PPI, and =99% in treatments containing isoxaflutole applied PRE. Palmer amaranth was completely controlled at 28 DAA with isoxaflutole and pendimethalin PPI fb acetochlor or S-metolachlor PRE, and pendimethalin PPI fb isoxaflutole tank mixed with diuron, fomesafen, acetochlor, or S-metolachlor PRE. At 50 DAA, treatments containing isoxaflutole and pendimethalin PPI fb any PRE controlled Palmer amaranth 81-97%, while treatments containing pendimethalin PPI fb isoxaflutole alone or tank mixed applied PRE controlled this weed 84-95%. Escaped Palmer amaranth density did not differ amongst treatments containing isoxaflutole PPI or PRE at 28, 42, and 50 DAA. End of season above ground Palmer amaranth fresh biomass was determined at 80 DAA and did not vary amongst treatments. These results suggest that soil residual Palmer amaranth control can be achieved using isoxaflutole-based treatments applied either PPI or PRE.

Effect of Mowing Height on Common Lawn Weeds as a Floral Resource. C Wang*[1], E Begitschke[1], AA Young[1], KA Tucker[1], GM Henry[1], JD McCurdy[2], D Held[3]; [1]University of Georgia, Athens, GA, [2]Mississippi State University, Starkville, MS, [3]Auburn University, Auburn, AL (140)

Pollinators provide one of the most important ecosystem services through their role in plant pollination. Unfortunately, urbanization and agricultural intensification have led to a loss of biodiversity and reduction in ecosystem function. Turfgrass weeds are adapted to local environments and often tolerate intense management. Adjustments to certain cultural practices could further promote floral production and long-term pollinator resource persistence. Mowing is one of the most common cultural practices performed on turfgrass; however, little is known about the response of turfgrass weeds to mowing. Therefore, the objective of our research was to study the effect of mowing height on perennial weed growth and floral production. Research was conducted at the Athens Turfgrass Research and Education Center in Athens, GA during summer of 2022. White clover (*Trifolium repens* L.), Virginia buttonweed (*Diodia virginiana* L.), and common lespedeza [*Lespedeza striata* (Thunb.) Hook. & Am.] were collected from local populations and transplanted into bare-ground by removing a soil core with a cup cutter and replacing it with a weed plug of similar size. Weeds were allowed to mature and acclimate for 2 weeks before trial initiation. Four mowing heights (non-mowed, 2.5, 5.1, and 7.6 cm) were evaluated in a split plot design with four replications. Plots were mowed once weekly with a rotary mower with clippings collected. No fertility was applied and irrigation in conjunction with natural rainfall was supplied at approximately 3.8 cm wk^{-1}. Plant lateral spread data (two perpendicular measurements) were obtained weekly and flowering data were collected daily over three months. Mowing height significantly affected the lateral spread and flowering of all three weed species. Virginia buttonweed lateral spread and floral production was greatest among species, regardless of mowing height. Common lespedeza and white clover exhibited similar responses to mowing height; however, lateral spread in response to no mowing and 7.6 cm was greater in common lespedeza. Additionally, common lespedeza and white clover floral production were similar, which were significantly less than Virginia buttonweed. As mowing height decreased, floral production declined in both species. Although each weed species shows potential as a floral resource for pollinators, evaluation of excavated vegetative propagules at the termination of this research will further determine plant persistence.

Khakiweed (*Alternanthera pugens*) Response to PRE and POST Herbicide Application. AE McEachin*, TL Grey; University of Georgia, Tifton, GA (141)

Khakiweed, *Alternanthera pugens,* is a perennial broadleaf weed difficult to control because of its multiple means of reproduction, vigorous growth, and deep tap root. It reduces the quality of pasture, pecan, and turf areas by chocking out desirable grass species. Seed burs attach to clothing, equipment, and animal fur aiding in dispersal and causing injury. While several herbicides, including metsulfuron, have proven effective in controlling khakiweed, none of these products are registered for use in pecan. Studies were conducted in the greenhouse to determine the effect of application timing, herbicide, and rate on khakiweed growth. In the PRE study, metsulfuron, indaziflam, or pendimethalin was sprinkled onto the plot surface to prevent contact with plant tissue. All rates of PRE herbicides significantly inhibited plant growth compared to the control. However, no significant difference was found between rates. The efficacy of metsulfuron, indaziflam, and 2,4-D amine were examined in the POST study. For metsulfuron and indaziflam, necrosis rate increased with application rate. Only the greatest rate of 2,4-D caused necrosis significantly different from the control. Metsulfuron at the highest application rate provided the greatest rate of control (76%).

Confirmation of Cross Resistance to Microtubule-inhibitor Herbicides in *Poa annua* L. from Texas and Florida Golf Courses. AW Osburn*[1], R Bowling[2], B Unruh[3], C McKeithen[3], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M University, Dallas, TX, [3]Florida State University, Jay, FL (142)

Annual bluegrass (*Poa annua* L.) is a pervasive and difficult-to-control weed in golf courses. Microtubule-inhibitor herbicides are commonly used in these systems for preemergence control of annual bluegrass infestations. Resistance to these herbicides is an emerging concern, and a number of resistance cases have already been reported in the United States, especially in the southern turfgrass systems. However, the current status of annual bluegrass response to microtubule-inhibitor herbicides in golf courses in the most southern regions of Texas and Florida is unknown. Annual bluegrass plants were collected during Spring 2020 in TX and FL golf courses based on suspected field control issues to the microtubule-inhibitor herbicides prodiamine and pronamide. The sensitivity of the collected populations was determined under greenhouse conditions in College Station, TX during Spring 2022. A total of 46 populations were screened first with the recommended field rate (1X) of these herbicides, which was then followed by a dose-response assay of select populations (two from TX and four from FL) to confirm the extent of resistance. A known susceptible population to these herbicides was used as a check for comparison. Annual bluegrass from a Florida golf course showed resistance to both prodiamine and pronamide, where survivors were found for up to 32-fold the recommended field rate (1X = 735.6 and 1155.9 g ai ha^{-1} respectively), for both herbicides. Annual bluegrass from a Texas golf course expressed a similar response, with survival to the 32-fold rate for prodiamine and 16-fold rate for pronamide. Results confirm the occurrence of cross-resistance to prodiamine and pronamide in TX and FL golf course populations. Turfgrass managers should implement management practices that include multiple herbicide modes of action and non-chemical options to thwart herbicide resistance in this species.

Herbicides Applied with an Agricultural Spray Drone Control Smooth Crabgrass in Managed Turf. D Koo*, S Askew, N Godara, JM Peppers; Virginia Tech, Blacksburg, VA (143)

Agricultural spray drones (ASD) have become increasingly accessible in recent years, but little is known regarding their use for pest control in managed turf systems. Two field trials were conducted at the Glade Road Research Facility and the Turfgrass Research Center in Blacksburg, VA to assess mature smooth crabgrass (*Digitaria ischaemum* (Schreb.) Schreb. ex Muhl.) control by quinclorac and topramezone herbicides applied by an ASD. Both trials were arranged as randomized complete block designs with 4 replications and a 2 x 2 factorial treatment design with a nontreated check for comparison. Each plot was 1.2 m wide and 2.4 m long. Fiberglass roof panels that were 1.2 wide and 4.8 m long were used to cover all plots in the experiment and, prior to each treatment, turf in one plot was exposed by sliding the appropriate panel. The surrounding area was also covered with tarps at a distance of 6 m from the trial area. Covering plots in this way allowed for repeated use of the ASD for different herbicide treatments while avoiding drift to adjacent plots. Quinclorac (841 g ai ha^{-1}) and topramezone (36.8 g ai ha^{-1}) were applied by a DJI MG-1P ASD (Shenzhen, China) operated in a manual plus mode that allowed for user-activated line spraying with height, speed, and spray output automatically controlled by the drone. The drone was operated 2 m above the ground at 6 Km h^{-1} to deliver 28 L ha^{-1} spray solution through four 11001 XR spray tips in a targeted 4.6-m-wide spray swath. Herbicides with the same rates were applied by a CO_2-pressurized backpack sprayer operated at 4.8 Km h^{-1} with four 11004 Turbo Teejet Induction spray tips held 0.3 m above the turf to deliver 373 L ha^{-1} in a targeted 1.2-m-wide spray swath. Both ASD and ground sprayer controlled smooth crabgrass equivalently regardless of herbicide. At 28 DAT, topramezone and quinclorac controlled smooth crabgrass 63% and 57%, respectively. Additional demonstration plots suggest that quinclorac applied at drone heights between 4 and 10 m does not consistently control smooth crabgrass. Thus, ASD application can control weeds in the turf when the assessed area comprises half of the intended spray swath and is located directly under the ASD. Future research will evaluate large plots that allow for multiple line passes of ASD and ground sprayers for consistency of weed control and turf response.

Selected Plant Growth Regulators Reduce Root and Foliar Biomass of Goosegrass and Smooth Crabgrass. JM Peppers*[1], JS McElroy[2], S Askew[1]; [1]Virginia Tech, Blacksburg, VA, [2]Auburn University, Auburn, AL (144)

Control of goosegrass and smooth crabgrass in creeping bentgrass putting greens is difficult due to a lack of selective herbicides. Based on preliminary field observations and the results of a Twitter survey of golf course superintendents, we hypothesized that early-GA-inhibiting plant growth regulators (PGRs) (i.e. paclobutrazol or flurprimidol) will reduce the overall competitiveness of goosegrass and smooth crabgrass in creeping bentgrass putting greens. To test this hypothesis, studies were designed with objectives to evaluate the effect of several PGRs on vegetative and root biomass of goosegrass and smooth crabgrass. These studies were conducted in field and greenhouse settings between 2017 and 2022 in Auburn, AL and Blacksburg, VA. Greenhouse studies were arranged as a RCBD with 18 treatments, six blocks, and two trial locations. Four PGRs were applied either PRE only or PRE plus two biweekly POST applications to simulate the first 1.5 months of a typical PGR program utilized on golf courses. The PGRs evaluated were flurprimidol (280 g ai ha^{-1}), paclobutrazol (280 g ai ha^{-1}), trinexapac-ethyl (52.6 g ai ha^{-1}), and prohexadione-calcium (154 g ai ha^{-1}). Two weeks after the final POST treatment, above-ground biomass, and root biomass were recorded. Field studies were arranged as RCBD with six treatments, four blocks and two trial locations. Treatments were applied every three weeks from April to August in an effort to keep reapplication intervals consistent but also approximate a seasonal PGR reapplication schedule that would be utilized by turf managers spanning cool and warm periods of the growing season. Treatments evaluated were flurprimidol (140 g ai ha^{-1}), trinexapac-ethyl, flurprimidol plus trinexapac-ethyl, paclobutrazol (175 g ai ha^{-1}), and fenoxaprop-p (17.5 g ai ha^{-1}). Weed coverage data were collected every three weeks throughout the growing season. All data were analyzed using PROC GLM and Fisher's Protected LSD (a<0.05) was utilized for means separation. At the conclusion of the greenhouse study, no PRE only treatment significantly decreased goosegrass or smooth crabgrass biomass. However, PRE plus POST applications of flurprimidol and paclobutrazol reduced goosegrass and smooth crabgrass biomass ~70 and ~60%, respectively, and greater than all other treatments. Paclobutrazol and flurprimidol reduced root biomass of goosegrass and smooth crabgrass 50-85%, relative to the nontreated, with both application programs. In the field study conducted in AL, flurprimidol-containing treatments and paclobutrazol reduced goosegrass coverage 77-83% and greater than all other treatments at the end of July. However, late summer decline of creeping bentgrass may have influenced product performance as assessed in September, as goosegrass coverage was equivalent for all PGRs. In VA, flurprimidol alone reduced smooth crabgrass 88% and greater than any other PGR program at the end of June. Flurprimidol plus trinexapac-ethyl and paclobutrazol also reduced smooth crabgrass coverage 68 and 63%, respectively. Both flurprimidol-containing treatments reduced smooth crabgrass coverage 48-63% which was greater than all other PGR-containing treatments in mid-September. From these studies we can conclude that early-GA-inhibiting PGRs reduce goosegrass and smooth crabgrass above-ground and root biomass greater than late-GA-inhibiting PGRs. This reduction in growth rate may reduce competitiveness and lead to a reduction in weed coverage during the summer growing season. However, weed suppression appears to be dependent on both creeping bentgrass competition and early-GA-inhibiting PGR suppression. Future research will evaluate PGR rates and tank mixtures with other products to achieve better season-long turf quality and weed control efficacy.

Identification and Quantification of Allelochemicals Released by Sweetpotato Roots. V Varsha*, W Segbefia, Z Yue, MW Shankle, T Tseng; Mississippi State University, Starkville, MS (145)

Weed competition and interference with the crops result in significant crop yield loss, environmental issues, loss of biodiversity, higher production costs, and a menace to ecosystem safety. Chemical herbicides have been widely used for weed control in crop fields to maintain and promote crop productivity and minimize labor requirements. However, long-term and extensive herbicide applications have facilitated the evolution of herbicide-resistant weed species. Therefore, there is a critical need for an alternative and effective strategy to control weeds in sweetpotato. Allelochemicals that some plants naturally produce can potentially suppress weeds and be used for weed management under conventional and organic cultivation systems. The current study was conducted to identify and quantify the allelochemicals having weed-suppressive effects in seventeen sweetpotato varieties using the high-performance liquid chromatography (HPLC) technique. Sweetpotato varieties were planted using slips with four nodes in test tubes with distilled water and allowed to grow in a growth chamber at 30/24 ? day/night temperature with a 16/8h day/night cycle. Water samples were collected from each test tube weekly for five weeks after transplanting (WAT) and were analyzed using HPLC. The allelochemicals were identified by comparing the retention times and peak intensities of the pure standards of compounds that had previously been reported to be associated with weed suppression in other crops. All the samples were analyzed for five allelochemicals, i.e., chlorogenic acid, hydro-cinnamic acid, caffeic acid, trans-cinnamic acid, and coumarin. Varieties like Heart-O-Gold and 529 were found to release chlorogenic acid. These allelochemicals have already been found to be weed-suppressive in several crops such as cotton, sorghum, rice, etc. The sweetpotato varieties releasing these compounds through their roots could be potentially used for breeding cultivars designed for organic production systems.

Response of Green Antelopehorn Milkweed (*Asclepias viridis* W.) and Hemp Dogbane (*Apocynum cannabinum*) to Auxinic Herbicides. KL Broster*, TH Duncan, JD Byrd, Jr.; Mississippi State University, Starkville, MS (146)

Green antelopehorn milkweed (*Asclepias viridis* W.) and hemp dogbane (*Apocynum cannabinum*) are perennial herbs native to North America. Commonly found throughout the southeastern United States, these plants can be problematic to livestock producers as both are potentially toxic to livestock which may cause injury or death, if sufficient quantities are consumed. Auxin mimicking herbicides are commonly recommended for the control of broadleaf species. Two new formulations of triclopyr have recently been added to the market. Two studies were applied at locations that were densely populated with these species. The milkweed field study included 3 locations in Oktibbeha County, MS; a hayfield (A) and pasture were used for the years of 2020, 2021, and 2022, with an additional hayfield (B) location added in 2022. The hemp dogbane study was applied at 3 locations in Clay County, MS; a hayfield and fallow field were used in 2020, 2021, and 2022, with an added roadside location in 2022. Treatments were organized in a randomized complete block design (RCB) with four replications: 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}, Grazon P+D (2,4-D + picloram) at 9.35 and 4.67 L ha^{-1} (milkweed only), Method (aminocyclopyrachlor) at 1.32 and 0.66 L ha^{-1} (dogbane only), Surmount (picloram + fluroxypyr) at 7.01 and 3.5 L ha^{-1} (dogbane only), and Tordon K (picloram) at 4.67 and 2.34 L ha^{-1} (dogbane only), making for 14 treatments for milkweed and 18 treatments for hemp dogbane. Applications were made witha CO_2 backpack sprayer thatdelivered 281 L ha^{-1} and made between the stages of juvenile and early flower for both species. Visual injury ratings were made 2 and 4 weeks after application (WAT). Data analysis was conducted using RStudio (Version RStudio 2022.07.1), with data analyzed using ANOVA and Fisher's Protected LSD (a=0.05) for mean separation. Year and locational differences were observed, so years and locations were analyzed separately. With milkweed, no differences were observed in hayfield A across year or treatment at 2 or 4 WAT. At the pasture location, across all years, DuraCor at 0.73 L ha^{-1} and Vastland at 2.34 L ha^{-1} were less injurious than Grazon P+D at 9.35 L ha^{-1} and MezaVue at 2.34 L ha^{-1} at 2 WAT. Across all years, DuraCor at 0.73 L ha^{-1} provided the least control of milkweed than all other treatments at 4 WAT. In 2022 across all locations (a=0.1), DuraCor at 0.73 L ha^{-1} provided less control of all treatments, except DuraCor at 1.46 L ha^{-1} and Trycera 3.26 L ha^{-1}. Hemp dogbane control results also varied between locations and year. No differences across treatments were found at the roadside location. The fallow field was analyzed separately by year, but for all years both DuraCor and Method at both rates were less injurious than all treatments, except for Tordon K at 2.34 L ha^{-1} in 2021 at 4 WAT. Similar results were found at the hayfield, but in 2021 both DuraCor treatments provided the least control, and in 2022 DuraCor at 0.73 L ha^{-1} and Garlon 3A at 3.12 L ha^{-1} resulted in less control compared to all treatments except for DuraCor at 1.46 L ha^{-1}. These results show variability in control response of both species. DuraCor cannot be recommended for control of either species.

Methyl Isothiocyanate (MITC) Concentration, Distribution, and Persistence in Sandy Soil as Influenced by Dazomet Application Methods. E Gomiero Polli*, T Gannon, M LeCompte, R Rogers, K Ahmed; North Carolina State University, Raleigh, NC (147)

Soil sterilization is a crucial step to eliminating weed species and undesirable turfgrass species when renovating turfgrass areas. Dazomet has become one of the most used fumigants since the methyl-bromide phaseout in 2005. This fumigant reacts with water in the soil when in presence of oxygen and releases methyl-isothiocyanate (MITC) gas which effectively controls plant tissues and seeds within the soil. Previous studies have demonstrated varying levels of control by dazomet. As MITC is highly water soluble, mobile in soil, and volatile, inconsistencies in efficacy may be related to practices conducted prior to and after application. The objective of this study was to analyze the effect of two common methods used for dazomet application: tilling, rolling, irrigating, and tarping (1), and rolling and irrigating post-application (2), on MITC concentration, distribution, and persistent following dazomet application in sandy soil. A field study was conducted in June 2022 at Sandhills Research Station in Jackson Springs, NC. The study was organized as a split-split-plot design of 2 x 11 x 6 in which the whole plot was the presence or not of a tarp, sub-plot the sample timing (2, 9, 16, 24, 36, 48, 72, 120, 168, and 240 hours after application), and sub-sub-plot the sampling depth (0-4 cm, 4-8 cm, 8-11 cm, 11-15 cm, 16-23 cm, and 24-30 cm). Dazomet was applied using a drop spreader calibrated to deliver 189 kg ai ha^{-1}. After application, tarped treatments were tilled to 10 cm depth using a tractor-mounted rotary tiller and subsequently rolled. All treatments were then irrigated with 15 mm of water to achieve soil saturation. Following irrigation, tilled treatment 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 plots at 13 mm, 6 mm, 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). 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 residue analyses were performed using high-performance liquid chromatography. MITC concentration data were subjected to analysis of variance in SAS software and treatment means were computed using Fisher's least significant procedure (a=0.05). Logarithmic transformation was performed to normalize data. Non-tarped treatments presented 28% lower MITC concentration than tarped treatments. The highest MITC concentrations were observed 36 and 48 hours after application (HAA) for non-tarped treatments and 36 HAA for tarped treatments. MITC was detected up to 72 HAA and 120 HAA for non-tarped and tarped treatments, respectively. Regarding soil depth, MITC was mostly concentrated within the top 11 cm of the soil profile. Results of this research suggest tarping is more effective in maintaining MITC in the soil than post-application irrigation. Furthermore, as the peak of MITC concentration was observed from 36 to 48 HAA, treated area needs to be tarped or irrigated for at least 2 days after dazomet application. In addition, greater seed and plant tissue control are expected within the top 11 cm of the soil profile since MITC concentration was higher at this depth range.

Using UAVs to Apply Pesticides: Determining Uniformity of Application. AA Tavares*[1], DM Dodds[1], JA Patterson[1], SC Baker[1], GA Stephens[1], CK Meyer[1], BK Fritz[2]; [1]Mississippi State University, Starkville, MS, [2]USDA-ARS, College Station, TX (148)

Unmanned Aerial Vehicles (UAV) may be used to make site-specific pesticide applications with high precision and spatial resolution. In the US, UAV platforms are used to apply pesticides despite a scientific gap supporting this technology. This research aimed to evaluate the influence of droplet size on the spray deposition pattern of applications made via UAV platform in different crops. Experiments were conducted at the Black Belt Experiment Station near Brooksville, Mississippi in a randomized complete block design with a factorial treatment arrangement including spray platform and nozzle type as factors. Applications were made using a CO_2-backpack sprayer with 8 nozzles spaced 50 cm and a four-rotor UAV sprayer with 4 nozzles spaced 76 cm at a flight height of 1m above the crop canopy using three nozzle models: XR110015, AIXR110015, and TTI110015 generating fine, coarse, and ultra-coarse droplet spectra, respectively. A solution containing fluorescent tracer (1 g L^{-1} of PTSA) was applied to soybean at the R1 stage and corn at the V3 stage. Spray depositions were evaluated using two methods of collection: 10x10 cm mylar cards spaced at 38 cm were placed across a 12.5-m sampling line and 15 m of a 1-mm diameter cotton string was positioned across each plot. Both collectors were positioned at canopy height. After application, strings were read using a string fluorometer and mylar cards were stored individually in zip-lock bags. The tracer was extracted using 30 ml of 1% alcohol and the resulting wash solution samples were transferred to a spectrofluorometer, and the results were converted to $\mu L\ cm^{-2}$. Data were used to calculate the coefficient of variation (CV%) for 25, 50 and 75% simulated swath overlap in each treatment and CV% were compared using Fisher's LSD at a=0.05. For both crops, ground applications produced the greatest deposition when compared to the UAV platform when considering mylar card data, except when using TTI110015 nozzles. For deposition into the soybean canopy, using 50% swath overlap, UAV and ground applications were no different based on CV% (p-value= 0.7447). The highest CV% for 75 and 50% swath overlap resulted from applications made using the UAV and an XR110015 nozzle. Applications to corn produced a higher average CV% (24.0%) when compared to soybean (20.1%). Overall, UAV applications resulted in lower mean volume deposition and higher swath variation when compared to ground applications.

Evaluating Rice Competitiveness Against Barnyardgrass and Hemp Sesbania at Various Water Salinity Levels. G Singh*[1], B Ward[2], R Karthikeyan[1], S White[1], J Rohila[3], MA Cutulle[2]; [1]Clemson University, Clemson, SC, [2]Clemson University, Charleston, SC, [3]USDA- ARS, Stuttgart, AR (149)

Weed competition is a major constraints in rice (*Oryza sativa* L.) production. In saline conditions, environmental selection of troublesome saline-tolerant weed species, weed management is complex. Rice is susceptible to salinity stress due to crop irrigation and flooding weed control practices. In saline environments, the population dynamics and composition of weeds differ than freshwater cultivation. Saltwater's potential as an alternative to herbicides in organic weed management has been the subject of limited research. Growing rice in partial saltwater agro-ecosystem may reduce weed pressure and labor requirements for weed control. A greenhouse study was conducted at the Clemson Coastal Research and Education Center in Charleston, SC, to determine the effect of different seawater concentrations on rice-weed growth and competition. The weeds included in this study were barnyardgrass [*Echinochola crus-galli* (L.) Beauv.] and hemp sesbania [*Sesbania herbacea* (Mill.) McVaugh]. Treatments were constructed as a factorial of five seawater levels with electrical conductivities (0.262, 0.525, 1.05 and 2.1 dS m^{-1}) by five rice-weed competition scenarios (rice, barnyardgrass, hemp sesbania, barnyardgrass seeded with rice, hemp sesbania seeded with rice). One-gallon pots filled with Yonges loamy fine sand were seeded with rice and weed seeds at 2 cm depth. Pots were placed in 15 cm depth water retention pans of different seawater concentrations. The data collected consists of weed count ratings, weed height, weed biomass, rice plant height and rice plant yield. The populations and biomass of the weed species tested decreased as salinity increased ($P<0.05$). Seawater concentration and weed competition impacted rice plant growth and yield ($P<0.05$). At electrical conductivity of 2.1 dS m^{-1} (3% seawater concentration), rice plants could not survive; however, certain weed species survived. The observations from this study may aid in evaluating the potential rice yield loss from weeds and developing efficacious weed control methods under saline environments.

Hybrid Rice Cultivar Seeded at Different Densities Response to Application of Florpyrauxifen-benzyl. TW Eubank*[1], J Bond[2], TD Burrell II[2], GA Mangialardi[3], LT Bell[1], HM Edwards[2]; [1]Mississippi State University, Greenville, MS, [2]Mississippi State University, Stoneville, MS, [3]Mississippi State University, Shelby, MS (150)

Florpyrauxifen-benzyl is a postemergence (POST) herbicide commercialized in 2018. Florpyrauxifen-benzyl applications have reduced rice yield in some situations, and producers are concerned that the impact could be even greater with low rice plant densities. Research was conducted in Stoneville, MS, from 2019 to 2021 to evaluate the effect of florpyrauxifen-benzyl on rice yield when a hybrid cultivar was seeded at reduced densities. The rice cultivar 'Clearfield XL7521' was seeded at 10, 17, 24, 30, and 37 kg ha^{-1}. The seeding rates were percentages (120, 80, 56.67, 33.3) based on the recommended seeding rate of 30 kg ha^{-1} for Clearfield XL7521. At the four-leaf to one-tiller growth stage, florpyrauxifen-benzyl was applied at 0 or 59 g ai ha^{-1}. Visible injury was assessed 7, 14, 21, and 28 d after application. Rice plant height was recorded by measuring from the base of the plant to the uppermost leaf of five randomly selected plants on rows two and seven of each plot. Rice maturity was estimated as the number of days to 50% heading and recorded as days after emergence. At maturity, rough rice grain yields were recorded and adjusted to 12% moisture. Rice injury with florpyrauxifen-benzyl = 8% across all seeding rates and evaluation intervals. Application of florpyrauxifen-benzyl reduced plant heights 14% across all seeding rates. The greatest reduction in rice plant height was between the two florpyrauxifen-benzyl treatments with rice seeded at 37 kg ha^{-1}. Rice seeded at 10 and 17 kg ha^{-1} matured more slowly than that seeded at 24, 30, and 37 kg ha^{-1}. Florpyrauxifen-benzyl reduced rough rice grain yields at the 17 and 37 kg ha^{-1} but not at any other seeding rate. These results indicate application of florpyrauxifen-benzyl at twice the labeled rate can result in a loss of yield due to variation in rice densities. Applying florpyrauxifen-benzyl to increased, and reduced densities is not recommended due to the loss of yield that can occur.

Response of Cotton Maturity Groups to Low Rates of 2,4-D. KR Russell*[1], PA Dotray[2], IL Pabuayon[3], GL Ritchie[1]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX, [3]Louisiana State University AgCenter, Rayne, LA (151)

With the introduction of auxin-tolerant cotton in 2017, the number of postemergence applications of 2,4-D to control troublesome weeds has increased awareness regarding the risk of damaging sensitive cotton from off-target movement. Field trials were conducted in 2020 and 2021 at the Texas Tech University New Deal Research Farm to evaluate changes in boll distribution, yield, and fiber quality in four sensitive cotton cultivars with varying maturity characteristics when treated with low rates of 2,4-D. Applications of 2,4-D choline at 0.00213 (1/500×), 0.0213 (1/50×), and 0.107 (1/10×) kg ae/ ha were applied to DP 1612 B2XF, DP 1822 XF, DP 1845 B2XF, and DP 1747 B2XF at first bloom. These varieties represent a range of different cotton relative maturity. When the 1/10× rate of 2,4-D was applied, yield decreased in all cotton cultivars in both years. In 2021, the 1/50× rate reduced yield in all cultivars. Reductions in boll retention throughout the plant were observed in all cotton cultivars; however, DP 1612 B2XF had increased retention between nodes 5 and 10 following all spray rates. In general, fiber quality measurements such as micronaire, length, and uniformity were most influenced by the 1/10× rate of 2,4-D; however, specific fiber quality parameters varied from year to year. While cultivar relative maturity appears to influence lint production, boll distribution changes, and fiber quality following exposure to 2,4-D, these interactions are not definitive and require further research to better understand cultivar effects.

Introduction of the First 4-Trait Herbicide Tolerant 'Axant ™ Flex System' Cotton. J Dudak*[1], ZR Treadway[1], TA Baughman[1], G Baldwin[2], T Barber[3], CW Cahoon[4], A Culpepper[5], AC Hixson[6], S Li[7], SA Nolte[8]; [1]Oklahoma State University, Ardmore, OK, [2]BASF, Research Triangle Park, NC, [3]University of Arkansas, Lonoke, AR, [4]North Carolina State University, Raleigh, NC, [5]University of Georgia, Tifton, GA, [6]BASF, Lubbock, TX, [7]Auburn University, Auburn, AL, [8]Texas A&M AgriLife Extension, College Station, TX (152)

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 Alite 27 (HPPD inhibitor) in cotton to provide producers another tool for weed management. Studies were conducted to evaluate the use of Alite 27 on weed efficacy, cotton response and lint yield. A multi-state research project was conducted at various 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 in 2021 and 2022: Alite 27 (3 fl oz/A) alone and either Direx/Cotoran (16-32 fl oz/A) or Reflex/Brake (12-24 fl oz/A) alone or in combination with Alite 27. All PRE treatments were followed by a POST application of Engenia (12.8 fl oz/A) + Outlook (12.8 fl oz/A) + Roundup PowerMax II (32 fl oz/A) + Aegos (8 fl oz/A). In 2022, Prowl H2O (32 fl oz/A) alone and in combination with Alite 27 (3 fl oz/A) was added to the treatment list. Treatment combinations varied between years at Tillar, AR. Less than 10% visible cotton injury was observed at any location 2 weeks after planting (WAP) at all site-years, except Ty Ty, GA. Alite 27 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 in 2021 and at all locations in 2022. Alite 27 + Direx controlled over 90% of Palmer amaranth and annual grass at all locations 4 weeks after the POST application in 2021. While Alite 27 in combination with either Direx or Prowl H2O were the only treatments that controlled both weed species at least 90 % season long in 2022. Palmer amaranth and annual grass was excellent season long in 2021 and less than 60% in 2022 at Tillar, AR. This decrease in control was attributed to the lack of two additional POST applications. Alite 27 exhibited excellent cotton tolerance while providing control of Palmer amaranth and annual grass when used as part of an overall cotton herbicide management program.

Effect of Rye Cover Crop Biomass and Herbicide Program for Weed Management in Cotton.
YR Upadhyaya*[1], P Devkota[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Jay, FL (154)

Cereal rye is a widely adopted cover crop due to its fast-growing and high biomass-producing nature. Although cereal rye biomass plays a significant role in weed suppression, it is unlikely to produce higher biomass levels by increasing the seeding rate. An experiment was conducted to determine cereal rye biomass production, and effect of rye biomass and herbicide program on weed control in cotton. The study was conducted as a RCB split-plot design with four replications for two years. Each year, cereal rye was planted at 78 kg ha^{-1} and four nitrogen (N) rates (0, 23, 45, and 67 kg N ha^{-1}) were used to evaluate rye biomass production. Weedy and weed-free fallows were also established, comprising of six main-plot factors. The three sub-plot factors were preemergence (PRE) herbicide (fluometuron, fluometuron + fomesafen, and non-treated check). The PRE herbicide applied treatments, glyphosate plus *S*-metolachlor was applied postemergence (POST) at six weeks after planting (WAP) cotton. The control rating were collected for Texas panicum, tropical spiderwort, and sicklepod at two and four weeks after PRE and POST herbicide application. At 4 wk after PRE and POST treatment, weed density and biomass data were collected. The cereal rye biomass was significantly higher in all N rates compared to 0 kg N ha^{-1}, but there was no significant difference among themselves. The cover crop treatment resulted in significantly higher weed control (all three weeds) than weed-free and weedy fallow. Tropical spiderwort and Texas panicum density were significantly lower with rye treatment compared to weed-free fallow at four weeks after PRE and POST treatment. Tropical spiderwort and Texas panicum biomass were significantly lower in rye plots compared to weed-free fallow at four weeks after POST herbicide application. The fluometuron + fomesafen herbicide mixture controlled sicklepod, spiderwort, and Texas panicum >84% compared to <83% control from fluometuron. Overall, integrating cereal rye with PRE and POST herbicides has the potential to control weeds effectively for cotton production system.

Modern Data Collection in Agriculture: Utilizing See and Spray^{TM} Cameras to Improve Quantitative Assessments. LM Lazaro*[1], MM Houston[2], S Brown[1], J Gizotti de Moraes[1], WL Patzoldt[1]; [1]Blue River Technology, Sunnyvale, CA, [2]Blue River Technology, Leland, MS (155)

Agricultural technology is rapidly advancing with the goal to reduce herbicidal use, increase plant health, and to be more environmentally friendly. John Deere's See & Spray^{TM} Ultimate technology utilizes both computer vision and machine learning to target weeds in corn (*Zea mays* L.), soybean (*Glycine max* (L.) Merr.), and cotton (*Gossypium hirsutum* L.) agronomic production systems to reduce herbicide use, increase weed control with a dual tank system, and to improve targeted spray benefits. However, with these technological advances, verification of quantitative data collection is needed for tractor-mounted sensor technology. Therefore, small plot field studies in corn, cotton, and soybean were conducted in Mississippi during the 2022 field season to examine the efficacy of the See & Spray Ultimate tractor-mounted sensor technology on weed detection in comparison to ground truthing. Trials for all crops were evaluated at three different model sensitivity levels (low, medium, and high) at three different POST application timing intervals to simulate early, on time, and late applications. All weeds within a subplot were tagged with weed species, height, width, and location of each weed recorded. After each application, weed hit rate, weed mortality, plot-level visual weed control, and visual crop injury were evaluated at 7, 14, and 28 days after application (DAA). The ground truthing data was then compared with the See & Spray Ultimate software for the ability to detect and quantify weed infestations. Overall, weed width was a better indicator than weed height for model detection regardless of timing or sensitivity level. Further, application timing was not a significant factor for the corn or soybean models. No significant difference seen in broadcast standard and medium/high sensitivity setting for weed control. Percent weed area was similar at the low sensitivity level and the broadcast standard. Sensors and machine learning algorithms on See & Spray Ultimate has the capability to detect weeds with comparable results to visual estimates and will allow for this methodology to potentially become the new standard for quantitative data collection for tractor-mounted sensor technology in agriculture.

Interaction of See and SprayTM Model Sensitivity and Application Timing in Soybean. DJ Contreras*[1], W Everman[1], JK Norsworthy[2], TH Avent[2], BG Young[3], M Zimmer[4], JM Mausbach[5], MM Houston[2], LM Lazaro[6], WL Patzoldt[6]; [1]North Carolina State University, Raleigh, NC, [2]University of Arkansas, Fayetteville, AR, [3]Purdue University, Brookston, IN, [4]Purdue University, West Lafayette, IN, [5]University of Nebraska-Lincoln, Lincoln, NE, [6]Blue River Technology, Sunnyvale, CA (156)

New technologies provide benefits to stakeholders in agricultural productions, such as improved productive efficiency, increased food security from a productive standpoint, as well as reduced costs. Remote sensing has garnered special interest in the past decade; a very promising use for remote sensing is the use of the technology in combination with a sprayer to realize site-specific herbicide applications. See & Spray™ technology, from Blue River and John Deere, can successfully detect, spray, and control weeds within a crop while specifically targeting weeds. See & Spray™ users can select the spray sensitivity of the system, which adjusts the confidence threshold for when to trigger sprays. A lower sensibility requires a higher confidence to spray, a higher sensibility requires a lower confidence to spray. Theoretically, a lower sensitivity results in reduced pesticide output, however small weeds might be missed. Higher sensitivity may miss fewer weeds, if any, but at the cost of an increased pesticide output. An experiment using See & Spray™ was set up at four sites (NC, AR, IN, MS) to test if overall weed control changes with the interaction of the sensitivity level (Low, Mid and High) used and application timing (Early [14 and 28 days after planting{DAP}], Mid [21 and 35 DAP] and Late [28 and 42]) in soybeans. There was no difference in weed control by species at all locations. Common species by locations had the same level of control regardless of sensitivity level and application timing. When grouped across locations, broadleaf weed species' control was the same across sensitivity levels and application timings. When grouped across locations, grass weed species control was the same 14 days after the first application, regardless of timing, however there was a slight grass control reduction 14 days after the second application (from 99% to 97% control, p=0.0003). Overall, See & Spray™ sensitivity level and application timing did not affect weed control in soybean.

What's New in Industry. JC Holloway Jr*; Syngenta Crop Protection, Jackson, TN (157)

(Industry update)

Single Tank vs Dual Tank See & SprayTM Programs in Soybean. W Everman*[1], DJ Contreras[1], JK Norsworthy[2], TH Avent[2], BG Young[3], LM Lazaro[4], WL Patzoldt[4], MM Houston[2]; [1]North Carolina State University, Raleigh, NC, [2]University of Arkansas, Fayetteville, AR, [3]Purdue University, Brookston, IN, [4]Blue River Technology, Sunnyvale, CA (158)

During the last few years, the implementation of machine learning for weed control has made significant progress. The first step were site-specific herbicide applications using green-on-brown technology to target weeds in fallow fields. The latest development has been green-on-green technology, where specialized sprayers can detect weeds within crops, as seen with Blue River and John Deere's See & Spray™ technology. See & Spray™ technology allows users to successfully detect, spray and control weeds within their crop productions. The See & Spray™ technology also includes a dual-tank system, which consists of two separate tank and spray systems, allowing a simultaneous application of different herbicides. The dual tank system provides benefits such as reduced herbicide output and joint application of herbicides that are incompatible as single tank mixes. An experiment was set up in soybeans at four locations (AR, IN, IL, MS) using and Agronomy Test Machine (ATM) with See & Spray™ technology to test how does a dual tank system compare to a single tank system regarding weed control. Herbicide treatments included a preemergence application and two postemergence applications with either a systemic or a contact product. Across all locations, dual tank system applications provided similar control as single tank system applications in soybeans.

Evaluation of Crop Herbicide Tolerance Using UAV Obtained Multispectral Imagery. RD Langemeier*, L Pereira, JT McCaghren, S Li; Auburn University, Auburn, AL (159)

The use of unmanned arial vehicles in agriculture has increased rapidly in recent years. While use is often focused on field scale usage, opportunity also exists for data collection in research trials. One area of potential focus is crop tolerance which does not require the use of artificial intelligence to identify weeds. In the 2021 and 2022 growing seasons four trials were conducted in central and southern Alabama on both corn (*Zea maize*) and upland cotton (*Gossypium hirsutum*). Both crops received herbicide treatments both pre-emerge 0 weeks after planting (WAP), and post-emergence 4 WAP. Each crop had herbicides from five different modes of actions (MOA) applied; ALS, HPPD, PSII, PPO, and synthetic auxin. Rates were chosen to cause moderate crop injury. Data collection involved visual injury and drone imagery collection 2, 4, 6, and 8 WAP. Heights were recorded at 4 and 8 WAP. Imagery was then stitched using Pix4D mapper, and analysis was conducted using QGIS 3.20. Green pixel count after thresholding was used to estimate stunting using a multispectral VDVI (visible difference vegetative index). UAV derived stunting values correlate well with data derived from imagery analysis, with most R^2 values in the 0.75 to 0.95 range. In addition, a similar process was done with a modified VDVI using RGB images, and results were similar as those derived from multispectral images. These results suggest that the use of UAVs could potentially add an objective data measurement to crop tolerance evaluations while reducing labor and time demands relative to current practices.

Effect of Adjuvants on Canopy Deposition with a UAV Spray Platform. RJ Edwards*[1], LA Boles[1], GK Dahl[2], SA Fredericks[1]; [1]WinField United, River Falls, WI, [2]Winfield United, Eagan, MN (160)

Unmanned aerial vehicle (UAV) spray applications are becoming a popular application method to apply agriculture sprays. There are many questions around best application practices and effectiveness of the spray UAVs. One of the questions is how do adjuvants influence canopy deposition and drift? This study sets out to assess multiple spray adjuvants that are commonly tank mixed in spray applications. The applications were made over tasseling corn using a UAV with four drop nozzles. Water sensitive cards were placed at three levels within the canopy, as well as downwind from the application. The cards were then analyzed for droplet number, size, and coverage.

Evaluation of Glyphosate Alternatives for Pine Control in the Coastal Plain. DC Clabo*[1], ED Dickens[2]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (163)

Wilding loblolly pine (*Pinus taeda*) and slash pine (*Pinus elliottii*) control during forestry site preparation can be problematic without the use of glyphosate or prescribed fire. Use of glyphosate during forestry chemical site preparation and prescribed fire as a site preparation method are becoming more limited for some ownership types across the southeastern United States for a variety of reasons. Alternative herbicide prescriptions will become necessary in these situations. The objectives of this study were to evaluate herbicide alternatives to glyphosate for control of wilding loblolly and slash pine. The field trial was located in Berrien County, Georgia, which is in the Okefenokee Plains ecoregion. The site was an abandoned pasture that had seeded in with approximately 3,700 loblolly and slash pine stems ha^{-1} from surrounding stands. Average seedling and sapling height was 1.4 m and ranged from 0.3-2.7 m tall. Six treatments and two application timings were installed. The first timing was installed 15 July 2020 and included a 0.9 kg ae imazapyr product and 2.34 L ha^{-1} methylated seed oil (MSO) in all tank mixes except the untreated control. Imazapyr was mixed with glufosinate and methylated seed oil (MSO); glufosinate, flumioxazin, and MSO; 2,4-D plus dichlorprop and MSO; ester triclopyr and MSO; and 2,4-D plus dichlorprop, ester triclopyr and MSO. The second application timing was 1 November 2020. Again, a 0.9 kg imazapyr product and 4.68 L ha^{-1} MSO were used in tank mixes for all treatments except the untreated control. The MSO rate was increased to improve herbicide uptake due to the likelihood of wilding pine dormancy with a November application. Imazapyr was mixed with glufosinate and MSO; glufosinate, flumioxazin, and MSO; NUP-19051 and MSO; ester triclopyr and MSO; and NUP-19051, ester triclopyr, and MSO. Pine assessments were made 30, 60, 120, and 365 days after treatment (DAT). Percent control was calculated using change in cumulative height growth from 0 DAT to 365 DAT. Results revealed imazapyr and glufosinate or glufosinate and flumioxazin applied during November resulted in 100% control 365 DAT, while July control for the same treatments was 61-73%. The next best treatment was the November application of imazapyr, NUP-19051, and ester triclopyr, which provided 79.7% control. Overall July treatments provided 31.6 control while November treatments provided 67.1% wilding pine control.

Age Three Loblolly Pine Survival and Growth Response to Impregnated Fertilizer for Herbaceous Weed Control. DC Clabo*[1], ED Dickens[2]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (164)

Herbicide impregnated fertilizer or weed-and-feed is an option for vegetation management and forest fertilization that offers the potential to reduce application costs and the number of entries into intensively managed pine plantations. These applications are usually made within the first couple of years after establishment to combine herbaceous weed control (HWC) and stand fertilization soon after planting when seedling survival has been deemed sufficient. Weed-and-feed applications have been tested with commonly used forestry herbicides such as hexazinone and sulfometuron methyl, but other herbicides may offer potential for HWC when combined with fertilization. The objectives of this study were to compare loblolly pine survival and growth three or four growing seasons following two herbicide impregnated fertilizer treatments, diammonium phosphate (DAP) alone, and an untreated control. Two field trials were established in Dooly County, Georgia on previously cutover loblolly pine (*Pinus taeda*) stands. Soil were from the Orangeburg series at each site, and 15 cm soil nutrient tests revealed these sites could be responsive to fertilization (soil phosphorus at or less than 6.7 to 11.2 kg ha^{-1}). Chemical site preparation resulted in excellent woody vegetation control prior to pine planting and made these good candidate sites to test weed-and-feed herbicide impregnated fertilizers. The two sites were planted in either January 2019 or 2020 with the same bareroot, full-sibling (mass control pollinated) loblolly pine family at 1.82 x 3.65 m spacing. The January 2019 planted site received a June 2019 application timing, while the January 2020 planted site received an April 2020 application timing. Loblolly pine survival prior to application at the June 2019 application site averaged 92.3%, while the April 2020 site averaged 99.1%. Four replications of four treatments were established at each site. Treatment one included 140.0 kg ha^{-1} DAP impregnated with 0.51 l ha^{1} aminopyralid (Milestone VM), 2.34 l ha^{-1} dithiopyr (Dimension 2EW), and 2.34 l ha^{-1} methylated seed oil (MSO). Treatment two included 140.0 kg ha^{-1} DAP impregnated with 199.6 g ha^{-1} aminopyralid plus florpyrauxifen benzyl (TerraVue), 2.34 l ha^{-1} dithiopyr (Dimension 2EW), and 2.34 l ha^{-1} methylated seed oil (MSO). Treatment three was 140.0 kg ha^{-1} DAP, while treatment four was an untreated control. Applications were applied to 14.6 x 36.6 m plots using a hand crank spreader. All applications were with ±10% of target application rates. Internal measurement plots consisting of either two rows of 12 trees or four rows of six trees were established at each site. Measurements conducted during September 2022 after three growing seasons (April 2020 application) or four growing seasons (June 2019 application) included diameter at breast height (dbh) and total height. Data were analyzed using analysis of variance as a completely randomized design with replication using PROC Mixed in SAS 9.4, and differences among treatment means were separated using Fisher's protected least significant difference (P<0.05). Dependent variables included survival, dbh, total height, and volume index (VI) per hectare. The survival variable received an arcsine square root transformation to stabilize variance. Results revealed no significant differences for loblolly pine survival with June 2019 (P=0.97) or April 2020 (P=0.42) application timings. Survival ranged from 73.9% with the control to 82.9% with treatment one for June 2019, while survival ranged from 88.9% with treatment two to 96.0% with treatment three. Average DBH did not differ for June 2019 (P=0.97) or April 2020 applications (P=0.63). Diameters ranged from 6.43 cm in the control to 6.68 cm in treatment one for June 2019. Average DBH in the April 2020 application timing ranged from 3.2 cm with treatment three to 3.63 cm with treatment one. Similar trends were observed for total average height with no statistical differences observed for June 2019 (P=0.92) or April 2020 (P=0.51). Average heights ranged from 4.2 m with the control to 4.4 m with treatment one in the June 2019 timing, while the control averaged 2.9 m and treatment one 3.2 m in treatment one with the April 2020 timing. No differences for VI per hectare were observed either, but treatment two had a 13% greater VI per

hectare than treatment four for the June 2019 application and treatment one had a VI per hectare that was 26% greater than treatment three and 21% greater than the control. The herbicide impregnated fertilizers did no damage or inhibit growth of one-year-old loblolly pine seedlings in this study. Grass and broadleaf weed competition were low at both sites prior to treatment application, and soil P was at or below critical threshold levels, which made these good candidate sites for weed and feed applications. Dithiopyr has shown good to excellent control of several grasses, but grass competition was low at both sites at application. Drought conditions during the second half of the 2019 growing season likely reduced any herbaceous weed competitive pressure at the June 2019 application site making fertilization only treatments more similar to weed and feed treatments. Widespread trumpet creeper (*Campsis radicans*) woody vine coverage was high across treatments one year after application at the April 2020 application site. This infestation could have potentially impacted results.

Control of Natural Pines Using Glufosinate -- A Comparison of Application Timings. JE Ezell*; Mississippi State University, Starkville, MS (165)

Control of natural pines continues to be an issue in forestry site preparation. The concern over using glyphosate has prompted the search for an effective alternative for controlling this vegetation. A total of 15 treatments (including an untreated check) were applied in July and September to R.O.W. locations in northern Mississippi which were well stocked with woody species. The target vegetation was naturally occurring loblolly pines (*Pinus taeda* L.). Treatments included five glufosinate products applied alone and in mixtures with imazapyr. Plots were evaluated at 14DAT, 28, DAT, 56DAT, and 1YAT. Results indicate that glufosinate is very effective at controlling natural pines and the July applications performed as well as September applications.

Efficacy of Mid-Rotation Brush Control Applications Using Imazapyr and Glufosinate. AW Ezell*[1], AB Self[2], JE Ezell[1]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Grenada, MS (166)

Mid-rotation brush control is an effective component of vegetation management programs for pine plantations in the South. While imazapyr is the primary material used in these applications, many situations have species groups which require additional herbicides to achieve the desired level of control. A total of 17 treatments (including an untreated check) were applied to the understory of a 31-year-old pine plantation in northern Mississippi. Plots were evaluated at 30DAT, 60DAT, 90DAT, 120DAT, and 1YAT. Treatments which included glufosinate had a rapid brownout for many species. Final evaluations indicated that glufosinate alone provided less control of hardwoods than may be desirable. In addition, adding glufosinate to imazapyr or glyphosate decreased control of hardwoods as compared to the latter materials applied alone.

Site Preparation with Mixtures Containing Triclopyr, Fluroxypyr, Imazapyr, 2,4-D, and Aminopyralid+ Florpyrauxifen. AB Self*[1], JE Ezell[2], AW Ezell[2]; [1]Mississippi State University, Grenada, MS, [2]Mississippi State University, Starkville, MS (167)

Site preparation continues to be a major focus of vegetation management programs in forestry operations focused on pine in the South. Cost-efficacy is always a major consideration in these applications, and the possibility of new products testing as cost-effective is very desirable. In this study, a total of eight treatments (including an untreated control) were applied to a recent cutover area in October, 2021. Plots were evaluated at 1MAT, 4MAT, 8MAT and 1 YAT. Control of the hardwoods on the site will be presented.

Loblolly Seedling Tolerance to Increased Rates of Florpyrauxifen-benzyl Applied During Site Preparation. AW Ezell*[1], AB Self[2], JE Ezell[1]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Grenada, MS (168)

Crop tolerance is a significant issue when testing a new herbicide for use in forest management. Florpyrauxifen-benzyl has shown potential for use in loblolly pine (*Pinus taeda* L.) management. Prior to operational use of any new rates, tolerance of the seedlings must be evaluated. Two treatments were applied in an area to be planted with loblolly seedlings with each treatment replicated three times. Loblolly seedlings were planted in each replication. Seedlings were evaluated at 30, 60, and 90 days after planting. No damage was observed on any seedlings at any observation timing.

Knotroot Foxtail Control in Bermudagrass Hayfields. JL Belcher*; Envu, Auburn, AL (169)

Knotroot foxtail (*Setaria parviflora* Poir) is a warm-season perennial foxtail species that occurs throughout much of the eastern U.S. and across into Texas and Oklahoma. Unlike many other foxtail species that are annuals and reproduce by seed, knotroot foxtail also produces stubby rhizomes that allow mature plants to persist from one year into the next. These rhizomes make controlling knotroot foxtail much more difficult than annual species. Two studies were conducted in the fall of 2021 to evaluate postemergence herbicides for control of knotroot foxtail. Both studies were treated on the same day on the same farm and the treatments that were evaluated were the same for both trials. The difference between these trials was the elapsed time since last harvest. One trial had been harvested and had been allowed two weeks to regrow and had knotroot foliage that was six inches in height. The second trial had been allowed to regrow for six weeks since harvest, and knotroot foliage was thirty inches tall. The treatments were arranged in a randomized complete block design with four replications. Knotroot foxtail counts were taken using a 1 m^2 frame in addition to visual percent control ratings. Bermuadgrass injury was also evaluated. Postemergence herbicide treatments were applied on October 14, 2021 and included glyphosate alone and with Pastora (62.34 g ai ha^{-1}) at 260, 390, or 520 g ai ha^{-1}, hexazinone (584.5 g ai ha^{-1}), imazapic (105.2 g ai ha^{-1}), and quinclorac (421 g ai ha^{-1}). In addition, the preemergence herbicide indaziflam (43.84 g ai ha^{-1}) was applied in the fall and again in spring in order to prevent germination of new plants. A true nontreated check was also included for comparison. All treatments included a nonionic surfactant. Bermudagrass injury was taken in April and May of 2022. Both studies showed that in April, all glyphosate rates resulted in injury, primarily in the form of stunting and delayed greenup. In the study with less regrowth, injury ranged from 15% at the low rate, to 45% with the high rate of glyphosate combined with Pastora. Injury ratings in the second study followed a similar pattern, although injury was much greater, with low glyphosate rates injuring bermudagrass at 47% and higher rates and combinations at 60% or greater. However, by the next evaluation in May, bermudagrass had recovered significantly in both studies, with injury falling below 30% for all the glyphosate treatments. No other treatment resulted in significant bermudagrass injury at any evaluation. All glyphosate rates and combinations resulted in 70% or greater control of knotroot foxtail the following July, except for the lowest glyphosate rate applied alone on the short regrowth trial. Other treatments generally resulted in poor control. These results indicate that timely applications of glyphosate can be used to manage knotroot foxtail populations in bermudagrass pastures when indaziflam is also included to prevent repopulation from the seed bank.

Using Unmanned Aerial Systems for Identifying Smutgrass (*Sporobolus indicus*) and Management Interventions. ZS Howard*[1], DE Martin[2], C Yang[2], SA Nolte[3]; [1]Texas A&M University, College Station, TX, [2]USDA-ARS, College Station, TX, [3]Texas A&M AgriLife Extension, College Station, TX (170)

Perennial grass weeds are often of the most difficult to control weeds in a pasture setting. Smutgrass (*Sporobolus indicus*) can significantly impact forage quantity, and therefore lead to required reductions in livestock stocking rate to protect from forage overgrazing, ultimately impacting profitability. Traditionally this plant is difficult to control and requires high inputs of either time or monetary resources. Site specific weed management (SSWM) could not only lead to effective utilization of non-selective herbicide glyphosate to control smutgrass but can spare the forage such that it is sprayed only on the weed. In this study, pastureland infested with smutgrass was characterized by red, green, blue, near-infrared, and a canopy height model and further processed for the identification of smutgrass by a machine learning algorithm. 25 points where smutgrass was identified in two locations where then utilized for UAS (unmanned aerial system) spraying. Additionally, 25 plants were sprayed by individual plant treatment method (IPT) to compare the time and productivity of each event. On target percentage and control measures were taken to evaluate the effectiveness of the UAS spray application. Various markers of productivity indicate UAS mapping and spraying can be a viable option for SSWM, and that there is room for improvement.

Dicamba Research Update. TC Mueller*[1], L Steckel[2]; [1]University of Tennessee, Knoxville, TN, [2]University of Tennessee, Jackson, TN (171)

Research focused on two general areas: resistance confirmation and environmental fate of auxinic herbicides. A greenhouse dicamba dose response screen was conducted on 15 Tennessee accessions. Relative resistance factor for dicamba ranged from 1.85-2.49 for several biotypes, upward to 14.25, indicating that this population could no longer be controlled using dicamba. Experiments were initiated in grower's fields where herbicide failures were previously observed to determine the impact of weed height on Palmer amaranth control following applications of dicamba or 2,4-D. While weed height at the time of application had a significant effect on Palmer amaranth control with auxin herbicides, control was still unacceptable in the field at the labelled rates of dicamba and 2,4-D at <10 cm tall weeds (48% and 53%, respectively). This research confirmed that these Palmer amaranth populations are resistant to dicamba. Studies examining the off target movement (OTM) of dicamba and 2,4-D continued in 2022. Field studies showed that dicamba emissions were slightly higher than 2,4-D choline, even when labelled adjuvants (VRA) were added to the dicamba. A lab study evaluated the utility of potassium borate (KBr) added to dicamba Diglycolamine formulation to reduce dicamba emissions. A low rate of KBr (0.025 molar) only slightly reduced dicamba emissions, although a KBr dose of 0.1M reduced dicamba emissions equal to the industry standard of Xtendimax+ a Vapor Reducing Agent.

Nutrient and Cost Ramifications of Soybean Residue Loss During Harvest Weed Seed Control. WJ Stutzman*[1], MP Spoth[1], LM Lazaro[2], G LaBiche[3], WE Thomason[1], K Bamber[1], ML Flessner[1]; [1]Virginia Tech, Blacksburg, VA, [2]Blue River Technology, Sunnyvale, CA, [3]Louisiana State University AgCenter, Baton Rouge, LA (172)

Harvest weed seed control (HWSC) removes, destroys, or gathers weed seed that is harvested. Different methods of HWSC may also destroy, remove, or concentrate chaff and straw from the harvest. For example, chaff lining/tramlining spreads the straw evenly but concentrates the chaff while bale direct removes both straw and chaff fractions from the field. Since these residues have nutrient value, HWSC methods that remove or concentrate residues will have fertility implications and associated costs. This study estimated the distribution of biomass comprised of seed, straw, and chaff from soybean (*Glycine max* (L.) Merr.) harvest with the nutrient composition of the straw and chaff. Results were based on n = 57. The average soybean harvest index was 0.57:1, and biomass that entered the combine was comprised of 7.25 ± 0.37% chaff, 36.05 ± 1.2% straw, and 56.7 ± 1.2% seed. Chaff residue was 13.4% of the seed weight while straw residue was 68.5%. In a soybean crop yielding 3368 kg ha^{-1} (50 bu a^{-1}), chaff contains 9.4, 0.8, 5.0, and 0.6 kg ha^{-1} N, P, K, and S, respectively, and straw 31.6, 2.1, 1.1, and 2.0 kg ha^{-1}. The cost of replacing these residues, calculated using the 5-year average fertilizer prices ending in 2021, was USD 1.58, USD 5.88, and USD 7.46 to replace chaff, straw, and both, respectively. This study shows nutrient outcome and replacement costs that are associated with HWSC. This study has been recently published in Agronomy: https://doi.org/10.3390/agronomy12092028

Summary of the 1st Annual Meeting of the Southern Extension Weed Science Working Group. CW Cahoon*[1], T Barber[2], TA Baughman[3], P Devkota[4], PA Dotray[5], W Everman[1], J Heiser[6], S Lancaster[7], S Li[8], J Carvalho de Souza Dias[9], MW Marshall[10], SA Nolte[11], EP Prostko[12], DP Russell[13], V Singh[14], L Steckel[15], C Webster[16], G Morgan[17]; [1]North Carolina State University, Raleigh, NC, [2]University of Arkansas, Lonoke, AR, [3]Oklahoma State University, Ardmore, OK, [4]University of Florida, Jay, FL, [5]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX, [6]University of Missouri, Portageville, MO, [7]Kansas State University, Manhattan, KS, [8]Auburn University, Auburn, AL, [9]University of Arizona, Maricopa, AZ, [10]Clemson University, Blackville, SC, [11]Texas A&M AgriLife Extension, College Station, TX, [12]University of Georgia, Tifton, GA, [13]Auburn University, Madison, AL, [14]Virginia Tech, Painter, VA, [15]University of Tennessee, Jackson, TN, [16]Louisiana State University AgCenter, Baton Rouge, LA, [17]Cotton Incorporated, Cary, NC (173)

Thanks to the efforts of Don Parker (National Cotton Council), Gaylon Morgan (Cotton Incorporated), and our industry partners (Bayer, BASF, Corteva, and Syngenta) the seed for more collaboration among the row crop Extension Weed Specialists of the southern region was planted over lunch at the 2022 SWSS. From that meeting, organizational structure for the Southern Extension Weed Science (SEWS) Working Group was born. Charlie Cahoon (NC State University) was elected chair, with Mike Marshall (Clemson) to serve as co-chair. Cahoon and Marshall, along with Don Parker, Gaylon Morgan, and additional National Cotton Council staff (Savana Denton, Debbie Richter, and Ellen Ferrell), commenced to planning the 1st meeting of the group for August 9th-11th in Raleigh, NC. Attendance included 17 Specialists (and 5 spouses), representing 14 states, and 15 industry partners. The meeting kicked off with state updates from Specialists focused on troublesome weeds, general concerns, and stories of success, followed by a welcome reception at a local restaurant. Day 2 consisted of one-on-one closed sessions with our industry partners. Feedback from participants found the candid conversations from these closed-session to be extremely fruitful and the group expects to expand these sessions in the future. The afternoon of Day 2 included socializing over a private game of bowling and concluded with dinner and entertainment provided by agriculture comedian, Mr. Jerry Carroll. To conclude the meeting on Day 3, the Specialists met privately to review the meeting and discuss opportunities for collaboration. Out of this discussion, a collaborative project investigating herbicide-resistant Italian ryegrass across several southern states was successfully funded for 2022, despite being late in the year. After the meeting, several meeting attendees participated in an optional tour of Cotton Incorporated in nearby Cary, NC. Plans for the 2023 meeting will be finalized at the 2023 SWSS.

The State of Weed Science Education in the US. CM Prince*, SF Enloe, J Ferrell; University of Florida, Gainesville, FL (174)

Management of weeds and invasive plants is necessary to safeguard food production, protect native biodiversity, and maintain human health and safety. Nuisance plants must be managed in a way that is both effective and environmentally safe; to achieve this, managers must have in depth knowledge of weed biology, herbicides, and more. It is critical that universities in the United States provide appropriate coursework related to weed and invasive plant management. To determine if we are meeting this need, we analyzed the availability of weed science courses within 1543 universities across the U.S. Our analysis included land grant institutions, universities represented in the Weed Science Society of America (WSSA) and Aquatic Plant Management Society (APMS) membership lists, and universities that are members of the Global Council for Science and the Environment (GCSE). Using university course catalogs, we recorded the number of courses in the following categories for each university: wetlands, weed science, invasive plant management, aquatic plants, ecological restoration, and limnology. We classified wetlands, invasive plant, and aquatic plant courses as either primarily theoretical (i.e., ecology focused) or applied (i.e., management focused) based on course descriptions. With this talk, we will discuss the availability of plant management coursework within different regions of the U.S., differences between land grant and non-land grant institutions, and identify gaps in weed science education.

Influence of Planting Pattern and Herbicide Programs for Sicklepod Control in Peanut. OS Daramola*[1], P Devkota[2], GE MacDonald[3], R Kanissery[4], BL Tillman[5], H Singh[2]; [1]University of Florida/IFAS, Jay, FL, [2]University of Florida, Jay, FL, [3]University of Florida, Gainesville, FL, [4]University of Florida/IFAS, Immokalee, FL, [5]University of Florida, Marianna, FL (175)

Sicklepod (*Senna obtusifolia* L.) is one of the most difficult-to-control weeds in peanut production due to its season-long emergence. An integrated approach may improve sicklepod control in peanut, but there is limited information on the integrated management of sicklepod for peanut production. The objective of this study was to evaluate the effect of planting patterns and herbicide programs on sicklepod control in peanut. A field experiment was conducted in the summer of 2022 using a split-plot design with four replications. The main-plot factor was planting pattern (single vs. twin-row) and the sub-plot factor was herbicide programs (Preemergence (PRE) application of fluridone, flumioxazin, or fluridone + flumioxazin each followed by (fb) early-post (E-POST) application of S-metolachlor, diclosulam + S-metolachlor, or paraquat + bentazone + S-metolachlor each (fb) imazapic + dimethenamid-p + 24DB). Twin-row pattern reduced late-season sicklepod density and biomass by 52% and 39%, respectively, and increased peanut yield by 14% compared with the single-row pattern. PRE application of flumioxazin or fluridone + flumioxazin provided =90% control of sicklepod with =85% reduction in sicklepod density compared with the untreated control but caused 15% to 25% peanut injury at 4 weeks after treatment (WAT). PRE application of fluridone alone provided 80% control of sicklepod with =5% peanut injury at 4 WAT. Regardless of the planting pattern, fluridone + flumioxazin (fb) paraquat + bentazon + *S*-metolachlor (fb) imazapic + Dimethenamid-p + 2,4DB provided =95% control of sicklepod and resulted in the lowest sicklepod density and biomass at 4 weeks after POST treatment, and highest peanut yield at end of the season. All the herbicide programs without EPOST application of paraquat + bentazon + *S*-metolachlor provided poor sicklepod control. This study showed that twin-row spacing improved late-season sicklepod control, but did not reduce the need for herbicide input, particularly EPOST application of paraquat + bentazon in peanuts.

Crop Rotational Effect of Winter *Brassica carinata* Production on Peanut Weed Control. P Devkota*[1], S Mathew[2], N Singh[1]; [1]University of Florida, Jay, FL, [2]University of Florida/IFAS, Jay, FL (176)

Ethiopian mustard (*Brassica carinata*) is recently introduced in the southeastern United States as a winter biofuel crop, and its effect on weed control in the summer crop needs to be studied. Field research was conducted from November 2021 to October 2022 at the University of Florida, West Florida Research and Education Center near Jay, FL to evaluate the influence of growing winter carinata for weed control on subsequent summer peanut production. The main plot factor was winter cropping history: a) carinata, and b) weedy fallow. The sub-plot factor was preemergence (PRE) applied herbicide programs: a) fluridone, b) acetochlor, c) fluridone+acetochlor, d) no PRE herbicide. PRE herbicides were followed by postemergence (POST) application of *S*-metolachlor+2,4-DB+imazapic at 4 weeks after PRE (WA-PRE). At 2 WA-PRE, the peanut stand with winter carinata treatment was >7 plants m^{-1} compared to weedy fallow. Results at 4 WA-PRE illustrated that peanut height was greater with carinata compared to weedy fallow. Likewise, grass weed species (barnyardgrass, Texas panicum, large crabgrass) control was 20% or greater and density was about 3 times lower with carinata production compared to weedy fallow. However, there was no effect of winter cropping history and PRE herbicide programs for control and density reduction of broadleaf weed species, such as sicklepod, morningglory spp., and yellow nutsedge control. At 4 WA-POST herbicide applications, winter cropping history resulted in 5 and 8 cm greater peanut height and canopy width, respectively, with winter carinata compared to weedy fallow. There was no effect of winter cropping history and herbicide programs on the grass or broadleaf weed control and density. The peanut yield was not different with winter cropping history and herbicide program treatments. Overall, the study suggests that winter carinata production has the potential to complement early-season grass weed control during subsequent summer peanut production.

Paraquat-Resistant Italian Ryegrass (*Lolium multiflorum*) Confirmed in Louisiana. AJ Orgeron*[1], AB Coco III[1], DJ Spaunhorst[2]; [1]Louisiana State University AgCenter, Baton Rouge, LA, [2]USDA-ARS, Houma, LA (177)

Paraquat is the only herbicide labeled for postemergence control of Italian ryegrass in sugarcane. In 2017, sugarcane farmers in Louisiana reported Italian ryegrass control failures with paraquat applications. Seeds were collected from sugarcane fields in White Castle, St. Gabriel, and Bunkie, Louisiana where control was not achieved (reduced susceptibility). Additionally, Italian ryegrass seeds were collected from a sugarcane field in Welcome, LA with a history of paraquat use and with no reported control issues (susceptible population). A dose-response study was conducted at the Louisiana State University Agricultural Center's Sugar Research Station in February 2021 and was repeated in November 2021. Paraquat was applied to 8- to 12- cm tall Italian ryegrass plants at 0, 1/32 1/16, 1/8, 1/4, 1/2, 1, 2, 4, 8, and 16X rates, of the maximum field use rate of 840 g ha^{-1}, for the reduced susceptibility populations. For the susceptible population, paraquat was applied at 0, 1/256, 1/128, 1/64, 1/32, 1/16, 1/8, 1/4, 1/2, 1, and 2X rates. At 18 d after application, injury was recorded, then biomass was harvested and dried for 96 h. Dose-response curves were fitted using a four-parameter, log-logistic model in R software. The effective paraquat dose to cause 50% injury (ED_{50}) was 77 g ha^{-1} for the Welcome population, whereas it required 200.4, 22.2, and 45.4 -fold more paraquat for the White Castle, St. Gabriel, and Bunkie populations, respectively. Likewise, the ED_{50} value required to reduce the dry weight by 50% was 44 g ha^{-1} for the Welcome population. To reduce dry weight biomass for 50% for the White Castle, St. Gabriel, and Bunkie populations, required rates of 13.3, 4.3, and 14.3 -fold more paraquat, respectively, when compared to the Welcome population. These results confirm the presence of paraquat resistant Italian ryegrass in Louisiana.

Kochia Management in No-till Cotton Systems. CR White*, W Keeling; Texas A&M AgriLife Research, Lubbock, TX (178)

Kochia (*Bassia scoparia*) is an increasingly problematic weed in Texas High Plains crop production. Kochia is a summer annual that emerges in the spring and matures in the fall and thrives in the hot, dry conditions of the High Plains. Kochia has traditionally been effectively controlled with spring tillage and dinitroaniline herbicides, but with an increase in no-tillage acres postemergence (POST) control of kochia becomes more important. Trials were conducted in 2020-2022 at the Texas A&M AgriLife Research and Extension Center in Lubbock, Texas to evaluate preemergence (PRE) and POST herbicide combinations for kochia control. Applications were made using a CO2-pressurized backpack sprayer calibrated to deliver 15 gallons per acre (GPA) with TurboTeeJet 11002 nozzles. PRE trials, conducted in 2020 and 2021, included dicamba in combination with Alite27, atrazine, Caparol, Direx, Prowl H2O, Reflex, Valor, and Zidua. These treatments were applied in early March prior to kochia emergence. Residual herbicides alone provided control greater than 90%; kochia control improved to greater than 98% when tank-mixed with dicamba. POST trials, conducted in 2021 and 2022, were applied between early-April and the end of May. Treatments included 2,4-D, dicamba, glyphosate, Reviton (1.0 and 2.0 oz/acre), Sharpen, Valor, and a BASF experimental (pre-mix of Sharpen and trifludimoxazin, 1.0 and 1.4 oz/acre); these herbicides were applied alone and in tank-mix combinations. Tank-mix combinations controlled kochia more effectively than dicamba, glyphosate, or 2,4-D alone. Combinations of dicamba + glyphosate + Valor, Sharpen + glyphosate, and Reviton + glyphosate + Valor controlled kochia >90%. When treatments were applied to larger weeds (6-8") Reviton + glyphosate controlled kochia >90%. Kochia can be effectively managed PRE (>95% control) with many registered residual herbicides tank-mixed with dicamba. POST control was most effective when applied to smaller weeds (<4") and was more challenging as weeds grew larger. Tank-mixes improved control (both PRE and POST) when compared to single herbicide applications alone.

Integration of Cover Crops and Herbicides for Weed Control in Cotton. A Kumari*[1], AJ Price[2], S Li[1]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL (179)

In the southeastern United States, Palmer amaranth *(Amaranthus palmeri* S. Wats*)*, morning glories *(Ipomoea spp.)*, nutsedges *(Cyperus spp.)*, sicklepod *(Senna obtusifolia L.)*, prickly sida *(Sida spinosa* L.*)* and large crabgrass (*Digitaria sanguinalis* L. Scop.) are the major weed species threatening crop production systems. However, cotton grows comparatively slower than other row crops in germination and root development during the initial vegetative stage. Therefore, it is essential to keep cotton weed-free during the critical phase to maintain lint yield. An experiment was conducted with the objective of increasing the adoption of integrated weed management tactics by combining weed suppressive cover crop qualities and chemical weed control to maintain long-term viability for sustainable agriculture. Six cover crop systems were utilized as main plots in a split-plot design: winter fallow, cereal rye, black oats, crimson clover, radish, and a mixture. In addition, four herbicide treatments were used in subplots: no herbicide, combination of two pre-emergence herbicides (Prowl H_2O + Reflex), combination of two postemergence herbicides (Liberty + Dual Magnum), and pre followed by postemergence herbicides. Results showed that the impact of only pre and post-emergence herbicides was observed only in the first two to three weeks after application. Whereas a mixture of pre + postemergence herbicides was most effective in weed control, and its effect remained late season. We found a significant impact of cover crops on decreasing weed biomass. In addition, cereal rye was most effective in weed control, specifically for small-seeded weed species like Palmer amaranth. In conclusion, cover crops, along with the inclusion of both preemergence and postemergence herbicides, suppressed weed density in cotton.

Cotton Tolerance to Over-the-Top Application of Various Herbicide Coated Fertilizers. SL Pritchett*[1], JK Norsworthy[1], MC Woolard[1], TA King[1], SC Noe[2], T Barber[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Fayetteville, KY, [3]University of Arkansas, Lonoke, AR (180)

Residual and postemergence herbicides are vital for season-long control of economically important weeds. When controlling these problematic weeds, cotton injury is a concern to producers when making early-season herbicide applications. This study was designed to evaluate herbicide injury when coated on granular fertilizer and applied over-the-top of cotton at the 6- to 8-leaf growth stage. The experiment was planted May 11, 2022, at the Milo J. Shult Agricultural Research and Extension Center in Fayetteville, Arkansas. The fertilizer blend utilized in the experiment consisted of 196 kg per hectare of urea and muriate of potash at 112 kg per hectare. The evaluated herbicide treatments included: pyroxasulfone at 128 g/ha, diuron at 841 g/ha, florpyrauxifen-benzyl at 29 g/ha, fluometuron at 841 g/ha, flumioxazin at 105 g/ha, fluridone at 168 g/ha, fomesafen at 280 g/ha, saflufenacil at 66 g/ha, S-metolachlor at 1388 g/ha, flumioxazin and pyroxasulfone at 160 g/ha, saflufenacil at 244 g/ha, and a combination of saflufenacil at 44 g/ha plus pyroxasulfone at 91 g/ha. All plots were maintained weed-free, and a non-treated control was included for comparison. Cotton injury was assessed at 7, 14, 21, and 28 days after treatment (DAT), and seedcotton yield was collected. Fluometuron, diuron, pyroxasulfone, and S-metlachlor caused =5% injury to cotton at 7 DAT. All protoporphyrinogen oxidase inhibitors, including saflufenacil, fomesafen, flumioxazin, flumioxazin and pyroxasulfone, saflufenacil and dimethenamid-P, and the saflufenacil plus pyroxasulfone combination, injured cotton 19 to 30% at 7 DAT, with the injury manifesting as necrosis of leaves associated with fertilizer prills. Furidone and florpyrauxifen-benzyl caused 8 and 16% injury, respectively, at 7 DAT. Injury from the treatments was transient, with no more than 5% observed by 28 DAT. There were no differences in seedcotton yields among treatments, with all yielding comparable to the non-treated control. These findings demonstrate there is high potential for utilizing herbicide-coated fertilizer in cotton production based on tolerance of the crop to the applications. Additional site years across multiple locations are needed to support or refute these findings.

Diflufenican: a Tool for Managing *Amaranthus* Species in Corn and Soybean Cropping Systems. J Buol*, C Coburn, R Leitz, E Riley, A Datta; Bayer, St. Louis, MO (181)

The continued development and spread of herbicide resistance constitutes a major threat to the efficiency and profitability of corn and soybean production. Weeds such as some *Amaranthus* species have developed resistance to multiple herbicide modes- and sites- of action and are among the most challenging broadleaf weeds in North America. Bayer CropScience is developing an herbicide platform that features the use of diflufenican, a new site of action for *Amaranthus* spp. control in corn and soybean production systems in North America, pending registration with the U.S. EPA and Canada PMRA. Diflufenican functions as a phytoene desaturase inhibitor classified by HRAC as a group 12 herbicide and has been used outside of the U.S. for control of broadleaf weeds in cereals, peas, lentils, lupins, clover pastures, and oilseed poppy. Given the increasing challenge of managing herbicide-resistant weeds, diflufenican is being evaluated in field trials in North America for residual activity on *Amaranthus spp*. and crop selectivity in soybean and corn. Pending registration with the U.S. EPA and Canada PMRA, diflufenican would enable a new weed management tool that should be used in combination with other weed management practices as part of an integrated weed management plan.

Does Timing of a Soil-applied Diflufenican Mixture Impact Soybean Tolerance and Palmer Amaranth Control? MC Woolard*[1], JK Norsworthy[1], CT Arnold[1], CH Arnold[1], MC Castner[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (182)

In midsouthern row crop production, Palmer amaranth (*Amaranthus palmeri*) is one of the most problematic weeds of row crops in the southern United States due to herbicide resistance to many sites of action. Diflufenican (DFF) would be a potentially new site of action for soybean and is capable of controlling herbicide-resistant Palmer amaranth. An experiment was conducted at the Milo J. Shult Research and Extension Center in Fayetteville, AR to evaluate application timings of a DFF mixture and its impact on soybean tolerance and Palmer amaranth and common lambsquarters control. The DFF mixture was applied 14-day preplant (DPP), 7 DPP, preemergence, and 3 days after planting (DAP). The rates evaluated included 1X and 2X of the anticipated labeled rate of the DFF mixture. To evaluate weed control, application timings included 14 DPP, 7 DPP, preemergence, 3 DAP, and a 1X rate of the DFF mixture. Injury 14 days after plating (DAP) ranged from 2-20% for the 1X rate and 6-32% at the 2X rate. The level of injury increased as application was closer to planting. By 28 DAP, injury ranged from 0-13% for the 1X rate and 2-23% for the 2X rate. The highest injury was observed for applications occurring 3 DAP. Palmer amaranth and common lambsquarters control 21 DAP was >97% for all application timings, except 14 DPP which achieved 88 and 93% control, respectively. By 42 DAP, the preemergence and 3 DAP timing were the only treatments providing =90% control of Palmer amaranth and common lambsquarters. Soybean grain yield was collected at maturity for each of the trials evaluated. For the tolerance trial, there were no observed differences in the soybean grain yield for the different application timings and rates evaluated. For the weed control trial, the soybean grain yield increased the later the application of DFF mixture was applied, with the only statical differences being between the nontreated check, 14 DPP, and 3 DAP. Future research should evaluate a DFF mixture as part of a programs approach to control herbicide-resistant Palmer amaranth in midsouthern U.S. soybean production. As an alternative site of action not currently labeled in soybean, the DFF mixture appears to be an additional tool for controlling Palmer amaranth.

A23980B: A Step Change for Residual Weed Control in Corn. JR Brewer*[1], SE Cully[2], M Kitt[3], T Beckett[3]; [1]Syngenta Crop Protection, Vero Beach, FL, [2]Syngenta Crop Protection, Marion, IL, [3]Syngenta Crop Protection, Greensboro, NC (183)

A23980B is a new selective herbicide coming soon for weed control in field corn, seed corn, popcorn and sweet corn. A23980B contains ratios of S-metolachlor, pyroxasulfone, mesotrione, bicyclopyrone, and the safener benoxacor that will provide extended residual weed control in corn. Field trials were conducted to evaluate A23980B for residual weed control compared to Acuron®, Acuron Flexi and other corn herbicide premixes in one pass and two pass weed control programs. Results show that A23980B will provide more consistent and longer lasting residual control of difficult to control weeds like *Amaranthus palmeri*, *Amaranthus tuberculatus* and other problematic broadleaf and grass weeds in corn.

A23980B: Exceptional Corn Weed Control from Four Complimentary Active Ingredients. BD Black*[1], SA Strom[2], M Kitt[3], TH Beckett[3]; [1]Syngenta Crop Protection, Searcy, AR, [2]Syngenta Crop Protection, Monticello, IL, [3]Syngenta Crop Protection, Greensboro, NC (184)

A23980B is a new selective herbicide coming soon for weed control in field corn, seed corn, popcorn, and sweet corn containing s-metolachlor, pyroxasulfone, mesotrione, bicyclopyrone, and the safener benoxacor. The combination of four active ingredients in A23980B was designed to deliver residual control of difficult to manage weeds. Field trials were conducted to determine the benefit of two Group 15 herbicides and two Group 27 herbicides in a premix for long-lasting residual weed control. Results demonstrated that the active ingredients in A23980B work better together to deliver consistency and efficacy resulting in control of key weeds such as *Amaranthus* spp. and grasses. Overall, A23980B provides the foundation needed for growers facing the most problematic broadleaf and grass weeds in corn agronomic cropping systems.

Single and Sequential Applications of Oxyfluorfen for Weedy Rice Control. CH Arnold*[1], JK Norsworthy[1], NH Reed[1], TR Butts[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (185)

Oxyfluorfen (ALB2023 and ALB2024) is a WSSA group 14 herbicide that can be used for preemergence (PRE) and postemergence (POST) weed control applications in the ROXY® Rice Production System (RRPS). Currently, oxyfluorfen is not labeled for use in rice, but weedy rice control is being evaluated in the RRPS. In the 2021 and 2022 growing seasons, two separate field trials were conducted at the Rice Research and Extension Center near Stuttgart, AR. The first trial was designed to determine if there was a rate response with POST applications of oxyfluorfen for weedy rice control, and the second trial focused on optimizing the rate of oxyfluorfen in a sequential program. For the rate response experiment, oxyfluorfen (ALB2024) was POST-applied at 560, 840, 1120, 1400, or 1680 g ai ha^{-1} when the rice reached the 2-leaf growth stage. In the second experiment, mixtures of clomazone and oxyfluorfen (ALB2023) (336 + 560 or 840 or 1120 g ai ha^{-1}, respectively) were PRE-applied followed by a POST application of oxyfluorfen at 560, 840, or 1120 g ai ha^{-1}. At 35 days after treatment (DAT), weedy rice control ranged from 57 to 73% for the rate response experiment, with only a slight improvement in control with increasing rate. In the second trial, PRE-applications of oxyfluorfen resulted in 46 and 70% control at the lowest and highest rates of oxyfluorfen, respectfully. At 14 days after the final treatment, weedy rice control ranged from 78 to 81% when oxyfluorfen was sequentially applied. Weedy rice may potentially be suppressed by oxyfluorfen in a RRPS, but the herbicide alone is not likely to provide complete control.

Does Application Timing of Fluridone Impact Rice Tolerance? JK Norsworthy[1], TA King[1], MC Souza*[1], SC Noe[2], T Barber[3], TR Butts[3]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Fayetteville, KY, [3]University of Arkansas, Lonoke, AR (186)

Herbicide-resistant weeds in rice are significant concern for farmers, creating weed management difficult and increasing the cost of production. The addition of new mechanisms of action to the rice system is essential to improve weed control for this crop. Thus, research was conducted to evaluate rice tolerance to different application timings of fluridone. The experiment was conducted at the Rice Research and Extension Center in Stuttgart, Arkansas in 2022 on a silt loam soil. It was organized in a randomized complete block design with ten application timings [22 and 11 days preplant, preemergence (PRE), delayed-preemergence (DPRE), 1-leaf, 2-leaf, 3-leaf, 4-leaf, tillering (preflood), and immediately after flooding (post-flood)]. Fluridone was sprayed at all timings at 168 g ai/ha. A non-treated check was included for comparison. Injury ratings and rice groundcover were collected at 35 and 70 days after emergence (DAE), and rough rice grain yield determined following crop harvest. Prior to establishment of the permanent flood at 35 DAE, the treatments PRE and DPRE caused 13% and 11% injury, respectively. However, by 70 DAE, injury had increased to 40% for both above-mentioned treatments. At 70 DAE, rice had the lowest groundcover (91%, 95%, and 94% of nontreated) following the PRE, DPRE, and 1-leaf treatments. Rice in non-treated plots produced greater rough rice yield than in plots treated with fluridone at the following application timings: PRE, DPRE, 1-leaf, 2-leaf, and 3-leaf stage. These findings demonstrate that timing of fluridone applications in rice and greatly influence the degree of injury that can result from the application.

Identification and Control of *Fimbristylis littoralis* in Louisiana Rice. C Webster*, JA Williams, M Arcement; Louisiana State University AgCenter, Baton Rouge, LA (187)

Over the past few growing seasons, the amount of inquiries concerning the control of *Fimbristylis littoralis* has grown exponentially. *Fimbristylis* is oftentimes misidentified as rice flatsedge (*Cyperus iria* L.), which leaves many growers in a dilemma later in the growing season. Both *Fimbristylis* and rice flatsedge belong to the cyperaceae (sedge) family; however, chemical control of these two weeds differs greatly. An on-farm study was conducted in 2022 in Abbeville, Louisiana to determine the most effective control measures for *Fimbristylis*. The study was a randomized complete block design containing a nontreated check and fifteen herbicide treatments replicated four times. Plot size was 1.5 by 5.1 m with water-seeded Provisia 'PVL03' rice at 67 kg ha^{-1}. A natural stand of *Fimbristylis* was present across the entire research area. Herbicide applications were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 140 L ha^{-1}. Each herbicide was applied with the recommended adjuvant at the recommended rate. Visual evaluations for crop injury and *Fimbristylis* control were recorded at 7, 14, 21, and 28 d after treatment (DAT), where 0 = no control and 100 = plant death. Two herbicides that are commonly used for postemergence control of rice flatsedge in rice production, halosulfuron and florpyrauxifen, provided 0 and 1% control, respectively, of *Fimbristylis* 14 DAT. Of the fifteen herbicide treatments evaluated, 2,4-D and triclopyr provided the highest levels of control of *Fimbristylis*. At 14 DAT, 2,4-D applied at 795 and 1,064 g ai ha^{-1} controlled *Fimbristylis* 90 and 99%, respectively, and triclopyr applied at 314 g ai ha^{-1} controlled *Fimbristylis* 98%. A reduction in control compared with 2,4-D and triclopyr was observed for bispyribac applied at 34 g ai ha^{-1}, with 79% control. All other herbicide treatments provided 18 to 54% control of *Fimbristylis* 14 DAT.

Canopy Coverage and Weed Control as Affected by Drill-spacing and Bed Width in Furrow-irrigated Rice. K Kouame*[1], TR Butts[1], NH Reed[2], BM Davis[1], LM Collie[1], T Dillon[1], JK Norsworthy[2], T Barber[1], J Hardke[3], J Bond[4], HD Bowman[5]; [1]University of Arkansas, Lonoke, AR, [2]University of Arkansas, Fayetteville, AR, [3]University of Arkansas, Stuttgart, AR, [4]Mississippi State University, Stoneville, MS, [5]Mississippi State University, Starkville, MS (188)

Furrow-irrigated rice, a relatively new production system in the Mid-South, lacks the cultural integrated weed management practice of flooding which negatively impacts weed management efforts. Therefore, alternative production practices and management strategies are needed in this production system to optimize weed management. Field experiments were conducted in 2021 and 2022 in Lonoke and Pine Tree (Arkansas) to investigate the impact of drill row spacing and bed width on weed control and canopy coverage in furrow-irrigated rice. A randomized complete block split-plot design was used with four replications. Treatments consisted of three bed widths (whole plot factor) (76-, 97-, and 152-cm) and four drill row spacings (subplot factor) (13-, 19-, 25-, and 38-cm). Hybrid rice cultivar RT7521 FP was drill-seeded and standard practices for fertility and irrigation were followed. Barnyardgrass density was assessed at the 5- to 6-leaf rice stage and preharvest. Aerial digital images from small unmanned aircraft systems were collected at the 3-6 leaf and panicle differentiation stages and processed with Field Analyzer software to estimate canopy coverage. Results indicated in general, as drill row spacing increased, barnyardgrass density also increased at both the 5- to 6-leaf rice stage and preharvest stage. However, as bed width increased, the beneficial effects observed of narrower drill row spacings (13- and 19-cm) were minimized or negated completely. The greatest canopy coverage in Lonoke and Pine Tree was observed from the 13- and 19-cm drill row spacings, respectively, when averaged across bed widths at the 3-6 leaf stage. At the panicle differentiation stage, averaged across locations, canopy coverage was numerically greater for smaller drill row spacings (13- and 19-cm), but no statistical differences were detected. Large variability was observed in the canopy coverage data, probably due to furrow-irrigated planting practices (pulling furrows after planting rice seed) that affected crop stand in some plots, this research demonstrated that greater rice canopy coverage and weed suppression could be provided by narrower drill row spacings (13- and 19-cm). Weed management efforts were also aided by reduced bed widths (97-cm or less). Overall, if wider drill row spacings were to be implemented in rice due to the adoption of new precision planting equipment, additional weed management efforts would be required, particularly early season. Keywords: drill-spacing, bed width, barnyardgrass, canopy coverage

Cultural Weed Management Strategies in Rice: Effects of Drill Row Width and Rice Cultivar.
NH Reed*[1], TR Butts[2], JK Norsworthy[1], J Hardke[3], T Barber[2], J Bond[4], HD Bowman[5], BM Davis[2], T Dillon[2], K Kouame[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR, [3]University of Arkansas, Stuttgart, AR, [4]Mississippi State University, Stoneville, MS, [5]Mississippi State University, Starkville, MS (189)

In a rice (*Oryza sativa* L.) production system, adaptive weeds such as barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] are problematic, causing increased input costs, labor, and yield loss. The evolution of herbicide resistance in weeds has caused the need for other weed management strategies such as drill row width manipulation and the use of more competitive rice cultivars. The objective of this study was to further evaluate these effects on weed control and rice canopy coverage. A field experiment was conducted in 2021 and 2022 at Lonoke, Pine Tree, and Rohwer, AR as a randomized complete block split-plot design. Four rice cultivars (subplot factor) [medium-grain (CLM04), long-grain in-bred (CLL16), and two long-grain hybrids (RT7301 and RT7521 FP)] were drill-seeded in four drill row widths (whole plot factor) (13-, 19-, 25-, and 38-cm). Barnyardgrass density was assessed at the 5- to 6-leaf rice stage (preflood) and preharvest. Aerial imagery from a small unmanned aerial system (sUAS) was also taken at the panicle differentiation rice stage and analyzed using Field Analyzer. All data were analyzed using JMP Pro 16.1 and subjected to ANOVA using Tukey's HSD (a=0.05). An interaction between drill row width and rice cultivar was not observed, regardless of the response variable. At the preflood rice stage, a 60% decrease in barnyardgrass density was observed for the 19-cm drill row width compared to the 38-cm drill row width across locations and years. Across locations and years at the preharvest rice stage, there was a 50% decrease in barnyardgrass density for the 19-cm drill row width compared to the 38-cm drill row width. The hybrid cultivars at the preharvest stage had a 60% decrease in barnyardgrass density compared to the inbred cultivars. Based on the sUAS imagery at panicle differentiation, there was a 20-percentage point decrease in canopy coverage for the 38-cm drill row width compared to 19-cm. No differences were observed in canopy coverage from cultivars. The optimal drill row width is still 19-cm or less for rice weed control compared to a wider width such as 38-cm. If wider drill row widths were to be implemented due to the adoption of new precision planting equipment, additional weed management efforts, such as an additional herbicide application, would likely be required for similar weed control as the current standard drill row width (19-cm). Characteristics such as enhanced tillering and growth of a hybrid rice cultivar might aid in weed management efforts compared to inbred cultivars.

Pronamide Resistant *Poa annua*: a Potential Target-Site Mutation Conferring Cross Resistance to Mitotic Inhibiting Herbicides. MJ Ignes[1], T Tseng[1], JS McElroy[2], CA Rutland[2], A Meredith[1], JD McCurdy*[1]; [1]Mississippi State University, Starkville, MS, [2]Auburn University, Auburn, AL (190)

The mitotic-inhibiting herbicide pronamide controls susceptible annual bluegrass (*Poa annua* L.) populations both pre- and post-emergence, but in some resistant populations, post-emergence activity is hypothetically compromised due to the lack of root uptake, unknown foliar resistance mechanisms, or target-site mutation. Plants from three suspected pronamide-resistant (LH-R, SC-R, and SL-R) and two pronamide-susceptible (BS-S and HH-S) annual bluegrass populations were collected from Mississippi. Dose-response experiments were conducted to confirm and quantify the level of pronamide resistance. Target-sites known to confer resistance to other mitotic-inhibiting herbicides were sequenced, as were target-sites for herbicides inhibiting acetolactate synthase (ALS) and photosystem II (PSII). In separate experiments, absorption, and translocation of pronamide were investigated at four different harvest times [8, 24, 72, and 168 hours after treatment (HAT)] following foliar and soil applications. Dose-response experiments confirmed pronamide resistance in LH-R, SC-R, and SL-R populations. Sequencing of the a-tubulin gene confirmed the presence of a mutation that substituted isoleucine for threonine at position 239 (Thr239-Ile) in LH-R, SC-R, SL-R, and BS-S populations. Foliar application experiments did not find differences in pronamide absorption and translocation between the five populations, regardless of harvest time. Most of the applied pronamide (>55%) was not absorbed foliarly. All populations had limited basipetal translocation—only 3–13% of the absorbed pronamide—across harvest times. Soil application experiments revealed that pronamide translocation generally did not differ between SC-R, SL-R, and both susceptible populations across harvest times. The LH-R population translocated less soil-applied pronamide than the susceptible populations, 24, 72, and 168 HAT, indicating that reduced acropetal translocation may contribute to pronamide resistance. This study reports three new pronamide-resistant populations from Mississippi and suggests that both target-site-based and translocation-based mechanisms may be associated with pronamide resistance in the same population. Further research is needed to confirm the link between the Thr239-Ile mutation and pronamide resistance.

Virginia Buttonweed Control in Common Bermudagrass. T Stoudemayer*, LB McCarty; Clemson University, Clemson, SC (191)

Virginia Buttonweed (*Diodia virginiana* L.) is a rhizomatous and stoloniferous, troublesome, perennial, broadleaf weed. V. Buttonweed re-emerges each year from perennial parts, eliminating pre-emergence herbicides (PRE) efficacy. It quickly grows into a thick, invasive mat often outcompeting desirable turfgrasses. V. Buttonweed also has the ability to flower and fruit above and below ground, increasing the difficulty for it to be successfully removed mechanically, as ruptured fruits from this releases viable seeds. Successful mechanical removal is further hindered with the presence of numerous adventitious buds along its roots, allowing Buttonweed to regenerate itself if any portion of it remains in the soil. Previous research consistently reports limited success of using post-emergence herbicides (POST) when used alone. With these issues in mind, a trial was conducted in the summer of 2022 in Clemson, SC with the objective to evaluate tank mixtures of certain POST herbicides on V. Buttonweed control. At trial initiation (July 19th, 2022), five treatments were included: 2,4-D + dicamba + MCPP [Trimec Classic 3.32L] at (4 pts/A); 2,4-D + trifloxysulfuron [Monument 75DF] at (0.5 lb ai/A + 0.45 oz/A); 2,4-D + dicamba + MCPP + sulfentrazone [Surge 2.18L] at (3.25 pts/A); 2,4-D + dicamba + fluroxypyr [Escalade 2 4.4L] at (2 pts/A); and, 2,4-D + dicamba + clopyralid [Millennium Ultra 2 3.56L] at (2 pts/A). Bentazon [Basagran T&O 4L] + Monument 75DF at (3 pts/A + 0.45 oz/A); and, Basagran T&O 4L + metsulfuron 60DF (at 3 pts/A + 1 oz/A) were added treatments on the second application date (September 8th, 2022) and only applied once. Trimec Classic; 2-4, D + Monument; Surge; Escalade; and, Millennium Ultra 2 all provided >98% control four weeks after the second application. Basagran T&O + Monument and Basagran T&O + Metsulfuron provided 70% and 83% control, respectively, four weeks after the only treatment they received. Common bermudagrass turf tolerance to these products was acceptable. Control of V. Buttonweed is attainable if 2,4-D is tank-mixed with other products and at least two applications are applied. Successful tank-mix partners with 2,4-D include dicamba, MCPP, trifloxysulfuron, clopyralid, and fluroxypyr. Successful control is also obtainable when bentazon is tank-mixed with metsulfuron.

Preemergence *Poa annua* and *Kyllinga squamulata* Control in 'TifEagle' Bermudagrass Putting Greens. RB Cross*[1], B McCarty[2], T Stoudemayer[2]; [1]Cross Turf & Agronomy LLC, Central, SC, [2]Clemson University, Clemson, SC (192)

Annual bluegrass (*Poa annua*) continues to plague the turfgrass industry as its most troublesome winter weed. Herbicide-resistant populations on golf courses are ever-increasing, with no new chemistries/MOAs introduced into this market in recent years. This is especially acute in golf course putting greens, where labeled options are minimal. Cumyluron is a substituted urea herbicide under development by Marubeni Corp. (Helena Argi-Enterprises, LLC) that has demonstrated preemergence (PRE) weed control in rice production in previous research. The purpose of this research was to evaluate PRE annual bluegrass control with cumyluron in 'TifEagle' bermudagrass putting greens in Clemson, SC. Cumyluron (HM-0814 4.2SC) was applied at 3, 6, and 12 oz/1,000 ft^2. Other labeled PRE herbicides included for comparison: bensulide (Bensumec 4LF) at 9.4 oz/1,000 ft^2, methiozolin (PoaCure 2.3SC) at 0.6 oz/1,000 ft^2 and pronamide (Kerb 50WP) at 2 lb/acre. Research was initiated in fall 2020 and continued through spring 2022. The same plots were treated in year 2 of the study. All herbicide treatments were applied fall (Sept.) and spring (Feb.). An additional methiozolin and pronamide treatment was applied in the fall three weeks after the initial September treatment. At 6 weeks after spring treatment (WAS) in year 1, cumyluron at 3 and 6 oz/1,000 ft^2 provided ~70% annual bluegrass control while 12 oz/1,000 ft^2 had 92% control. At this time, bensulide provided 93% control, pronamide 95%, and methiozolin 45%. At 6 WAS in year 2, all cumyluron treatments provided >94% control, bensulide 30%, while methiozolin had 53% and pronamide 86% control. None of the treatments injured 'TifEagle' bermudagrass during either year of the research in terms of turf phytotoxicity, stand density, or root growth. During summer 2021, populations of cock's-comb kyllinga (*Kyllinga squamulata = Cyperus metzii*) naturally infested the research putting green, thus, control ratings for this weed continued from the *Poa annua* treatments. Through 24 WAS, cumyluron at 12 oz/1,000 ft^2 controlled cock's-comb kyllinga >98% in both years. Control with 6 oz cumyluron/1,000 ft^2 was reduced to 85% at this time, while 3 oz/1,000 ft^2 provided ~70% control. Other herbicides included in this study provided <50% control of cock's-comb kyllinga in both years. Cumyluron could be an important addition for weed control in bermudagrass putting greens where few existing herbicides possess excellent turf safety and extended residual activity for PRE control. Future research should continue to evaluate cumyluron efficacy on other weed species and integrating cumyluron into existing weed control programs for putting greens for herbicide resistance management.

Postemergent Control for Cockscomb Kyllinga in Bermudagrass Putting Greens. A Gore*, LB McCarty, T Stoudemayer; Clemson University, Clemson, SC (193)

Cock's-comb kyllinga (*Cyperus metzii (Hochst. Ex Steud.) Mattf. & Kukenth. = Kyllinga squamulata)* is a problematic warm-season weed in turf situations due, in part, to its ability for rapid growth and continuous, season long germination potential. Further complicating control is the lack of labeled herbicide options for use on hybrid bermudagrass (*Cynodon dactylon* (L.) Pers. X *C. transvaalensis* Burt-Davy) putting greens. In this study, cock's-comb kyllinga was treated with Celero 75WDG (imazosulfuron), Monument 75WG (trifloxysulfuron), Certainty 75WDG (sulfosulfuron), Sedgehammer 75WP (halosulfuron), Basagran T&O 4L (bentazon), Dismiss 4L (sulfentrazone), Dismiss South 4L (sulfentrazone + imazethapyr), Basagran T&O + Certainty, MSMA 6L + Certainty, and Dismiss + Certainty. Cock's-comb kyllinga control (%) was measured over the following 21 days with cock's-comb kyllinga canopy coverage (%) measured 35 and 42 days after treatment. Celero (312 g ha^{-1}), Monument (11.3 g ha^{-1}), Basagran T&O (3.5 L ha^{-1}), Sedgehammer (36 g ha^{-1}), Basagran T&O + Certainty (3.5 L ha^{-1} + 34 g ha^{-1}), and Dismiss + Certainty (0.58 g ha^{-1} + 34 g ha^{-1}), provided >75% control at 21 days after (DAT) treatment. By 42 DAT, Monument, Basagran T&O, and Basagran T&O + Certainty had least (<10%) cock's-comb kyllinga canopy coverage, indicating best (>90%) long term control. In conclusion, this study identifies potential cock's-comb kyllinga control options in bermudagrass putting green situations with Monument 75WG (11.3 g ha^{-1}), Basagran T&O 4L (3.5 L ha^{-1}), and Basagran T&O 4L + Certainty 75WDG (3.5 L ha^{-1} + 34 g ha^{-1}) providing greatest long-term control with single application.

Recognition, a New Herbicide Safener, Enhances Weed Control Options in Zoysiagrass and St. Augustinegrass. T Stoudemayer, LB McCarty*; Clemson University, Clemson, SC (194)

With limited introduction of new active ingredients/modes-of-action into the turfgrass specialty market for the past 20 years, exploring new uses of older products is a major objective of our research program. One such new possibility is the herbicide safener metcamifen. Metcamifen was initially developed for the corn and rice market. Syngenta is anticipated to introduce a combination of metcamifen plus trifloxysulfuron, with the trade name Recognition, in 2023. The objectives of our studies were to evaluate the potential herbicide safening properties of Recognition with various POST herbicides on tall fescue (*Lolium arundinaceum*), St. Augustinegrass (*Stenotaphrum secundatum*), zoysiagrass (*Zoysia matrella*), and Tifway bermudagrass (*Cynodon dactylon* x C. *traansvalensis*) plus examine common bermudagrass control with various safener and herbicide combinations. When tank-mixed with fluazifop (Fusilade T&O 2L) at 12 oz, metcamifen alone did not satisfactory safen tall fescue tolerance to herbicides. Adding chelated iron or triclopyr ester to the mix also did not improve tall fescue tolerance. Tall fescue eventually recovered from all treatments but required up to 5 months. Recognition (1.25 to 1.95 oz/ac) plus fluazifop 2L (up to 24 oz/ac) applied three times on four-week intervals to 'Diamond' or 'Royal' zoysiagrass resulted in no turf phytotoxicity for any treatment on any rating dates. Fluazifop alone generally has a maximum tolerable rate on zoysiagrass of about 5 oz/ac, but some turf yellowing can be expected. These treatments provided 100% control of common bermudagrass, but interestingly, had insignificant effect on Southern Crabgrass (*Digitaria ciliaris*). On St. Augustinegrass demonstration trials, Recognition at 1.29 with fluazifop (up to 24 oz/ac), quinclorac (Drive XLR) at 0.5 lb ai/ac, or additional trifloxysulfuron 75WP at 0.56 oz/ac, applied three times, 4 weeks apart, had no visible turf phytotoxicity. When Recognition was combined with triclopyr amine 4L at 32 oz/ac, approximately 20% St. Augustinegrass phytotoxicity occurred following the third application but eventually recovered. Additional demonstration trials on 'Tifway' bermudagrass showed little turf tolerance improvement with Recognition (1.95 oz/ac) and MSMA, glufosinate, glyphosate, metribuzin, Speedzone, and topramezone. In conclusion, Recognition combined with fluazifop, quinclorac, and possibly triclopyr amine, totally safens turf tolerance for zoysiagrass and St. Augustinegrass. Recognition plus fluazifop also provided excellent common bermudagrass control but little control of crabgrass. Tall fescue tolerance to fluazifop was not enhanced when combined with Recognition. The combination of Recognition with fluazifop or quinclorac provides turf safety and excellent POST control of troublesome weeds in zoysiagrass and St. Augustinegrass but has trivial effect on crabgrass. Additional studies are needed with other POST herbicides, combinations of various products, and screening of tolerance of additional fine turfgrass species.

Endothall and Methiozolin: Potential New Herbicides for Weed Control on Ultradwarf Bermudagrass. JM Peppers*, S Askew; Virginia Tech, Blacksburg, VA (195)

Herbicide resistance coupled with a dearth of labeled selective herbicide options has increased annual bluegrass (*Poa annua*) control problems in ultradwarf bermudagrass (*Cynodon transvaalensis x dactylon*) putting greens. Methiozolin is a newly registered herbicide labelled for selective annual bluegrass control in various types of turf. Although its annual bluegrass control efficacy is well documented, information regarding its use on ultradwarf bermudagrass greens is lacking. Endothall is a relatively old herbicide that is primarily utilized for aquatic weed control. Although currently unlabeled for usage in US turfgrass systems, it has historically been labeled for annual bluegrass control in cool-season turf species. To date, no peer-reviewed research has evaluated ultradwarf bermudagrass tolerance to endothall or methiozolin. In spring of 2021 and 2022, a total of 16 field studies were established on eight golf greens to evaluate effects of methiozolin, endothall, and several additional herbicides on bermudagrass spring transition. The 16 studies were split equally between initial herbicide treatments to dormant versus mid-transition turf. Treatments included three biweekly applications of methiozolin at 500 and 1000 g ai ha^{-1}, single applications of endothall at 420 and 840 g ai ha^{-1}, and single applications of trifloxysulfuron, pronamide, and cumyluron at 27.8, 289, and 6450 g ai ha^{-1}, respectively. For studies initiated in fully dormant turf, percent bermudagrass green coverage was evaluated biweekly until 100% green coverage was obtained. Delay in bermudagrass spring transition (green-up) was determined by evaluating time taken to reach 90% green coverage (T90) for each treatment. For studies initiated mid-transition (~50% green bermudagrass), percent bermudagrass injury was evaluated biweekly. Bermudagrass injury data were converted to days over a threshold of 30% injury (DOT30) and injury maximum to account for repeated measures over time. Treatment effects on bermudagrass T90, DOT30 and injury maximum were dependent on trial location, and generally attributed to variable turf variety and microclimate conditions. Nontreated turf required 53-71 days to reach T90 depending on location. Methiozolin at the low and high rates delayed T90 12 ± 8 and 37 ± 26 d, respectively across the eight locations. The high rate of endothall and pronamide significantly increased T90 at a few locations, but not more than 10 d. Conversely, bermudagrass treated by cumyluron reached T90 equivalent to or more quickly than nontreated bermudagrass. For mid-transition applications, endothall treatments were the most injurious. Baring one newly-established green that exhibited higher injury, only endothall at either rate and methiozolin at the high rate exceeded a DOT30 of 10 d. Endothall at the high rate caused an average DOT30 of 13 ± 10 d. Methiozolin at the high rate had two locations (immature green and shaded green) where DOT 30 was 38-45 d. The low rate of endothall, although significant, never exceeded a DOT30 of 7 d. Endothall at the high rate caused unacceptable maximum injury at most locations. Endothall at the low rate caused between 33 and 46% maximum injury at 5 of 8 locations, but this injury recovered rapidly leading to short DOT30 durations. Additionally, the high rate of methiozolin, pronamide and trifloxysulfuron had an average injury maximum greater than 30% at three, one and one locations, respectively. The low rate of methiozolin and cumyluron had no locations in which maximum injury exceeded 30% when trials were initiated during mid-transition. Results from these studies indicate that to prevent negative effects on bermudagrass, methiozolin should be applied at 500 g ai ha^{-1} to post-dormant greens as opposed to higher rates and applications made during dormancy. Conversely, to minimize detrimental bermudagrass effects from endothall, applications should be made in full dormancy. These data indicate that cumyluron can be safely applied to ultradwarf bermudagrass during dormancy or during mid-transition with minimal detrimental effects to the turf.

Tank Mixes with Recognition, Syngenta's Safened Trifloxysulfuron, for Broadleaf and Grassy Weed Control. AL Wilber*[1], JD McCurdy[1], L Dant[2]; [1]Mississippi State University, Starkville, MS, [2]Syngenta Crop Protection, Greensboro, NC (196)

St. Augustinegrass (*Stenotaphrum secundatum*), a common lawn grass in the southeastern and gulf-coastal United States, is sensitive to some common postemergence herbicides. Recognition, trifloxysulfuron + metcamifen, is a safened formulation of trifloxysulfuron for use in St. Augustinegrass. Field studies were conducted to evaluate the efficacy and safety of Recognition alone and in combination with other herbicides for control of dollarweed (*Hydrocotyle* spp.), dallisgrass (*Paspalum dilatatum*), and common bermudagrass (*Cynodon dactylon*) and safety in St. Augustinegrass. Commercial standards were included in each trial for comparison. Initial applications were made on 8 Aug. 2022, with a follow up application made in the dallisgrass and bermudagrass studies on 6 Sep. 2022. Statistical analysis was performed in RStudio 4.1.1 using the agricolae package. Means were separated using the Student-Newman-Keuls method. Eight weeks after application, over 90% dollarweed control was achieved with Celsius XTRA (30 g thiencarbazone ha^{-1}, 6.5 g iodosulfuron ha^{-1}, 70 g halosulfuron ha^{-1}), 21 g metsulfuron ha^{-1}, 28 g trifloxysulfuron ha^{-1} + 21 g metsulfuron ha^{-1}, and 28 g trifloxysulfuron ha^{-1} + 560 g triclopyr ha^{-1}. Eight weeks after application, 420 g fluazifop ha^{-1}, 28 g trifloxysulfuron ha^{-1} + 420 g fluazifop ha^{-1}, and 28 g trifloxysulfuron ha^{-1} + 560 g triclopyr ha^{-1} + 420 g fluazifop ha^{-1} provided 100% bermudagrass control. Only 420 g fluazifop ha^{-1} significantly injured St. Augustinegrass. Twelve weeks after application, over 90% dallisgrass control was achieved with 420 g fluazifop ha^{-1} and 28 g trifloxysulfuron ha^{-1} + 420 g fluazifop ha^{-1}. Commercial standards, Tribute Total (22 g thiencarbazone ha^{-1}, 44 g foramsulfuron ha^{-1}, 69 g halosulfuron ha^{-1}) and 3360 g MSMA ha^{-1}, provided 68% and 54% control, respectively. The addition of Recognition to fluazifop minimally decreases weed control, while significantly increasing Augustinegrass safety. Recognition is safe for use in St. Augustinegrass and when combined with other postemergence herbicides provides control of dollarweed, dallisgrass, and common bermudagrass.

Simulation-based Nozzle Density Optimization for Maximized Efficacy of Machine-vision Based Weed Control System for Applications in Turfgrass Settings. P Petelewicz*[1], Q Zhou[2], M Schiavon[3], AW Schumann[4], N Boyd[5]; [1]University of Florida, Gainesville, FL, [2]North Carolina State University, Raleigh, NC, [3]University of Florida, Davie, FL, [4]University of Florida, Lake Alfred, FL, [5]University of Florida/Gulf Coast Research and Education Center, Balm, FL (197)

Precise application technologies have the capacity to drastically diminish herbicide inputs, thereby reduce their environmental burden. A key to the success using such systems requires the best possible performance of all its components including the machine vision (MV) based weed detection and spraying sections. This study assessed 1) the performance of spotted spurge [*Chamaesyce maculata* (L.) Small] recognition in 'Latitude 36' bermudagrass (*Cynodon* Rich.) turf canopy using You Only Look Once (YOLO) real-time multi-object detection algorithm, and 2) the impact of various nozzle densities on the model efficiency and projected herbicide savings under simulated conditions. The YOLO model was trained with a dataset of 710 images and evaluated on a dataset of 581 testing images. The simulation design consisted of 4 grid matrix regimes (3 × 3, 6 × 6, 12 × 12, and 24 × 24) demonstrating respectively: 3, 6, 12, and 24 non-overlapping nozzles with the same specifications, producing a perfect spray pattern, and equally distributed on the spraying boom to cover a total of 50 cm bandwidth within the same time interval. Simulated efficiency testing was conducted using 50 images containing predictions (labels) generated with newly trained YOLO model, by applying each of grid matrixes to individual images and manually collecting efficacy data. Our model resulted in exquisite accuracy. When subjected to simulation, the lowest nozzle density (3-nozzle scenario) resulted in the largest application area (41%) required to ensure herbicide deposition to all weeds detected within images, thus providing the lowest probable savings. As presumed, the least area required for satisfactory target weed coverage (13%), thereby greatest predicted herbicide use efficiency, was achieved with the highest simulated nozzle density (24-nozzle scenario). However, it was not different when compared to 12-nozzle scenario (18% area under simulated herbicide application). Considering various economic and logistic factors, the optimal savings would occur by increasing nozzle density from standard 1 covering 50-cm band to 12 assuming each individual nozzle covers approx. 5-cm band.

Long-term Annual Bluegrass Control with Cumyluron. GM Henry*, E Begitschke, KA Tucker; University of Georgia, Athens, GA (199)

Annual bluegrass (*Poa annua* L.) is one of the most problematic weeds in turfgrass. However, few postemergence herbicides are available for safe, efficacious control of annual bluegrass in creeping bentgrass putting greens. Research was conducted on an 'SR 1020' creeping bentgrass putting green at The Orchard Golf and Country Club in Clarkesville, GA from 2020 to 2022. The putting green was maintained at a height of 0.3 cm and had a recurrent annual bluegrass infestation of approximately 50% cover. The soil was a USGA spec sand-based profile and the putting green received significant shade throughout the day. Herbicides were applied with a CO_2 backpack sprayer calibrated to deliver 1,219 L ha^{-1} at 241 kPa. Treatments were initiated on 22 September 2020 and consisted of cumyluron (0.5, 1.1, and 2.2 kg ai ha^{-1}), methiozolin at 0.5 kg ai ha^{-1}, and bensulide at 14.3 kg ai ha^{-1}. Sequential applications were made in October and the following spring for two consecutive years, depending on treatment. Plots were 1.5 x 1.5 m and were arranged in a randomized complete block design with four replications. A non-treated check was included for comparison. Annual bluegrass control 10 weeks after initial treatment (WAIT) was greatest in response to methiozolin (86%), while all other treatments resulted in = 45% control. Annual bluegrass control increased in response to cumyluron at the highest rate (2.2 kg ai ha^{-1}) 33 WAIT resulting in 58% control, while control with methiozolin remained at 86%. At 66 WAIT, control was 100% in response to methiozolin and 86% in response to cumyluron at 2.2 kg ai ha^{-1}. Annual bluegrass control 80 WAIT remained the same for methiozolin and cumyluron at 2.2 kg ai ha^{-1}, while control was reduced to = 65% for the lower cumyluron rates. Bensulide never resulted in > 13% annual bluegrass control during the duration of the experiment. Although excellent annual bluegrass control was achieved with methiozolin and cumyluron at 2.2 kg ai ha^{-1}, control with methiozolin may have been exacerbated by the presence of shade on the putting green.

Germination Ecology of Palmer Amaranth and Yellow Nutsedge: Problematic Weeds for Row Crops in Florida. S Mathew*[1], P Devkota[1], S Regmi[1], YR Upadhyaya[2], OS Daramola[3], N Singh[1]; [1]University of Florida, Jay, FL, [2]University of Florida, Gainesville, FL, [3]University of Florida/IFAS, Jay, FL (200)

Palmer amaranth (*Amaranthus palmeri* S.Watson) and yellow nutsedge (*Cyperus esculentus* L.) are among the major problematic summer weeds in the southern U.S. Various environmental factors were investigated under laboratory and greenhouse conditions to determine the effect on germination of these weed species. The germination response of both species was higher at a warmer temperature, and maximum germination (83 and 88%) was at 35/25 °C (day/night) temperature. The growth of both weeds was vigorous at 24-hour dark conditions, but the germination was not influenced by light. Yellow nutsedge was tolerant to salinity and 44% germination/sprouting occurred at 100 mM salt concentration. On the contrary, Palmer amaranth seed germination was reduced at 50 mM (31%) salt concentration and beyond. Both weed species were sensitive to the osmotic potential at <-0.1 Mpa. In the laboratory, yellow nutsedge was apparently tolerant to lower (pH 3) or higher (pH 11) pH solutions. In the greenhouse, Palmer amaranth was highly sensitive to seed burial depth, and the highest germination (88%) was observed at 1 cm depth, and no germination occurred beyond 6 cm soil depth. Yellow nutsedge showed adequate sprouting (34%) even at 16 cm soil depth, and tubers did not sprout at the soil surface. Both weed species were sensitive to soil moisture levels, and the highest germination/sprouting was observed at soil moisture levels >75% of field capacity. Palmer amaranth germination was markedly declined by increased cereal rye residue, and seed germination did not occur at 6 tons ha^{-1}. Whereas yellow nutsedge tubers resulted in the highest sprouting (32%) at 6 tons ha^{-1} and sprouting ceased as cover crop residue increased thereafter. As the germination/sprouting of Palmer amaranth and yellow nutsedge is influenced by seed burial depths, tillage could be implemented as a cultural method for their management in summer crops.

Study of Rapid Evolution of Competitive Ability in Weeds Using Resurrection Studies. SR Ethridge[1], S Chandra[1], W Everman[1], DL Jordan[1], AM Locke[1], MD Owen[2], RG Leon*[1]; [1]North Carolina State University, Raleigh, NC, [2]Iowa State University, Ames, IA (201)

The ability of weeds to quickly adapt to environmental and agricultural changes has been widely cited in the literature, but with the exception of herbicide resistance, there is not much direct evidence of such adaptability. To explore the possibility of rapid evolutionary changes in weeds, we monitored changes in life-history traits, competitive ability, and herbicide sensitivity in a single population of *Abutilon theophrasti* and *Setaria faberi* using a resurrection approach based on seeds collected from the 1980s to the 2010s. The studies demonstrated that there have been important increases in competitive ability in both species. The onset in the evolutionary increase in competitive ability for *S. faberi* as well as in the hormetic response to glyphosate exhibited by *A. theophrasti* occurred after 1995 coinciding with the adoption of glyphosate resistant crops.

Protecting Sweet Potato from Deer Browsing Using Weed Extracts. Z Yue*, K Beneton, CA Snoddy, MW Shankle, T Tseng; Mississippi State University, Starkville, MS (202)

Deer spread all over North America, forming a landscape scenery. They also damage various plants, such as forestry seedlings, ornamental plants, crops, and household garden plants, causing huge losses. Among crops, deer damage to soybean and maize was widely reported partly due to their substantial planting acres and preference for deer. Sweet potato deer damage was relatively less documented, only leaf browsing has been reported, yield loss has not been documented. Furthermore, sweet potato leaves are even more preferred over soybean leaves by deer dug sweet potato roots closer to the harvesting season. Deer-resistant ornamental plant species have been reported, but deer-resistant crop cultivars have not been reported. Deer repellents have become the only strategy, besides fencing, to protect crops from deer browsing. Current deer repellents are made of animal or plant bi-products or chemically synthesized. Egg-based deer repellents have dominated the market for 30 years and were ranked No. 1 in sweet potato protection. Plant-derived repellents have made significant progress, such as pepper capsaicin and mint terpenes recently used as deer repellents. We prepared weed extracts from sicklepod and coffee senna (anthraquinones) as deer repellents. Our experiments compared these weed extracts with commercial repellents Deer Pro (egg-based) and Deer Out (mint derived). UAV imaging and root yield were used to evaluate leaf browsing and total and cumulative deer damage. The results showed that two applications of Deer Pro, Deer Out, and Coffee senna extract provided good protection for sweet potato from deer browsing. All yielded significantly higher than controls. Deer Pro was best in terms of leaf browsing and yield. Protection of leaf browsing was an effective way to protect sweet potato from deer root digging.

IR-4 Update - Weed Science Food Crop Projects. RB Batts*, JJ Baron, V Pedibhotla; IR-4 Project HQ, NC State University, Raleigh, NC (203)

Residue projects IR-4 data submitted to EPA led to over 600 new uses in 2022. Of these, nearly 280 uses were for herbicides (tribenuron and glufosinate) in many specialty crops, crop groups or subgroups. Glufosinate approvals include avocado, bushberry subgroup, cottonseed subgroup, fig, vining small fruit subgroup, hops, melon subgroup, pepper/eggplant subgroup, rapeseed subgroup, squash/cucumber subgroup, tomato subgroup, tropical and subtropical small fruit-edible peel subgroup, tuberous and corm vegetable subgroup. Tribenuron approvals involve dried shelled bean subgroup, dried shelled pea subgroup, rapeseed subgroup, cottonseed subgroup, proposed wheat subgroup, proposed barley subgroup, proposed field corn subgroup, proposed grain sorghum and millet subgroup, and proposed rice subgroup. IR-4 submitted three herbicide data petitions to EPA in 2022 (acifluorfen, triclopyr and saflufencail). These submissions could potentially lead to more than a dozen new uses. Ten new herbicide magnitude-of-residue studies began in 2022, which could result in more than 50 new uses. Twenty-one new herbicide and PGR residue studies will begin in 2023. Product Performance projects Generating Product Performance (efficacy and crop safety) data to support registration of pest management tools in specialty crops continues to be an important and expanding part of the IR-4 annual research plan. This data is often required by registrants and/or states to complete the registration process. The number of on-going herbicide Product Performance studies in 2022 was twenty (60 individual trials), with twelve of them beginning in 2022. The 2023 field research plan for herbicides and plant growth regulators includes twenty-nine (>90 individual trials) continuing or new Product Performance studies. Integrated Solutions projects IR-4's Integrated Solutions (IS) Program is structured to assist specialty crop growers outside of the traditional single product/single crop residue and product performance research. IS research efforts focus on crop-pest combinations to address solutions in these four areas, 1) pest problems without solutions, 2) resistance management, 3) products for organic production and 4) pesticide residue mitigation. In 2022, there were nine active IS projects with herbicides and plant growth regulators (22 individual trials), three of which will continue in 2023. Four new weed control IS studies will begin in 2023 (10-12 individual trials), including quinoa, stevia, date palm, and dry bulb onion.

Optimizing Anaerobic Soil Disinfestation for Use in South Carolina Watermelon Production.
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Weed control options in watermelon production are limited and require non-chemical tactics. This is especially true for controlling weeds such as Yellow Nutsedge (*Cyprus esculentus*) and Purple Nutsedge (*Cyprus rotundus*) Anaerobic soil disinfestation (ASD) is an ecological alternative to chemicals and is an effective method to suppress soil-borne diseases and weeds in various crops. An experiment was conducted at the Edisto Research and Education Center in Blackville South Carolina to evaluate the impact of ASD on watermelon yield, soil anaerobic conditions and weed control. The experiment was designed as randomized complete block with 4 replications. The treatments were structured as a factorial of two plastic treatments (Black or Clear) by 5 carbon sources (Cotton Seed Meal, Rutabaga, Rutabaga + Rice Hulls, Broil Litter + Molasses and no carbon source). The impact of carbon source on cumulative anaerobicity averaged across plastic treatment found cotton seed meal to be the greatest in anaerobicity of the C Sources tested. When looking at the two plastic treatments, clear film was found to have greater anaerobicity over the opaque black film. In terms of the C Source and plastic type's output of average harvested weight per treatment there was a consistent average of 6.4 kg across the plot. There was a clear demonstration of the suppression of nutsedge in weed counts between the C Source treatments versus the standard (no treatment) in the black plastic and in the clear film, visible weed counts under the film were lower in the Broiler Litter + Molasses and the Cotton Seed Meal treatments.

Possible Contribution of Two Different Mechanisms to Evolution of *S*-Metolachlor Resistance in Palmer Amaranth (*Amaranthus palmeri* S. Wats.). 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, Lonoke, AR (206)

A Palmer amaranth (*Amaranthus palmeri* S. Wats) biotype resistant to a very-long-chain fatty acid (VLCFA) inhibitor *S*-metolachlor was confirmed from croplands near Crawfordsville, AR in 2017, and responses of the biotype as a function of herbicide dose were evaluated in a previous study. The present study investigated seed germination and root elongation of *S*-metolachlor-susceptible (S) and -resistant (R) Palmer amaranth biotypes following treatments of *S*-metolachlor and metabolic inhibitors such as malathion (cytochrome P450 inhibitor) and 4-chloro-7-nitrobenzofurazan [NBD-Cl; glutathione S-transferase (GST) inhibitor]. Additionally, *S*-metolachlor metabolism and VLCFA production in S and R biotypes were evaluated to infer the herbicide resistance evolution mechanism. Co-treatments of *S*-metolachlor and each metabolic inhibitor did not affect root elongation and seed germination of the tested Palmer amaranth biotypes, excepting that the co-treatment of 2 µM *S*-metolachlor and 50 nM NBD-Cl reduced root elongation of the R biotype by 20%. The reduction in root elongation observed may show the relevance of GSTs to evolution of the herbicide resistance. Productions of identified (metolachlor-oxanilic acid and -ethanesulfonic acid) and unidentified (UM-1 and -2) metabolites during the entire 7-d study period were 1.4- to 12.1-fold greater in the R biotype than in the S biotype. Particularly, 4.0-12.1 times greater production of metolachlor-ethanesulfonic acid in the R biotype was observed, which indicates that this metabolite could be considered an indicator to verify the presence of *S*-metolachlor in Palmer amaranth. Production of cerotic acid which is one of VLCFAs containing 26 carbons was significantly reduced in both S and R biotypes by *S*-metolachlor treatment, and its reduction magnitude was greater in the S biotype (3.8 times) than in the R biotype (1.8 times). Further studies evaluating overexpression and mutation to genes of proteins associated with production of cerotic acid would be important to reveal the association of VLCFA production and herbicide resistance.

Evaluating the Backcrossing Potential in the F_1 Progeny of *Sorghum bicolor* x *S. halepense* Interspecific Crosses. UR Pedireddi*, M Chung, R Afshang, NK Subramanian, G Hodnett, W Rooney, MV Bagavathiannan; Texas A&M University, College Station, TX (207)

Plant breeders have been working on the improvement of numerous traits in sorghum because of its potential to thrive under low input conditions. Some potential traits for sorghum improvement include herbicide tolerance, increased water use efficiency, cold tolerance, disease tolerance, and salt tolerance. However, owing to the genetic similarities of sorghum and johnsongrass, they have the potential to cross-pollinate and produce viable hybrids (Arriola and Ellstrand, 1996). It is possible that herbicide-resistant traits may outcross and transfer to Johnsongrass, thereby challenging the sustainability and value of this system. We do not know much about how genes or traits are introduced into derivatives by genetic means. To achieve this breeding objective, we have conducted several backcrosses between the established F1 progeny plants and one of their parents, the grain sorghum plant. We have used two sorghum inbreds (Tx378 and Tx2928) for backcrossing these F1 progeny derived from crosses between cultivated sorghum and johnsongrass in both directions in this work. Backcrosses with both sorghum parents were observed to have seed sets of between 0.5 - 2%. As of now, the progeny characterization for BC1F1 and the backcrossing of the F 1 derived from the other cross with sorghum pollen parents are in the process of completing in the summer of 2022. As a result of the study, it is expected that the results will provide further insight into the introduction of genes/traits from the parents to the F1 progeny.

Evaluation of Non-chemical Options for Johnsongrass Control in Fallow. G Camargo Silva*, MV Bagavathiannan; Texas A&M University, College Station, TX (208)

Johnsongrass [*Sorghum halepense* (L.) Pers.] is one of the most problematic perennial grass weeds in row-crop production across the southern United States. Control of this species has been historically difficult in conventional systems, but it is especially challenging in organic systems due to a lack of effective non-chemical options. Experiments were conducted at the Texas A&M research farm near College Station, TX, from Fall 2019 to Spring 2021 to evaluate various non-chemical options for the management of johnsongrass in the fallow season. Treatments included different timings of disking, mowing, flooding, plastic mulching, and acetic acid applications, as well as combinations of them. Each treatment was evaluated by how well it controlled johnsongrass both above-ground (density, shoot biomass) and below-ground (rhizome length, biomass, and node number). Disking followed by flooding in the fall effectively reduced johnsongrass density, above-ground biomass, rhizome biomass, rhizome node number, and rhizome length compared to the control plots. On the other hand, disking followed by flooding after the first frost did not reduce johnsongrass density, above-ground biomass, rhizome node number, or rhizome length. Periodic mowing effectively reduced johnsongrass density, above-ground biomass, rhizome biomass, and rhizome length compared to the control plots at the end of the study in Spring 2021. Disking followed by the installation of black plastic mulch was the most effective treatment. This treatment reduced johnsongrass density, shoot biomass, rhizome biomass, rhizome node number, and rhizome length by 98, 83, 99, 99, and 99%, respectively, compared to the control plots. Disking alone once or twice per growing season or repeated application of acetic acid failed to control johnsongrass adequately. These results indicate that organic johnsongrass control in the fallow winter season is possible through continuous mowing, flooding, and plastic mulching, and that implementation timing is essential for good results.

Response of Soybean at Different Growth Stages to Drift Rates of Imazapyr. MW Marshall*, MB Williams; Clemson University, Blackville, SC (209)

Imazapyr is an ALS-inhibitor herbicide with both foliar and soil activity. The typical rate use rate for imazapyr in forestry applications is 840 to 1400 kg/ha. It is used for management of undesirable vegetation found in site preparation prior to planting conifers. There are several application methods for imazapyr including aerial, ground, and spot spraying with aerial the most common. Aerial applications require the use of drift reduction technologies including Microfoil/Thru-Valve booms. However, particle drift onto non-target broadleaf crops, such as cotton and soybeans still occur. Particle drift from these aerial applications can impact crop growth, development, yield, and maturity, especially during reproduction. Research is lacking on the effect of drift rates of imazapyr on soybean growth, development, and yield. Field experiments were conducted at the Clemson University Edisto Research and Education Center in 2021 and 2022. Soybean variety Asgrow 72X2 was seeded at 157K seed/ha from Mid-June to Early July in both years on a 97 cm row spacing. The imazapyr treatments were 1/10, 1/20, 1/40, 1/80, and 1/160 X of the normal use rates (840 kg/ha) of imazapyr. Treatments were applied in water at 125 L/ha at a pressure of 220 kPa. An untreated check was included for comparison. The middle two rows were treated leaving the outside rows as a buffer between plots. The experimental design was a randomized complete block design with 4 replications. The herbicide treatments were applied at vegetative growth stage (V3-V4) and reproductive growth stage (R1). Percent soybean visual injury and heights (6 randomly selected plants per plot) were collected 14 and 28 days after treatment (DAT). Soybean plots was harvested at maturity on November 4, 2021, and November 18, 2022. Percent soybean injury, height, and yield were analyzed using ANOVA and means separated using LSD at the P = 0.05 level. In the vegetative growth stage, soybean injury ranged from 89 to 11% at 28DAT which corresponded to the 1/10 to 1/80X imazapyr rates. Soybean heights were also affected resulting in a 54, 36, 25, and 11% reduction at the 1/10 to 1/80X rates, respectively. At the reproductive growth stage, soybean injury was visually lower (70-72% at 0.1X imazapyr rate) at 28 DAT. Similarly, soybean height reductions were also lower. At the 160X rate, soybean injury was minimal (0-5%) for both timings. Soybean yield was severely reduced at the 1/10 to 1/40X rates (0 kg/ha, both years) applied at the reproductive growth stages. Although injury in the vegetative growth stages was high, the plots did compensate by the end of the season with yields ranging from 700 to 2100 kg/ha in the 1/10 to 1/80X treatments across both years. No yield differences were observed between the 1/160X and the control. The reproductive growth stage in soybean was significantly more sensitive to low rates of imazapyr compared to the vegetative growth stage suggesting early in the season exposure may allow recovery and compensation for the injury. In summary, soybean yield reductions were more evident during the reproductive growth period.

Chaff Lining for Management of Weeds in Soybean. MP Spoth[1], ML Flessner*[1], K Bamber[1], V Kumar[2], V Singh[2], WC Greene[1], C Sias[1], EC Russell[1]; [1]Virginia Tech, Blacksburg, VA, [2]Virginia Tech, Painter, VA (210)

Harvest weed seed control has helped Australian farmers overcome herbicide resistant weeds. Chaff lining is a form of harvest weed seed control that concentrates the chaff fraction of harvest residues and weed seed therein into a narrow line using a chute installed on the back of the combine. We examined Palmer amaranth (*Amaranthus palmeri* S. Wats.) and common ragweed (*Ambrosia artemisiifolia* L.) in separate experiments to determine how varying soybean yield and the associated chaff amount affects chaff lining weed control compared to a conventional harvest. Since chaff amount increases with crop yield, chaff lines were created to mimic a range of soybean yields, with equal weed seed additions based on existing fecundity and seed retention data to each chaff line. A conventional harvest (control) and an outside-the-chaff-line treatment were included, where total fecundity or weed seed rain occurring prior to harvest were broadcast, respectively. An additional factor of a drilled cereal rye cover crop or no cover crop was imposed after creation of chaff lines to evaluate integrating cover crops with chaff lining. Of the total seven Palmer amaranth and six common ragweed experiment location-years, all chaff lining treatments reduced cereal rye emergence in the chaff line in 19 of 36 treatments relative to conventional harvest. Full-season soybean emergence was not affected, likely because planted rows straddled chaff lines. In common ragweed experiments, conventional harvest resulted in 9% greater field scale cereal rye yield (above ground biomass) than chaff lining, while in Palmer amaranth, conventional harvest cereal rye yield was 13% lower than chaff lining. Full-season soybean yield on the field scale did not change between chaff lining and conventional treatments in common ragweed trials. In Palmer amaranth experiments, the low and medium yield associated chaff amounts yielded 6 and 7% greater than conventional harvest. Chaff lining reduced common ragweed emergence across the cereal rye and soybean growing seasons by 64% and in two of three locations by 85%, respectively. Cereal rye mulch decreased total Palmer amaranth emergence by 41%. In six of seven Palmer amaranth location-years, chaff lining decreased field scale weed emergence in soybean by 81%. Generally, as crop yield and therein chaff amount increased, cover crop and weed emergence decreased. These results show soybean chaff lining comes at very little cover crop consequence, while improving weed management and maintaining or increasing soybean yield.

Use of a Spray Drone for Corn Harvest Aid Herbicide Applications. RD Langemeier*, L Pereira, JT McCaghren, S Li; Auburn University, Auburn, AL (211)

Pre-harvest desiccation of corn (*Zea maize*) is used to aid in harvest, speeding harvest and reducing operator fatigue. This can be done via ground application, but only if soil conditions allow. In addition, a ground sprayer will knock over crop resulting in lost yield. Airplanes may also be used but can struggle in small and/or oddly shaped fields. Spray drones have made rapid advances in recent years, and are now more capable of covering large acreage, while also alleviating some of the problems with other application methods. However, questions about efficacy remain. With that in mind, an experiment was conducted in early August 2022 at two commercial fields in Autauga and Coffee counties, Alabama. Both experiments included three treatments: 1) glyphosate, 2) glyphosate + carfentrazone, 3) paraquat. All treatments were applied using a DJI Agras T30 using Greenleaf AM110-01 nozzles at 18.7 L ha^{-1}. Plots were ~1.4 hectares in Autauga Co. and 0.6 hectares in Coffee Co. There were three replications of each treatment. Data collection involved visual injury of three species found throughout the plots at each site at 4, 7 and 14 days after treatment (DAT). In addition, multispectral imagery was collected 0, 4, 7, and 14 DAT. By 14 DAT at both sites grass control for all treatments which included glyphosate was >80%. On broadleaves control varied between specie/treatments combinations. In most but not all cases, on broadleaf weeds a mixture of carfentrazone + glyphosate provided the best control. Mean reduction in NDVI from 0 DAT to 14 DAT was highest for glyphosate + carfentrazone, glyphosate, and then paraquat at both sites. These results show that spray drones are a viable method for corn harvest aid applications, and can provide high levels of efficacy.

Simulating Postemergence Optical Spot Spraying Applications Following Acuron Applied Preemergence. JW Adams*[1], R Wuerffel[2], R Lind[3], T Glenn[4], D Belles[5]; [1]Syngenta Crop Protection, Vero Beach, FL, [2]Syngenta Crop Protection, Gerald, MO, [3]Syngenta Crop Protection, Jealotts Hill, United Kingdom, [4]Syngenta Crop Protection, Orlando, FL, [5]Syngenta Crop Protection, Greensboro, NC (212)

Optical spot spraying technology is becoming more common in the marketplace. Understanding how this technology may perform in integrated weed management systems is important; however, access to research equipment is currently a challenge. Therefore, the objective of this study was to evaluate if high resolution drone imagery can be used to simulate postemergence applications using an optical spot sprayer following preemergence applications. Bicep II Magnum® or Acuron® were applied to corn plots preemergence. Following the preemergence application, drone flights were performed at the V1, V3, and V5 corn growth stages. Images from each flight were then converted and analyzed using a Syngenta modeling tool to simulate postemergence optical spot spray applications. The simulated post sprays indicated greater weed control from Acuron® compared to Bicep II Magnum®. The resulting simulated postemergence spray volume savings aligned well with previous field results. The results from these trials indicate that the use of high-quality drone imagery can be used to simulate postemergence optical spot spraying applications. Furthermore, these data indicate that early season weed management will remain critical to weed management in a future where optical spot sprayers are used.

Optimizing Herbicide Programs in Response to Reduced Palmer Amaranth Emergence and Growth Rate in Cover Crops. C Sias*, ML Flessner, K Bamber; Virginia Tech, Blacksburg, VA (213)

The need for non-chemical weed control options is highlighted by the development of herbicide resistance to multiple modes of action in Palmer amaranth (*Amaranthus palmeri* S. Wats.). Cover crops have proven to be a viable option, but questions remain concerning the potential for a reduction in herbicide inputs, as well as the termination practices needed to maximize the weed control benefits of cover crops. Experiments were conducted in 2021 and 2022 in Blacksburg, VA to determine the effect of cover crop termination timing on Palmer amaranth emergence patterns and growth rate. Treatments included a no cover (winter fallow) check, "planting brown" (cereal rye terminated two weeks before soybean planting), and "planting green" (cereal rye terminated at soybean planting). Emergence counts and growth rate of Palmer amaranth was recorded every two weeks for 10 weeks by following weed emergence cohorts after soybean planting. Additionally, simulated herbicide programs were compared by including all relevant combinations of residual and postemergence (POST) applications from 1-, 2-, and 3- pass programs that resulted in Palmer amaranth control until soybean canopy. The number of days it took Palmer amaranth to reach a 10 cm height was used to determine if a residual, POST1, POST1+residual, or POST2 herbicide applications were necessary. Several assumptions were implemented including a 28-day suppression period by the residual application, a POST herbicide application resulted in complete weed control, and the cost of application, seed, herbicide, diesel, etc. Herbicide program analysis indicated that the simplest and most cost-effective cover crop and herbicide regime was winter fallow with two POST applications and no residual herbicides. This finding contradicts previous research and survey data, likely due to the abnormally dry May experienced in the first year of this study. Among cover crop termination options (planting green versus brown), there was no economic impact on inputs, but Palmer amaranth emergence was delayed further under both cover crop treatments compared to winter fallow. Furthermore, density at POST 1 was reduced in the cover crop treatments compared to the winter fallow, which would help mitigate herbicide resistance development. Although more site-years are necessary, this information will provide better recommendations for herbicide programs when integrating cover crops.

Comparison of Residual Palmer Amaranth Control with Soil-applied Herbicides in Rainfed Systems. MC Castner*, JK Norsworthy, MC Souza, SL Pritchett; University of Arkansas, Fayetteville, AR (214)

Palmer amaranth has been one of the most troublesome weeds for Midsouth row crop producers for almost two decades, primarily due to its tendency to evolve resistance to herbicides. One of the best management practices for reducing postemergence selection for weed resistance is use of soil-applied herbicides. To evaluate the influence of activating rainfall on residual herbicide activity and overall performance of dicamba, flumioxazin, isoxaflutole, pyroxasulfone, and *S*-metolachlor, five bareground experiments were conducted in 2021 and 2022, in Fayetteville, AR. In addition to visible weed control evaluations, a WatchDog® weather station was placed in the field to monitor rainfall for the duration of each experiment and weed density by species was determined 28 days after treatment (DAT). For most of the evaluated herbicides, a delayed activating rainfall reduced initial weed control over instances where immediate (within a few days) activation occurred. At 14 DAT, without adjusting for rainfall, box and whisker plots indicate that 3 out of 5 herbicides have minimal variation with comparable levels of Palmer amaranth control (above 85%). Greater variation in control was observed with isoxaflutole and dicamba, with data points as low as 50 and 40%, respectively. Trends in the results at 28 DAT were similar to 14 DAT, however; variation in control began to increase for all herbicides, which indicated the environment influenced the residual activity over time. Rainfall soon after a dicamba application reduced herbicide performance, unlike the other herbicides evaluated. For most soil-applied herbicides, choosing the appropriate herbicide and timeliness of an activating irrigation event is imperative to optimize weed control.

Integrated Weed Management Practices to Control ALS and PPO-Inhibitor Resistant Palmer Amaranth. JT McCaghren*, S Li, RD Langemeier, L Pereira; Auburn University, Auburn, AL (215)

Palmer amaranth (*Amaranthus palmeri*) is an economically damaging weed found throughout the 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 pre-emergent 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 herbicide 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. This study was conducted in summer of 2021 in Henry, Elmore, and Baldwin counties in Alabama. This study was repeated in summer of 2022 in Baldwin County, Alabama. 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 all 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 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.

Detection and Site-Specific Treatment of Waterhemp 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 (216)

To limit seedbank input and future weed infestations, late-season management of uncontrolled weed escapes is critical. Common waterhemp (*Amaranthus tuberculatus*), a common and problematic weed in southeast Texas cotton, may produce more than one million seeds per plant, therefore late-season escapes must be targeted to reduce seedbank addition. Site-specific treatment using a remotely piloted aerial application system (RPAAS) may be effective in this regard. Additionally, aerial images captured using an Unmanned Aerial System (UAS) can be utilized for the detection of weed escapes and subsequent treatment using the RPAAS. Field experiments were conducted in 2021 and 2022 at the Texas A&M University Research Farm in College Station, TX with 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 herbicide was used in the experiment to allow for effective estimation of herbicide spray coverage and injury. First, the accuracy of RPAAS targeting individual waterhemp escapes based on coordinates obtained through manual recording was evaluated. Additionally, visible plant injuries were recorded at 10 days after treatment, and the efficacy between RPAAS treatments and conventional backpack application was compared. The overall accuracy of waterhemp detection using image analysis was 65%; the low detection accuracy is partly due to waterhemp escapes inter-mingled within the cotton canopy. Compared to backpack applications, the efficacy of drone-based applications was lower in 2022 due to insufficient coverage. No differences were observed between the backpack application and the drone-based application with weeds located manually in 2021. This experiment provided necessary directions for further improvements in achieving higher detection accuracy as well as improving RPAAS spray coverage for late-season weed applications.

Response of Glufosinate-Resistant Palmer Amaranth Population to Current Weed Control Technologies. P Carvalho-Moore*[1], JK Norsworthy[1], TA King[1], TH Avent[1], CT Arnold[1], D Smith[1], T Barber[2]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Lonoke, AR (217)

Glufosinate resistance was detected in Palmer amaranth [*Amaranthus palmeri* (S.) Wats.] accessions from Arkansas. Glufosinate is a commonly used postemergence option to control Palmer amaranth in row crops carrying the gene endowing glufosinate resistance. The spreading of this resistant weed is of high concern. The aim of this study was to evaluate different herbicide programs in soybean to control glufosinate-resistant Palmer amaranth. The experiment was conducted in Fayetteville, Arkansas, and organized as a randomized complete block design with four replicates. The treatments were: 1) sequential glufosinate applications, 2) sequential 2,4-D applications, 3) sequential 2,4-D plus glyphosate applications, 4) sequential 2,4-D plus glufosinate applications, and 5) sequential dicamba applications. Besides the postemergence applications, these treatments were combined with the presence or absence of residuals (*S*-metolachlor plus metribuzin at preemergence, and *S*-metolachlor at early postemergence). This experiment was conducted in an area geographically isolated from agricultural lands, and seeds of the highly glufosinate-resistant Palmer amaranth accession were spread and incorporated on the field. Treatments were sprayed preemergence (PRE), early postemergence at 4 weeks after PRE application (EPOST), and late postemergence at 6 weeks after PRE application (LPOST). Nontreated controls were included for comparison. Palmer amaranth control was assessed 2 weeks after LPOST. Overall, sequential applications of a single chemistry without residuals obtained the lowest control levels. Due to the presence of resistance, the lowest control level was obtained in sequential applications of glufosinate without residuals (22%). The addition of an additional postemergence chemistry or the use of residuals showed to be an effective approach to control glufosinate-resistant Palmer amaranth.

Confirming Georgia Palmer Amaranth Resistance to PPO-inhibiting Herbicides Applied PRE and POST. TM Randell-Singleton*[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 (218)

PPO-inhibiting herbicides are critical tools to manage troublesome weeds across more than 40 agronomic and vegetable crops in Georgia. Common use patterns in these crops include preemergence (PRE), postemergence (POST), and row middle applications. In 2017, a population of Palmer amaranth (*Amaranthus palmeri* S. Watson) was identified and confirmed by Extension to exhibit reduced sensitivity to fomesafen when applied to emerged plants. To quantify the level of resistance, dose-response assessments were conducted, and PPO-inhibiting herbicides were applied PRE or POST from 2017 to 2022. Greenhouse studies included a control population of Palmer amaranth collected from a field without any historical use of this chemistry; the distance between the sample collections was only 200 m ensuring genetic similarity. For the PRE experiment, flumioxazin (1X=57 g ai ha^{-1}), fomesafen (1X=210 g ai ha^{-1}), oxyfluorfen (1X=561 g ai ha^{-1}), and trifludimoxazin (1X=38 g ai ha^{-1}) were selected for evaluation. With the sensitive population, all herbicides were applied at 6 to 8 different use rates, ranging from 1/729X to a 1X rate. Higher rates were used for the suspected resistant populations ranging from 1/27 to a 3 or 6X rate depending on herbicide. Following application, all treatments were activated with overhead irrigation of 0.75 cm and supplemented with subirrigation for the remainder of the study. Visual control, mortality, and biomass i50 values indicated a R:S ratio of 3 to 5, 2 to 8, and 7 to 40 for fomesafen, oxyfluorfen, and trifludimoxazin, respectively. Greater levels of resistance were noted with flumioxazin with R:S ratios of 31, 34, and 25 for control, mortality, and biomass, respectively. The POST experiment included fomesafen (1X=420 g ai ha^{-1}), lactofen (1X=219 g ai ha^{-1}), acifluorfen (1X=420 g ai ha^{-1}), and trifludimoxazin (1X=25 g ai ha^{-1}) applied to Palmer amaranth ranging from 8 to 10 cm in height; adjuvants were included. Thirteen rates ranging from 1/256 to 4X were applied to the sensitive population, while rates of 1/32 to 40X were applied to the suspected resistant population. Measuring control, mortality, and biomass, R:S ratios were 102 to 350, 38 to 1244, 214 to 316, and 9 to 89 for fomesafen, lactofen, acifluorfen, and trifludimoxazin, respectively. Research results confirm a Palmer amaranth population present in Georgia is resistant to traditionally effective PPO-herbicides applied PRE and POST.

Can Palmer Amaranth be Managed without Dicamba or Glufosinate? L Steckel*[1], PA Dotray[2], G Morgan[3]; [1]University of Tennessee, Jackson, TN, [2]Texas Tech University and Texas A&M AgriLife Research & Extension, Lubbock, TX, [3]Cotton Incorporated, Cary, NC (219)

Recent research that documented glufosinate resistance and dicamba resistance in Palmer amaranth that is already resistant to acetolactate synthesis inhibiting herbicides as well as glyphosate begs the question of how cotton growers will manage this weed in the future. One management tactic to control Palmer amaranth that is resistant to most POST-applied herbicides is to limit the emergence with extensive use of residual herbicides. Research was conducted at Jackson, TN during the 2022 growing season. The treatments compared using overlaying residual herbicides applied in sequence either once, twice, three or four times. The PRE applied herbicides used were either fluridone, flumeturon, or fluridone + flumeturon. The herbicide applied at 2-leaf cotton was either S-metolachlor or dimethenamid. At 6-leaf cotton, pyroxasulfone applied via fertilizer was the third residual treatment. At 12-leaf, a POST-direct application of diuron + MSMA was applied. A treatment of glyphosate + glufosinate applied at 2-lf cotton was also tested with and without the overlaying residual treatments. Overhead irrigation was initiated to increase the level of residual herbicide control the day after each application. Overlaying two or three herbicide treatments provided very poor Palmer amaranth control and cotton yield. Overlaying four sequential herbicide treatments provided Palmer amaranth control and cotton yield similar to the standard system used in Tennessee today which is PRE applied fluridone followed by S-metholachlor + glyphosate + glufosinate followed by pyroxasulfone via fertilizer. These results suggest that a management tactic of overlaying four herbicides timely throughout the growing season that have good residual activity on Palmer amaranth can provide acceptable control. However, executing this tactic in fields without irrigation equipment and in a timely fashion over thousands of acres could be very problematic.

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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